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A critical evaluation of selected Persistent Inorganic and Organic Pollutants in the hydrological system

A case study on Keoladeo National Park (KNP), a UNESCO World Heritage Site in India

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Main and specific objectives

Consolidation of data on persistent inorganic and organic pollutants in the hydrological systems in and around Keoladeo National Park (KNP), Bharatpur, India

- Do toxic metals in the hydrosphere compartments show a temporal scale pattern?
- How do organo-chlorine and organo-phosphate pesticide residues in different hydrological compartments persist over time?

Expected outcome

- Knowledge base on persistent chemical residues in the KNP and its neighbouring satellite wetlands
  - Source and concentration of toxic metals, organo-chlorines and organo-phosphates in water and soil, and their decadal trend, if any.
  - Flux of these chemical residues into KNP from the surrounding landscape including the rivers or water inflow, etc.
- Agro-chemical use: Shift (decadal) in
  - Time of use
  - Frequency of use
  - Application rate
- Influencing factors (meteorological data), which affect these chemicals influx into the hydrological system
  - Decadal changes?

Data Availability and Access

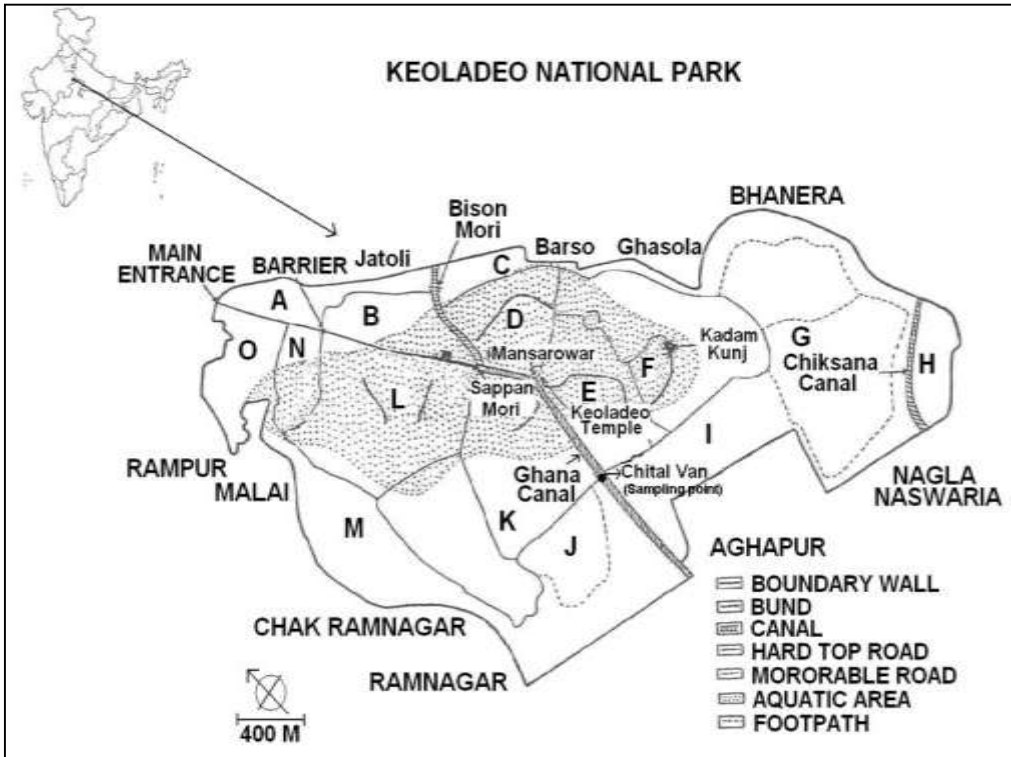
Aspects	Hydrosphere (compartment)	Potential source
Meteorological aspects (Rainfall, temperature)	---	• India Meteorological Department (IMD), Jaipur • Department of Water Resources, Government of Rajasthan (GoR), India
Water input to KNP	Water	• Irrigation Department, Bharatpur • Office of The Director, KNP
Area and site features	Satellite wetlands and watershed (river basins in the area)	• Department of Water Resources (GoR)
Water availability		
Agrochemical usage	Land (application in farmland)	• District Statistical Handbook (GoR) • Earlier survey reports by the Project investigator.
Toxic metals	Water and soil	• Published and unpublished research articles and reports • Earlier project reports and publications of the Project Investigator & his team, and other researchers in India
Organochlorines	Water and soil	
Organophosphates	Water and soil	
Any of the above pollutants	Strategic locations / aspects	• Environmental samples will be collected and the pollutants will be measured following standard analytical methods.

Contribution to UNESCO's main project

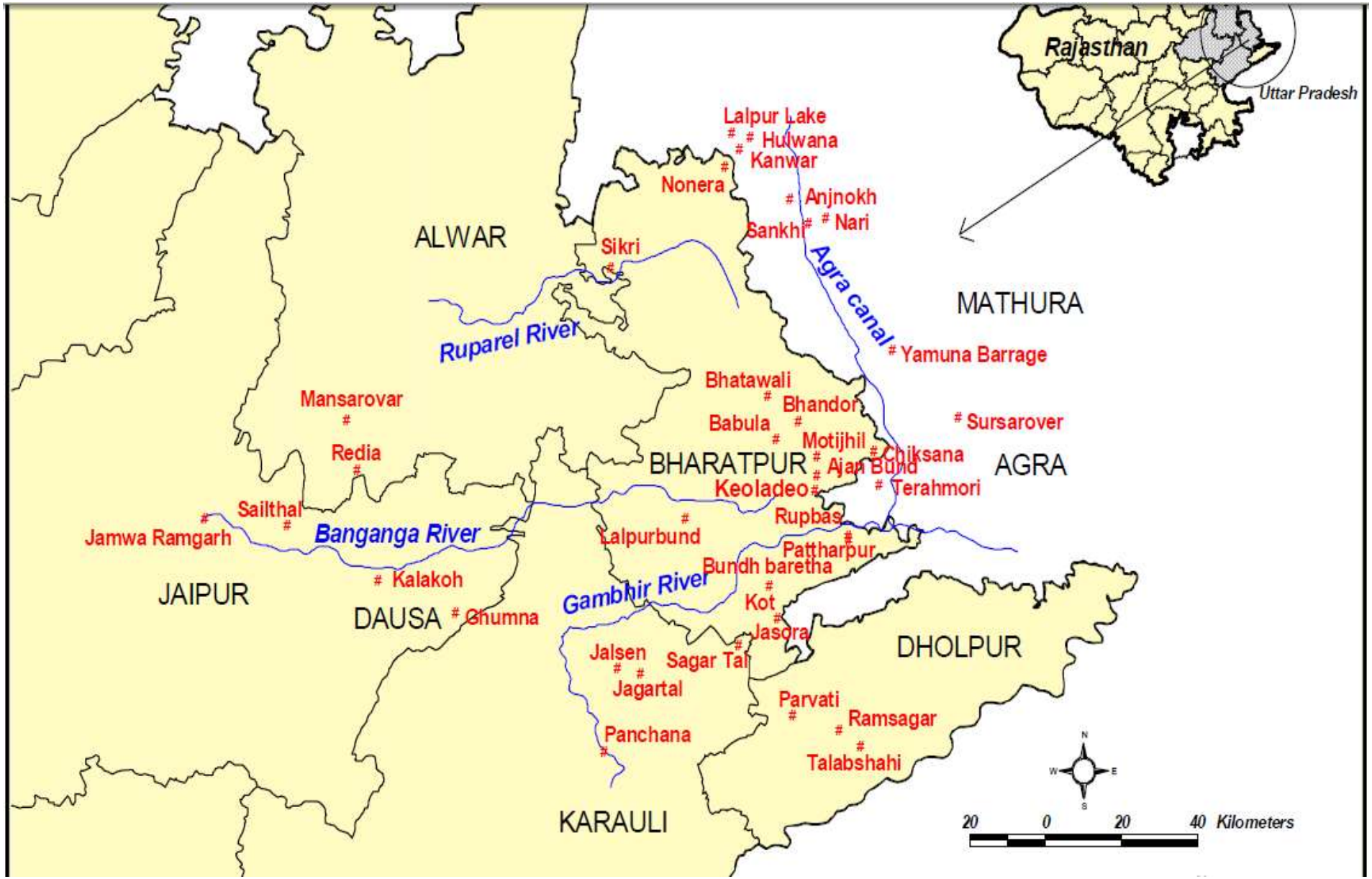
By plugging the data gaps on persistent pollutants in hydrological systems from one of the representative

- Habitats of South Asia
- UNESCO World Heritage Sites

Year	Ecological causalities
1987-1988	18 Sarus cranes 50 Collared doves Few Blue Rock Pigeons
1989-1990	
2003-2005	Proliferation of water hyacinth
2005-2006	Invasion of *Clarias gaeripineus*
23-11-2000	15 Sarus cranes and 03 Common cranes



Location of KNP and satellite wetlands



Wetlands	July Aug Sep Oct Nov Dec Jan Feb March Apr May June	Species	Size (km^2)
Pattharpura		18	0.5
Bhandor		16	1
Nonera		55	1
Kanwar		12	1
Jasora		37	1
Babula		14	2
Lalpurbandh		20	2
Rupbas		19	2
Anjnokh		17	2
Hulwana		15	2
Talabshahi		36	2
Bhatawali		6	3
Nari		37	3
Sagartal		22	3
Jalsen		9	4
Sankhi		20	4
Sursarover		48	5
Ghumna		20	5
Lalpur		24	5
Kot		57	5
Ramsagar		35	6
Yamuna barrage		43	6
Motijhil		25	7
Senthal		24	7
Chiksana		10	8
Redia bundh		45	8
kalakhoh		54	10
Jagartal		48	10
Mansarover		45	10
Jamwa Ramgarh		17	12
Baretha Bundh		63	12
Ajan Bundh		21	12
Panchana		32	14
Parvati		40	70

Satellite wetlands and their hydrological details *(located within 200 km from KNP in order of their increasing distance from KNP)*

- **Various toxic chemicals being used in the farmlands**
  - **Endosulfan**
  - **Aldrine**
  - **2,4-D**
  - **Cypermethrine**
  - **Other Organochlorines and**
  - **Organophosphates**

Agrochemicals usage rate (% increase)
•25% (cereals and oilseed crops)
• 108% (vegetable crops)

Expected POP residues

Sl. No.	POP	Group	Sl. No.	POP	Group
1	α- HCH	OC	17	DDT	OC
2	β- HCH	OC	18	Benzene hexachloride	OC
3	γ- HCH	OC	19	Dicofol	OC
4	δ- HCH	OC	20	Lindane	OC
5	S- HCH	OC	21	Phorate	OP
6	Aldrin	OC	22	Acephate	OP
7	Dieldrin	OC	23	Dimethoate	OP
8	Heptachlor	OC	24	Profenofos	OP
9	Hept. Epoxide	OC	25	Cypermethrin	Pyrethreoids
10	Endosulphan- I	OC	26	Fipronil	Phenylpyrazole
11	Endlosulphan- II	OC	27	Carbendazim	Benzimidazole carbamate
12	Endosulphate	OC	28	Mancozeb	Dithiocarbamate
13	S- Endosulphan	OC	29	Chlordane	Cyclodiene (OC)
14	Endrin	OC	30	Dichlorvos	OP
15	4,4’ –DDE	OC	31	Acetamiprid	Neonicotinoid
16	4,4’- DDD	OC	32	2,4-D	OP

Reported OC residues

POP	2014	2010
α -BHC	√	√
β- BHC	√	√
ϒ -BHC	√	√
δ- BHC	√	√
Heptachlor	√	√
Aldrin	√	√
Heptachlor epoxide	√	√
α -Chlordane	√	---
ϒ -Chlordane	√	---
Dieldrin	√	√
4,4'-DDD	√	√
4,4'-DDT	√	√
4,4'-DDE	√	√
Endosulfan-I	---	√
Endosulfan-II	---	√
Endo.sulfate	---	√
Endrin	---	√

It is just the beginning of data synthesis

(case study development)

Much more to come.....

Thanks.