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UNESCO-IWRA ONLINE CONFERENCE
17-19 JANUARY 2023
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Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Impacts of anthropogenic activities on water quality in the Guiers Lake basin (Senegal): Spatio-temporal evolution of emerging pollutants

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Wednesday, January 18th , 2023 / 12:30 CET

CONTEXT

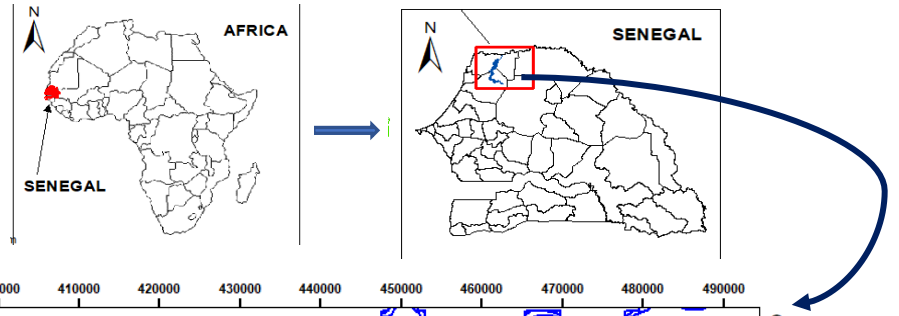
Livestock

Biodiversity

Fishing

Irrigation

Water supply



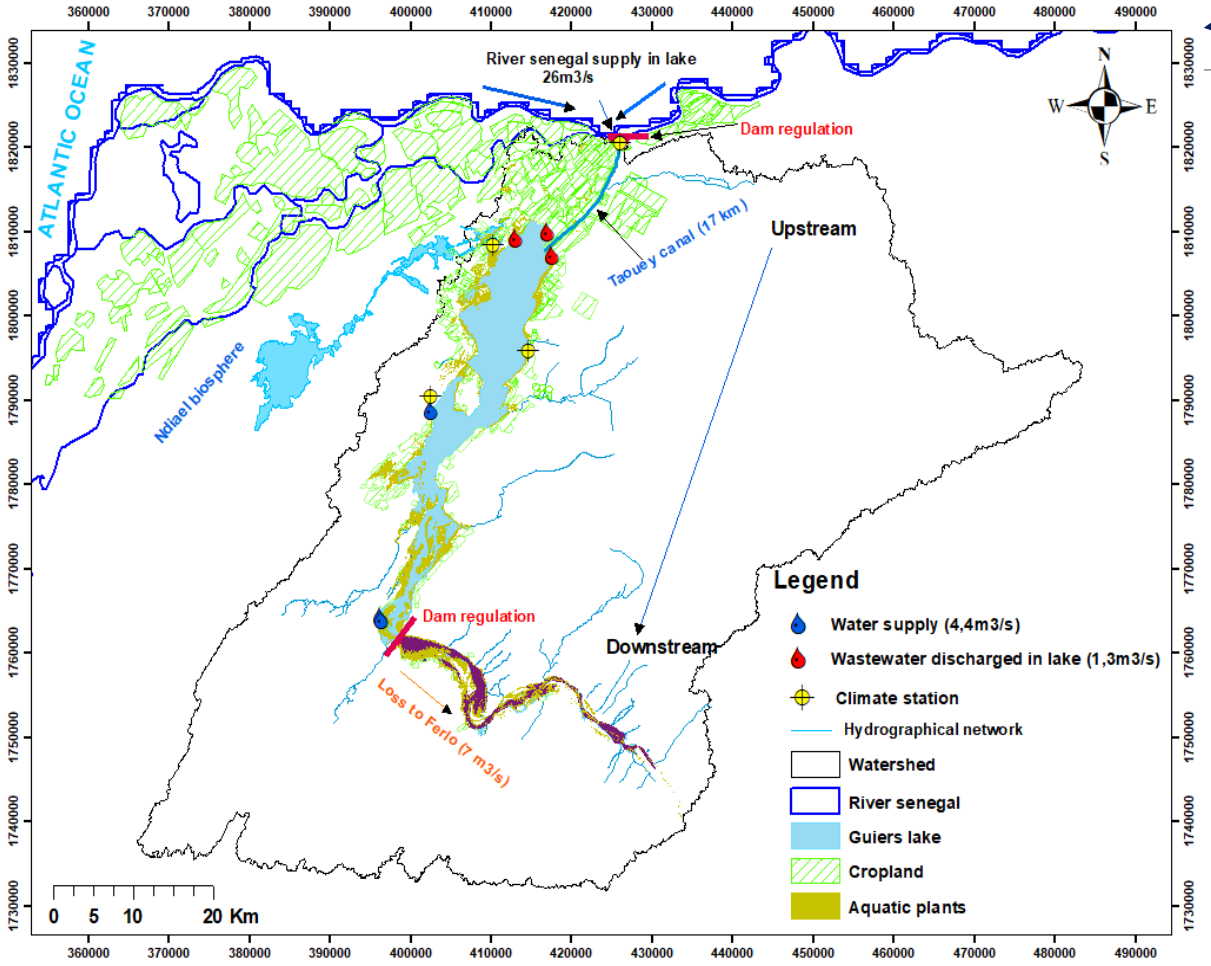


Figure 1: location of the study area

❑ Renewable potential

up to 700 Mm3 (water level 1.5 to 2.5 m)

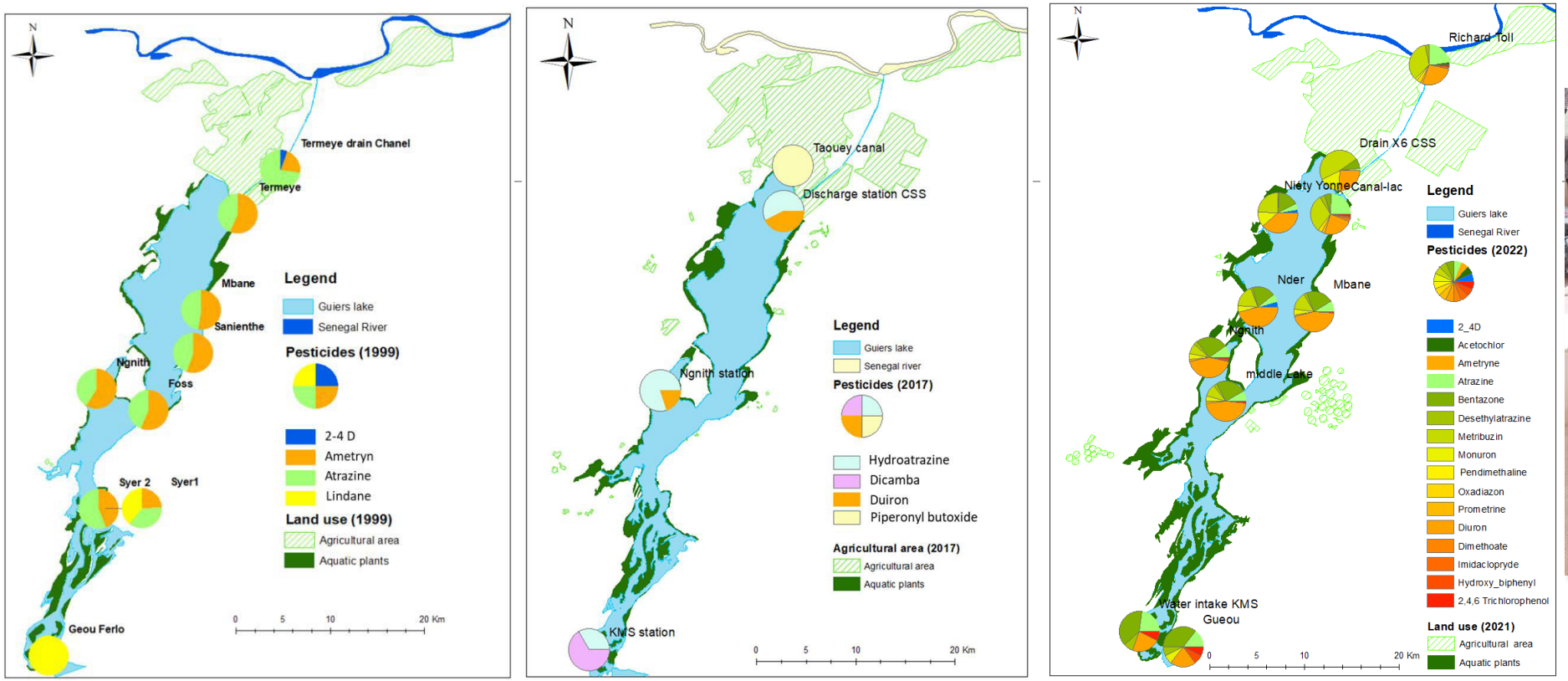
❑ Climate

- **Precipitations: 260 mm/year**
- **Evaporation: 2000 mm/year**
- **Temperature: annual average 26.1 °C**

❑ Pollution

- **Domestic**
- **Agricultural & Industrial effluents**

Spatio-temporal evolution of pesticides and Land Use



Water sample Guiers lake 2022

Figure 2: Spatio-temporal evolution of pesticides in the study area

1. **Historical data: 1999-2017**
2. **4 molecules detected in 1999 at 9 sites and in 2017 at 4 sites**
3. **Current data: 2022**
4. **16 molecules detected at 10 sampling points (12 insecticides, 2 herbicides and 2 fungicides)**

- Pesticides found include organochlorines (OCs), organophosphates (OPs) and carbamates.
- Atrazine, Bentazone, Dimethoate, Lindane, Monuron , Metribuzin , and pesticides not approved by the CILSS and UE institutions.
- Increase in the number of molecules in 2022

Spatio-temporal evolution of pesticides and Land Use

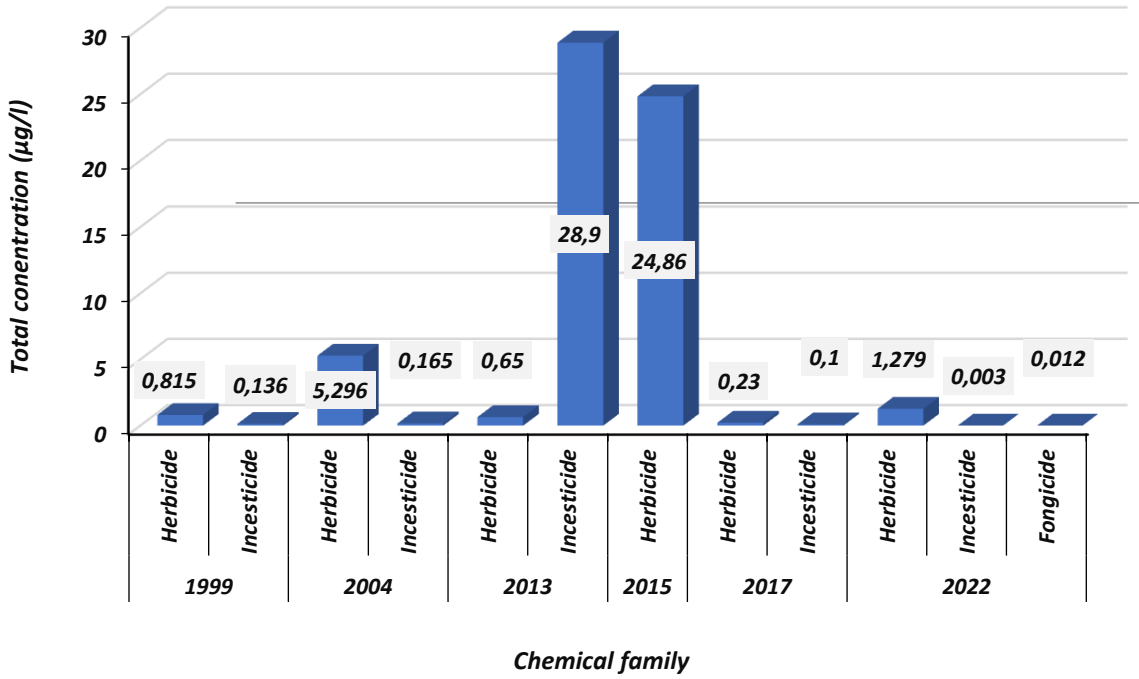


Figure 4: temporal variations of pesticides concentrations and molecules

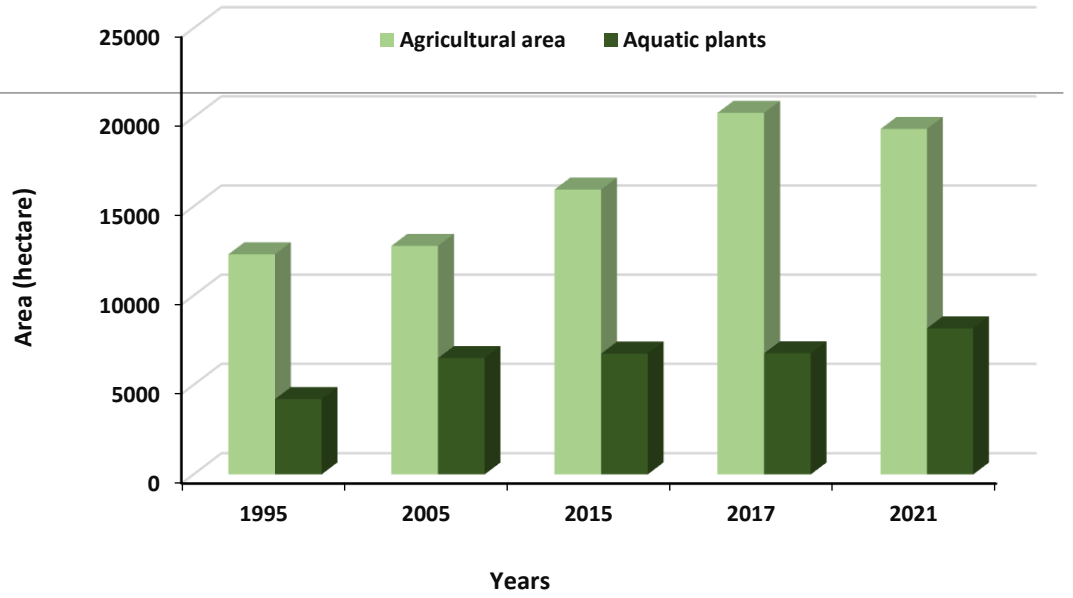


Figure 5: temporal variations of Agricultural areas and aquatic plant

- ❑ **Detailed proportions for four types of pesticides (insecticide, fungicide, herbicide)**
- ❑ **High concentrations of insecticides (2013) and herbicides (2015): this could be related to the specific use of pesticides on certain crops or against pests.**

- ❑ **Proportional temporal variation of Aquatic plants & Agric. area**
- ❑ **2017-2021: Agric. Area decrease ➔ COVID-19**

Statistical analysis of Heavy metals

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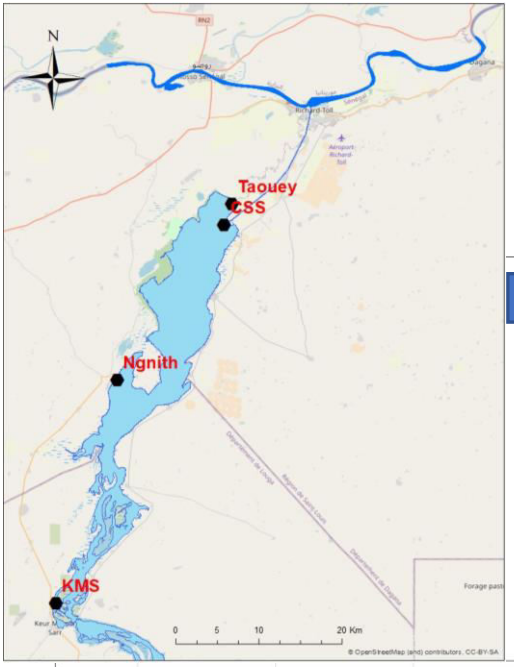

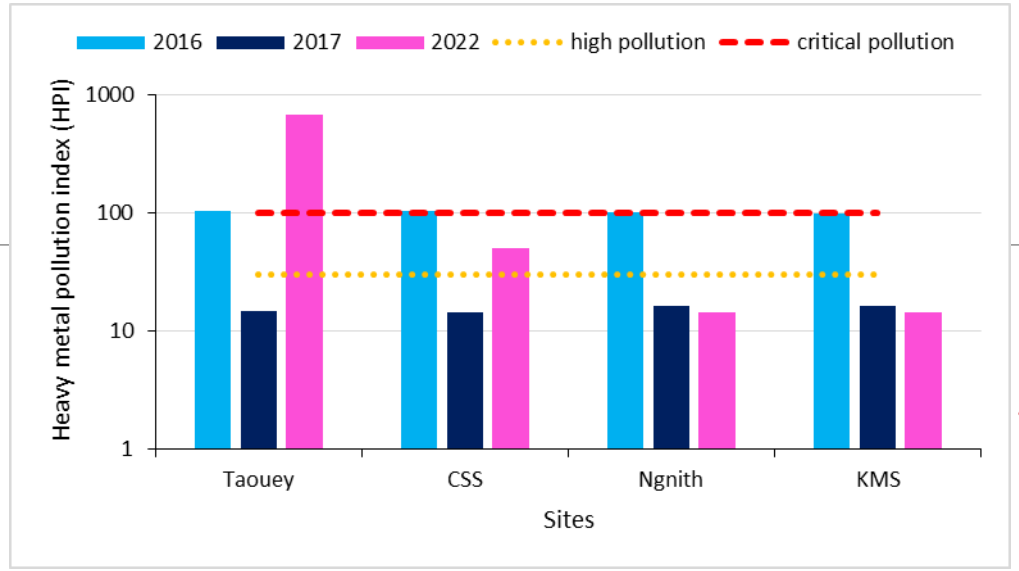

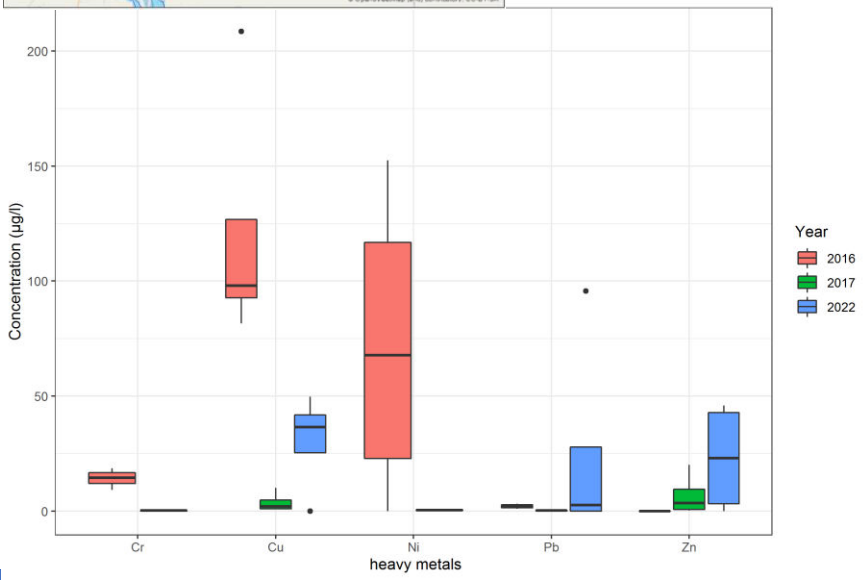

- **Stat. tests**: temporal variations of HM
- **Heavy metals**: active compound of pesticides
- **Correlation**: potential sources of HM

Table 2: Correlation matrix between pesticides and HM form KMS, Taouey and Ngnith in 2022

	Cu	Pb	Zn	Atrz	Bentz	Deseth.	Metrib.	Monu	Pend	Promet	Diuron	Dimet	Imidacl	Hydr biph
Cu	1													
Pb	0.66	1.00												
Zn	-0.96	-0.42	1.00											
Atrz	0.42	0.96	-0.14	1.00										
Bentz	-1.00	-0.62	0.97	-0.36	1.00									
Deseth.	-0.31	0.50	0.57	0.73	0.37	1.00								
Metrib.	0.41	0.95	-0.13	1.00	-0.35	0.74	1.00							
Monu	-0.98	-0.50	1.00	-0.23	0.99	0.50	-0.21	1.00						
Pend	0.66	1.00	-0.42	0.96	-0.62	0.50	0.95	-0.50	1.00					
Promet	-0.31	0.50	0.57	0.73	0.37	1.00	0.74	0.50	0.50	1.00				
Diuron	-0.81	-0.10	0.94	0.20	0.84	0.81	0.21	0.91	-0.10	0.81	1.00			
Dimet	0.66	1.00	-0.42	0.96	-0.62	0.50	0.95	-0.50	1.00	0.50	-0.10	1.00		
Imidacl	0.66	1.00	-0.42	0.96	-0.62	0.50	0.95	-0.50	1.00	0.50	-0.10	1.00	1.00	
Hydr biph	-0.98	-0.50	1.00	-0.23	0.99	0.50	-0.21	1.00	-0.50	0.50	0.91	-0.50	-0.50	1.00

CONCLUSION

- Annual increase of pesticide use and occurrence of new molecules in recent years

- Growing anthropic pressures (intensive agriculture, sanitation, water withdrawals) combined with climate change threaten the lake's water resources (pollution, eutrophication…)

- In depth sampling, spatial analysis and modeling tools for the qualitative and quantitative monitoring of the Lake Guiers basin (BLG) are implemented as part of our research

- High to moderate pollution levels have been detected at some sites for most of the targeted parameters.

- Environmental degradation of the BLG resources is not negligible, and impacts on human health to be expected considering all the parameters under study (nutrients, pesticides, metals, major elements, chlorophyll, cyanobacteria)
- Ongoing monitoring of the chemicals and emerging pollutants in the BLG is required and must be accompanied by:
  - Integrated management of BLG's resources with multiple stakeholders
  - Increased awareness to avoid eutrophication