

Water quality assessment of the Kadisha “Abou Ali” River basin, North Lebanon

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07 January 2020

Introduction

1

Water Scarcity

4

Increasing Mortality

2

Water Pollution

5

Air Pollution

3

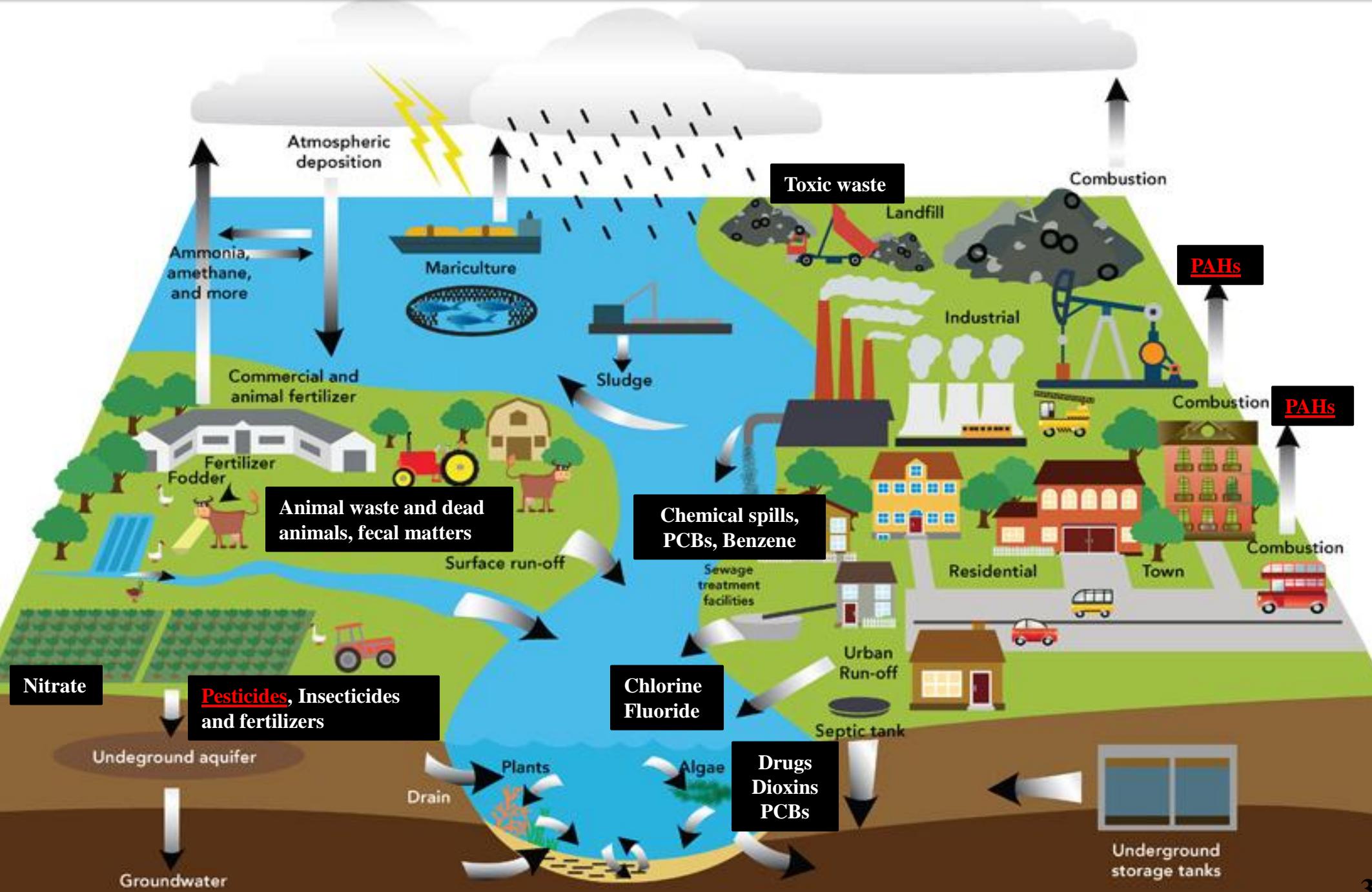
Loss of Biodiversity

6

Climate change

People need to change their environmental behavior

Water Pollution and Major Contaminants

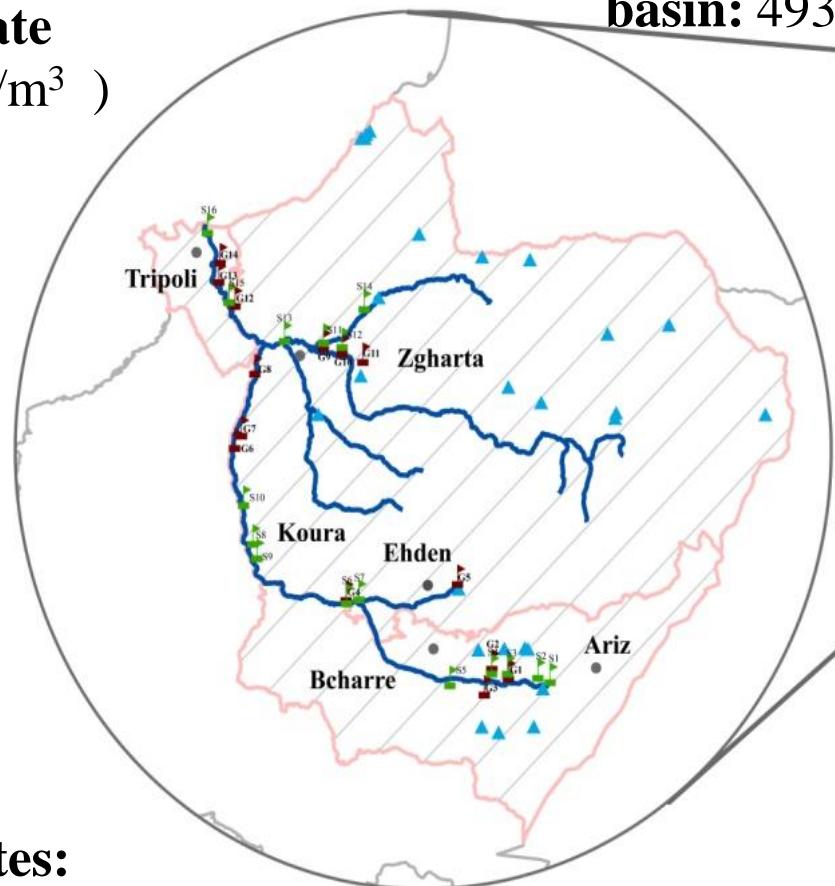


Case Study: The Kadisha River (North Lebanon)

Mean water annual
discharge rate
(262 million/m³)



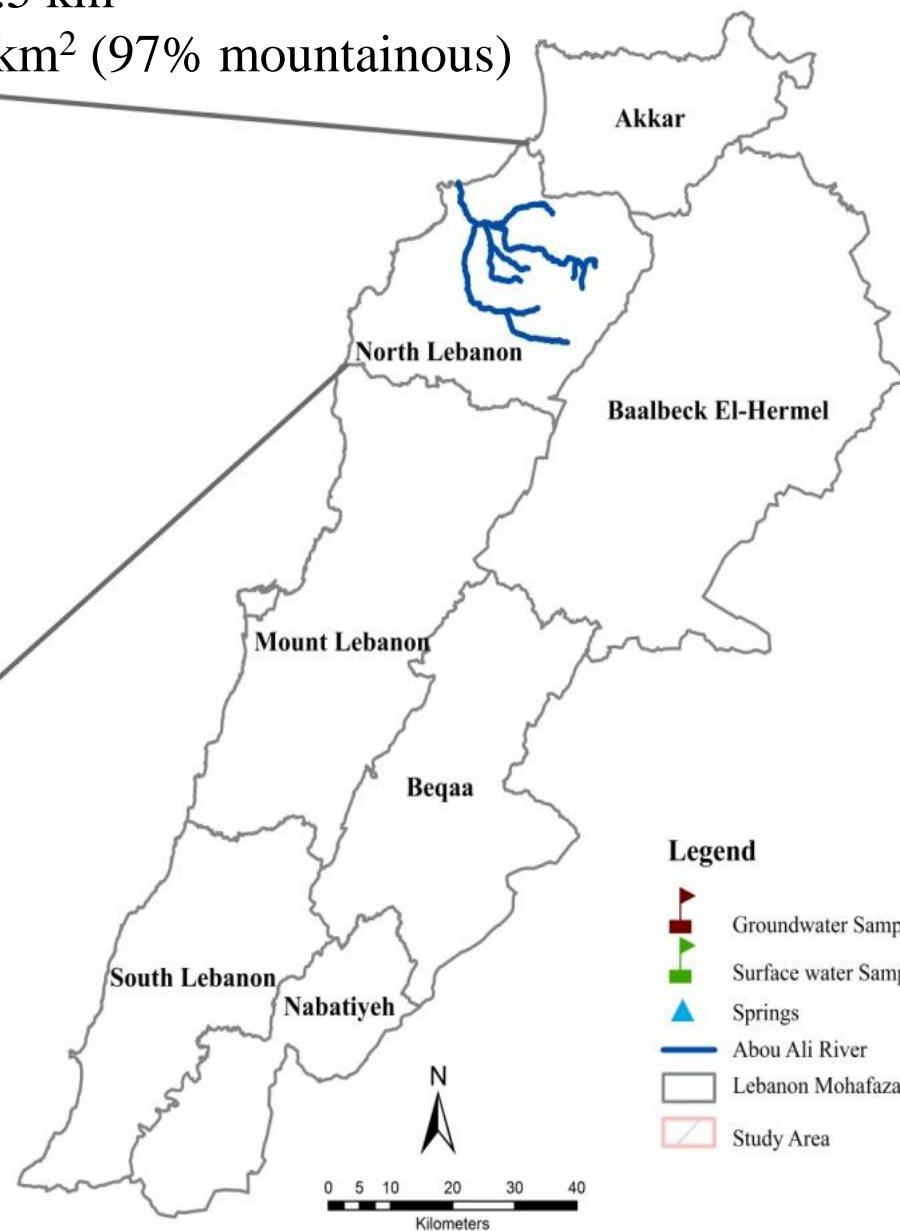
Length: 44.5 km
basin: 493 km² (97% mountainous)



Coordinates:

34°12' and 34°27' North latitudes 35°50' and
36°07' East longitudes

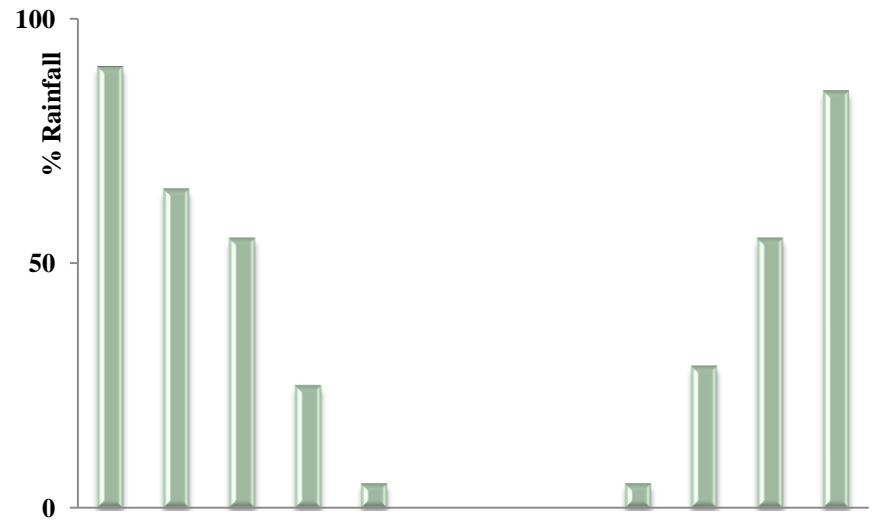
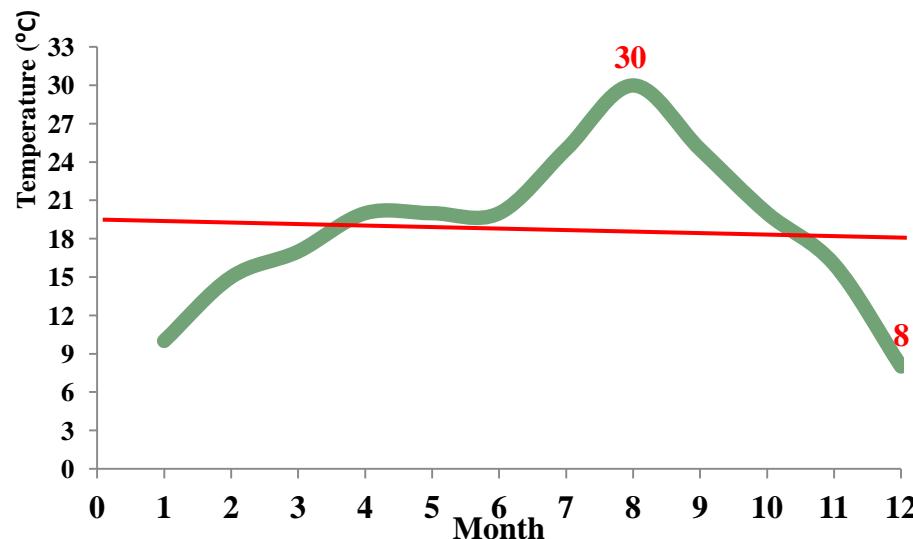
Population: Exceeding 10,000 inhabitants/ km²
(23,000 inhabitants/ km² in Tripoli)



Case Study: The Kadisha River (North Lebanon)

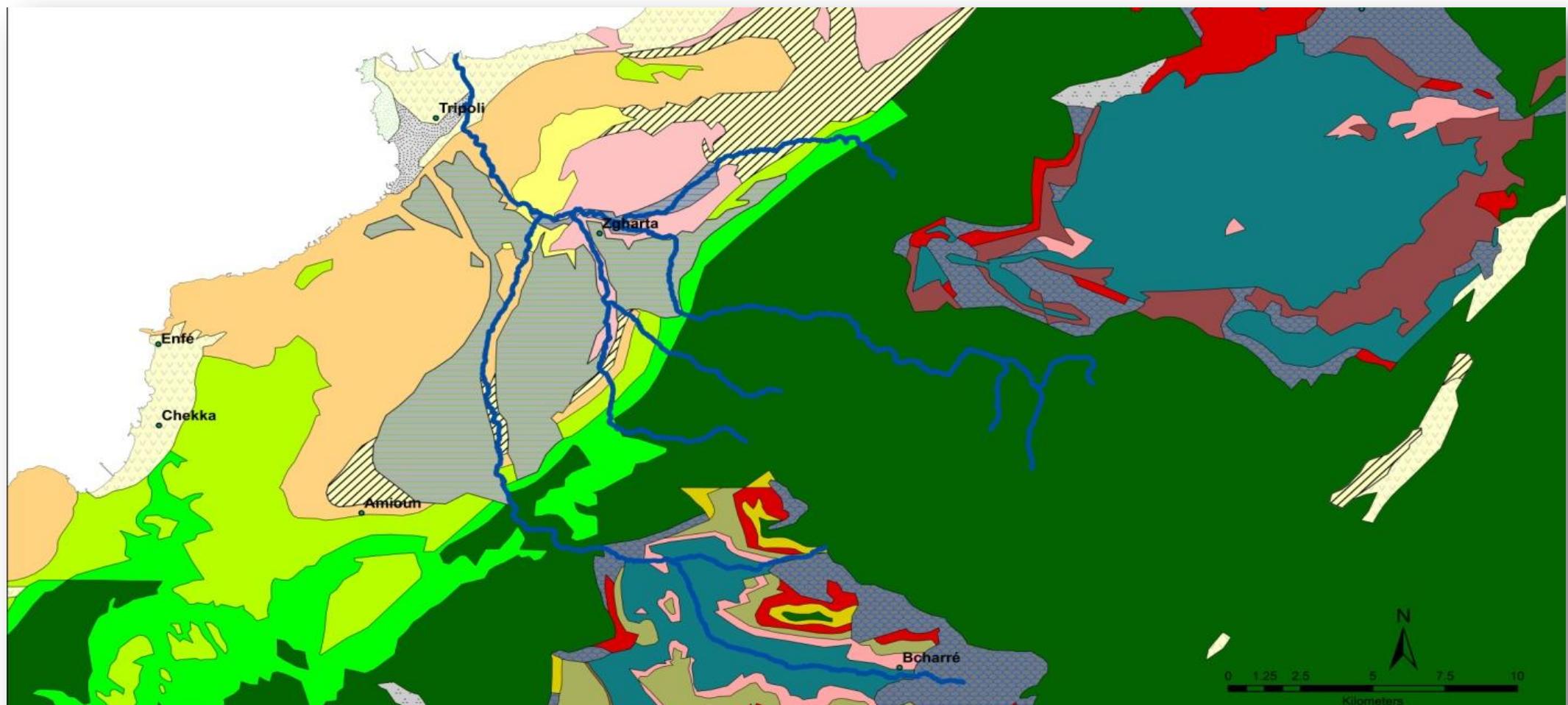
➤ Climate

- Mediterranean climate (mild winters and warm summers)
- Mean annual rainfall (1600 mm at Kadisha grove and 700 mm at river mouth)



Case Study: The Kadisha River (North Lebanon)

➤ Geology

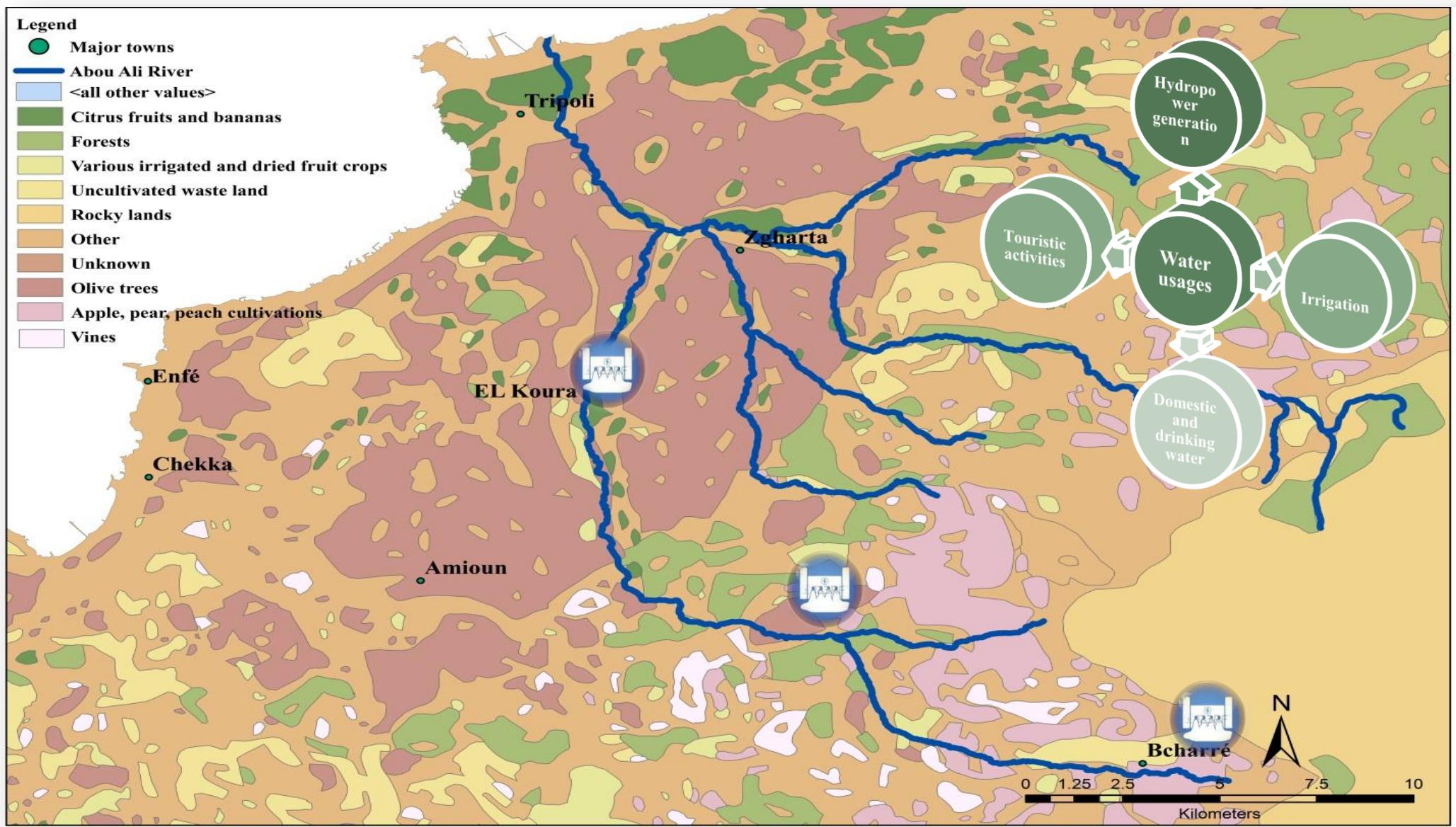


Geology Class	
QUATERNIAIRE	qsr: sols rouges qta: terres arables
	lac: cuvette lacustre de Yammouné
	qaa: alluvions anciennes
	qar: alluvions actuelles
	qcpb: callotis de pentes et coulées boueuses
	qd: décollements
	qgl: grés littoraux
	qsl: sables littoraux

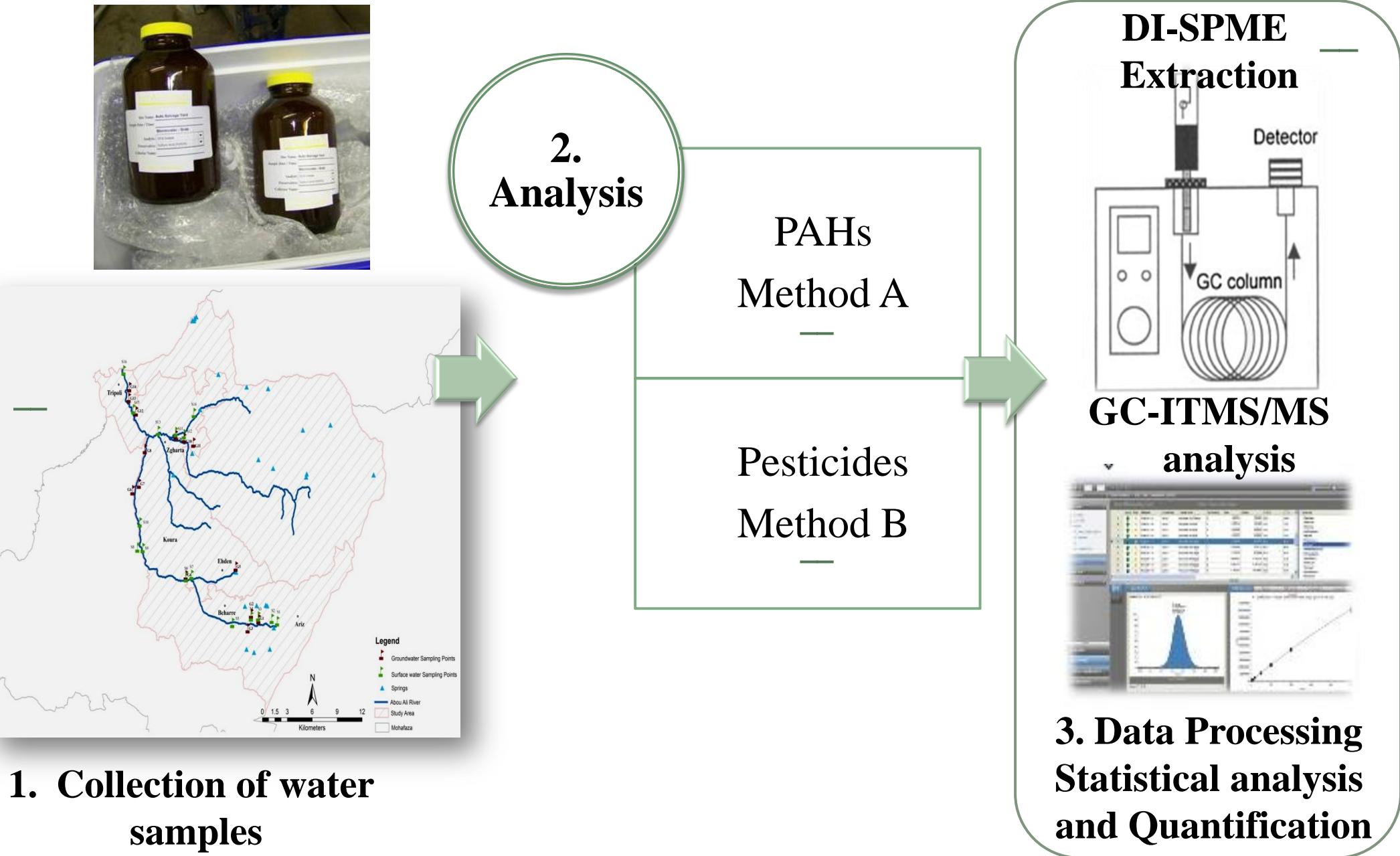
CRETACE	
c6: marnes et marno-calcaires blancs	
c5: calcaire et marno-calcaire à lits de silex	
c4: calcaire régulièrement lités, clair	
c3: alternance de marne verte et de banc calcaire	
c2: alternance de terrains argilo-sableux et de banc calcaire	
c1-2: Crétacé inférieur et Aptien indifférenciés	
c1: grés de base	
JURASSIQUE	
j4-7: calcaire massif gris-clair/jurassique terminal détritique ou récifal	
j2-3: dolomies noires/calcaire ocre	
ROCHES ERUPTIVES BASALTE	
bq: basalte quaternaire	
bp: basalte pliocène	
bm: basalte miocène	
bc: basaltes du crétacé inférieur	
bj: basaltes du jurassique terminal	

Case Study: The Abou Ali River (North Lebanon)

➤ Land use and Water usages



Methodology Flowchart



1. Collection of water samples

2.
Analysis

PAHs
Method A

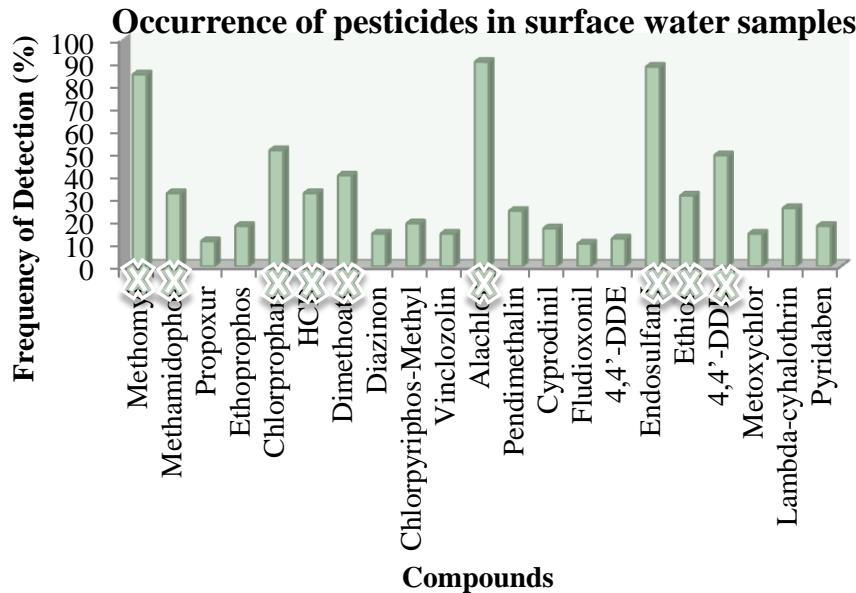
Pesticides
Method B

DI-SPME Extraction

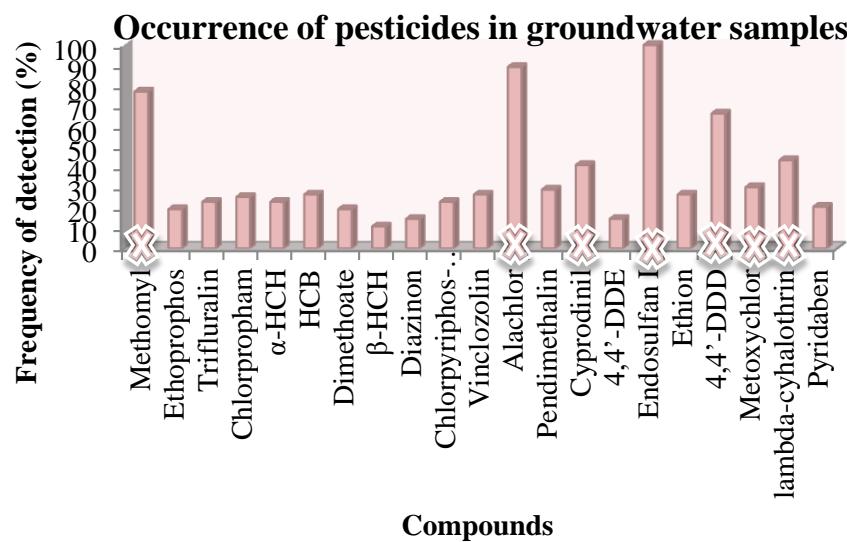
GC-ITMS/MS analysis

3. Data Processing
Statistical analysis and Quantification

Contamination of Water Samples With Pesticides



Pesticides	Range (ng/mL)	Mean (ng/mL)	Standard Deviation
Methomyl	0- 3.282	1.497	0.735
Methamidophos	0- 0.985	0.208	0.334
Chlorpropham	0- 0.093	0.017	0.019
HCB	0- 1.795	0.251	0.403
Dimethoate	0- 0.82	0.059	0.114
Alachlor	0- 0.960	0.29	0.176
Endosulfan I	0- 0.234	0.102	0.04
Ethion	0- 0.138	0.043	0.064
4,4'-DDD	0- 0.194	0.075	0.08



Pesticides	Range (ng/mL)	Mean (ng/mL)	Standard Deviation
Methomyl	0-0.716	0.447	0.252
Alachlor	0-0.391	0.254	0.123
Cyprodinil	0-0.400	0.148	0.179
Endosulfan I	0-0.266	0.056	0.041
4,4'-DDD	0-0.146	0.076	0.057
Metoxychlor	0-0.092	0.016	0.027
lambda-cyhalothrin	0-0.187	0.056	0.067

Bad Publicity

THE DAILY STAR

LEBANON



BETA - Beirut for the Ethical Treatment of Animals

10 August 2016 · *

BAN OF LANNATE SALES IN LEBANON!!

On June 13, 2016, the Ministry of Agriculture and the Ministry of Public Health issued new regulations concerning pesticides, and completely banned the use of Methomyl or what we know as "Lannate poison", effective starting June 2017. The previous regulations stated that lannate, which is colorless and odorless had to be mixed with other products in order to have a color and a strong smell.

Methomyl (Lannate poison) is not only deadly to dogs and cats. It is also extremely dangerous for kids and humans, and causes a serious threat to our health! And it also causes horrible damage to the wildlife populations!

Beloved adopted Tracy, a very loved and pampered dog lost her life 2 days ago because someone had spread lannate poison where she was being walked, and so did a big number of cats in the Bouar Area.

Our sincere condolences to Vicky who is suffering from one huge loss that words cannot describe, and to everyone who has lost their pets to lannate



green area
greenarea.me

[Manchette](#) [Main Report](#) [News](#) [Expert Opinion](#) [Green Press](#) [Climate Change](#) [Multimedia](#)

ADD YOUR ARTICLE

Lannate... A fatal poison killing animals in Lebanon's streets

[Ask the ministry of Agriculture to Ban the selling of Lannate - Change.org](#)

<https://www.change.org/.../ministry-of-agriculture-ask-the-ministry-of-agriculture-to-...>

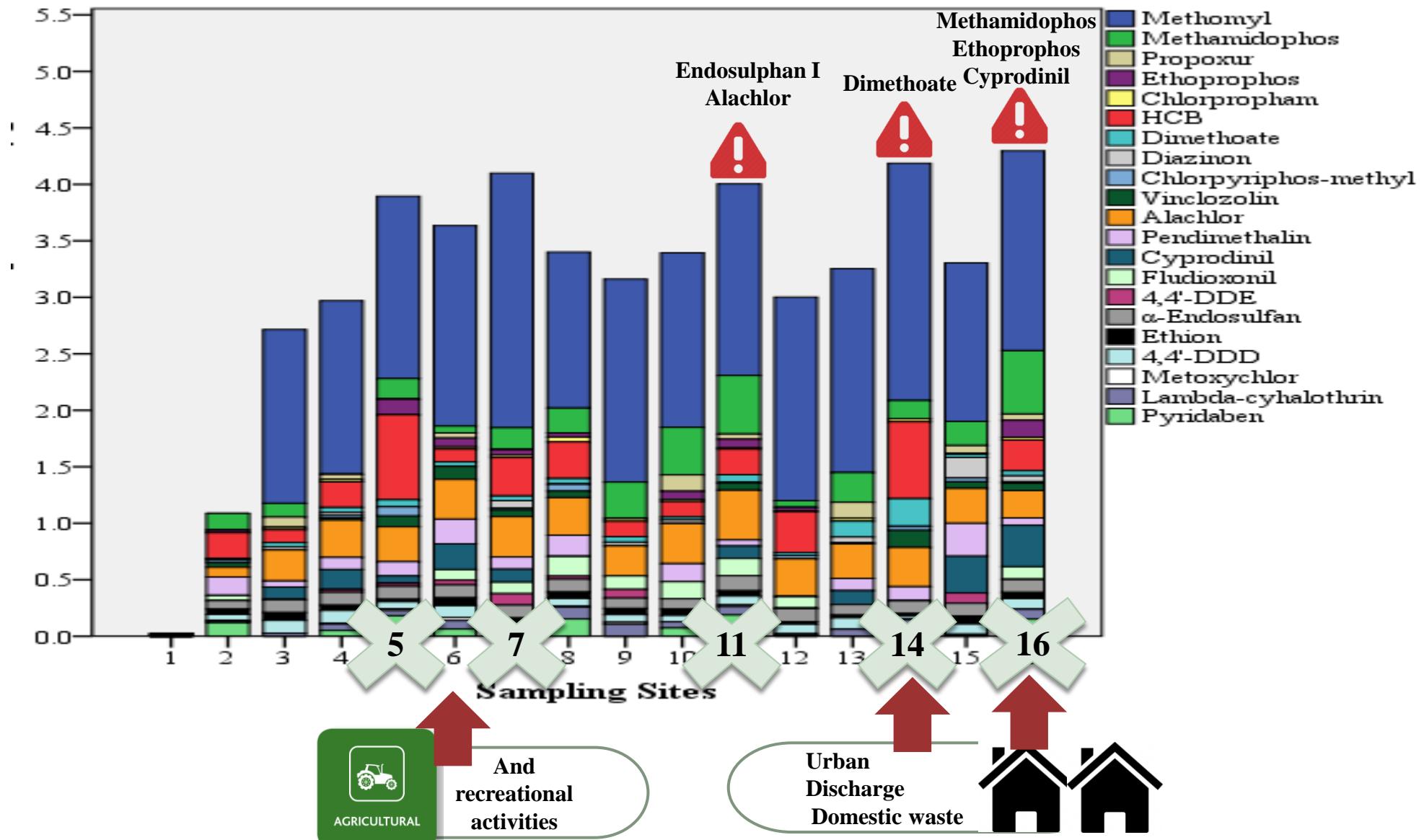
Please help us relay this message to the ministry of Agriculture by asking them to BAN THE SELLING OF LANNATE IN LEBANON AND PUNISH EVERY ...

October 14, 2016 | Zeina Nasser

14

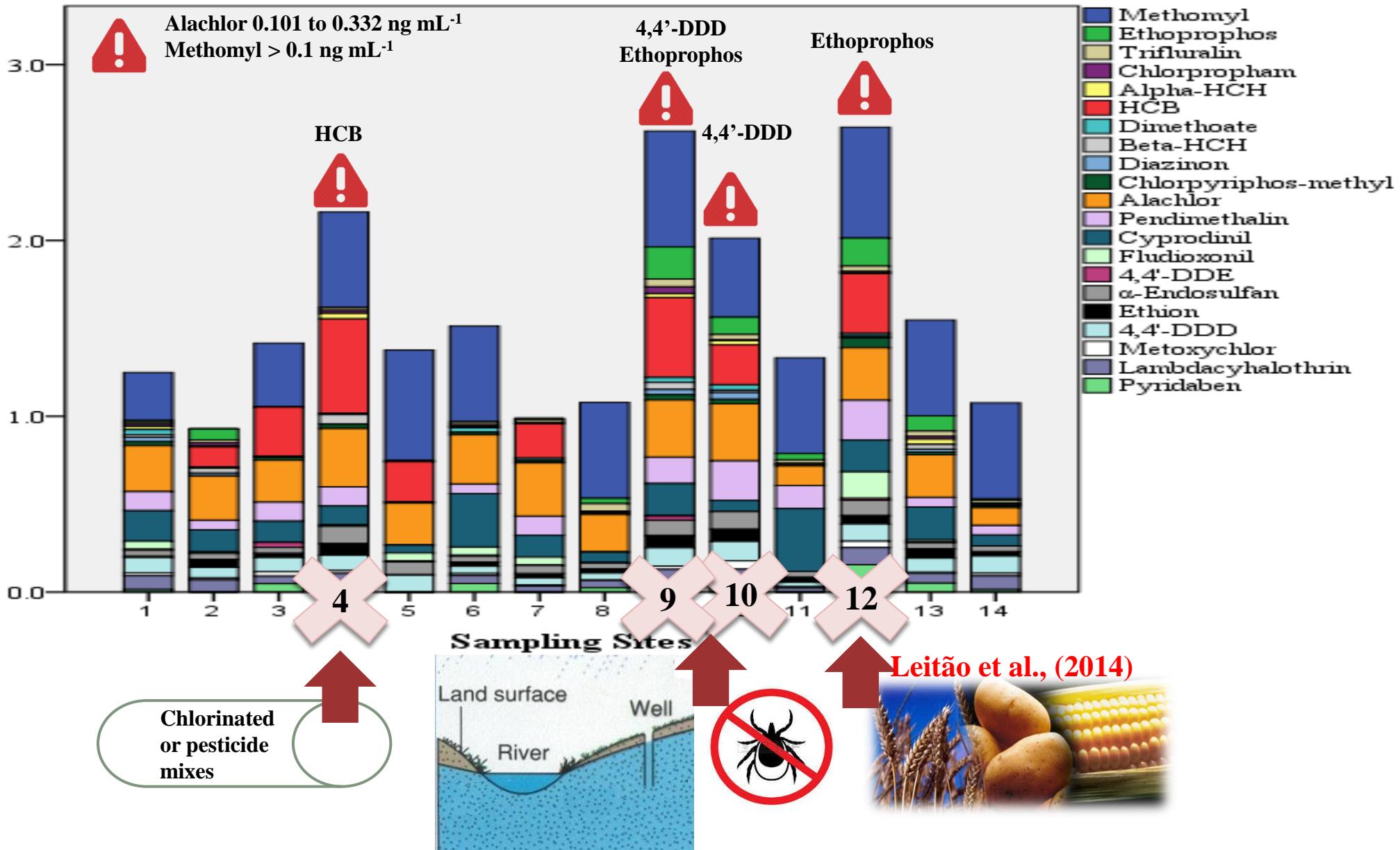
Spatial Distribution of Pesticides

Total Concentration of Pesticides in surface water samples (ng/mL)



Spatial Distribution of Pesticides

Total Concentration of Pesticides in groundwater samples (ng/mL)



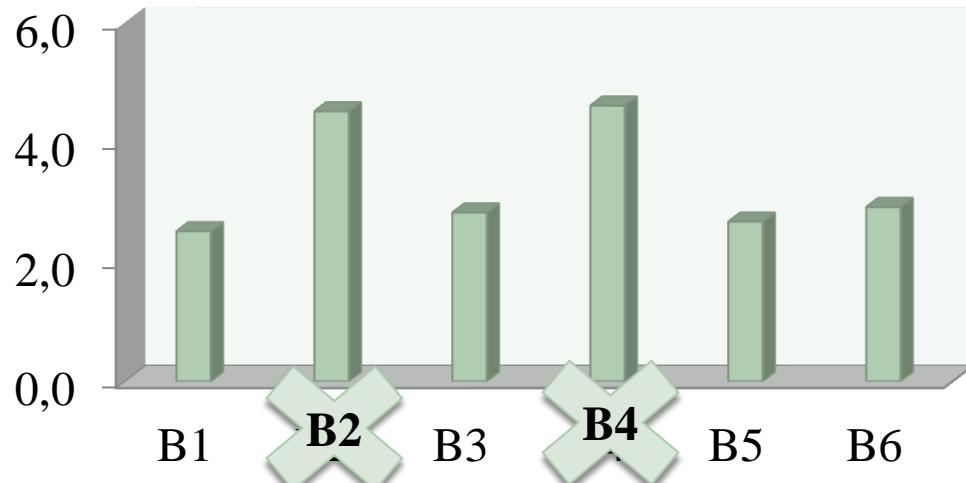
Distribution of Pesticides by Sampling Batch and Sampling Period

Total mean concentration of pesticides in surface and groundwater (ng/mL)



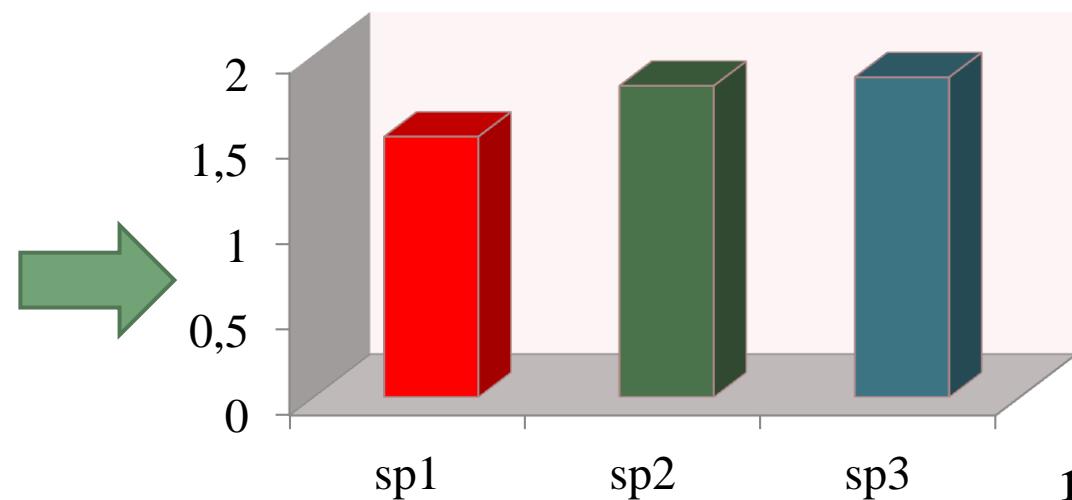
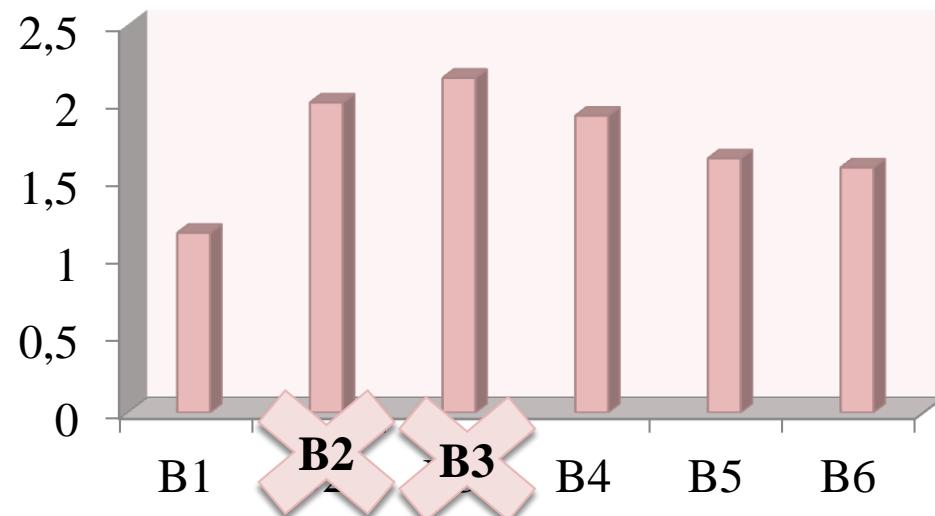
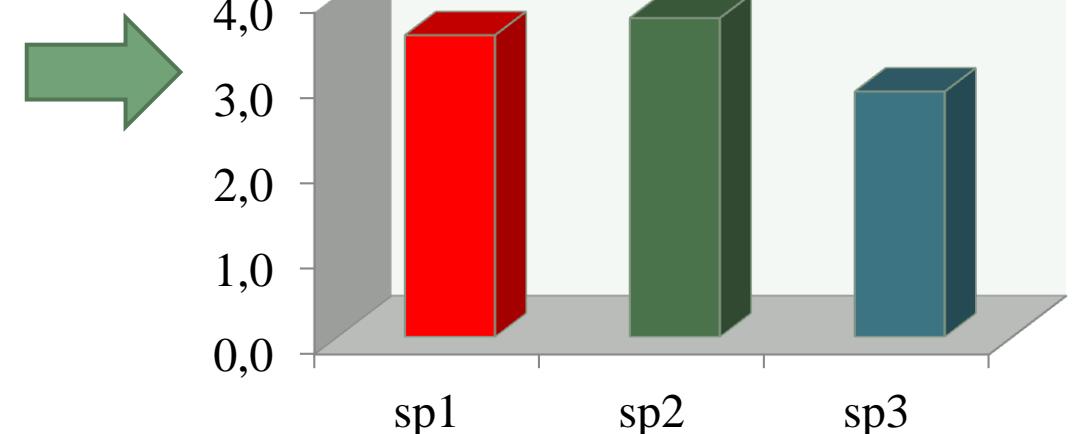
a. Sampling Batch

B1/B4=Aug 2015/2016
B2/B5=Oct 2015/2016
B3/B6=Mar 2016/2017



b. Sampling Period

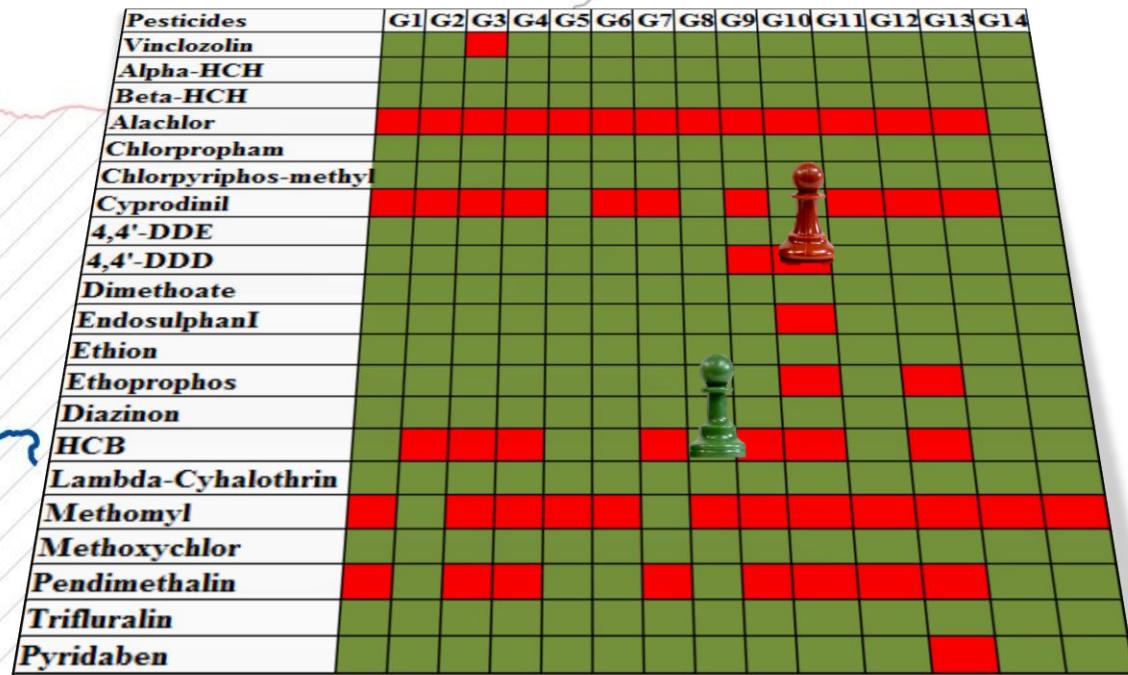
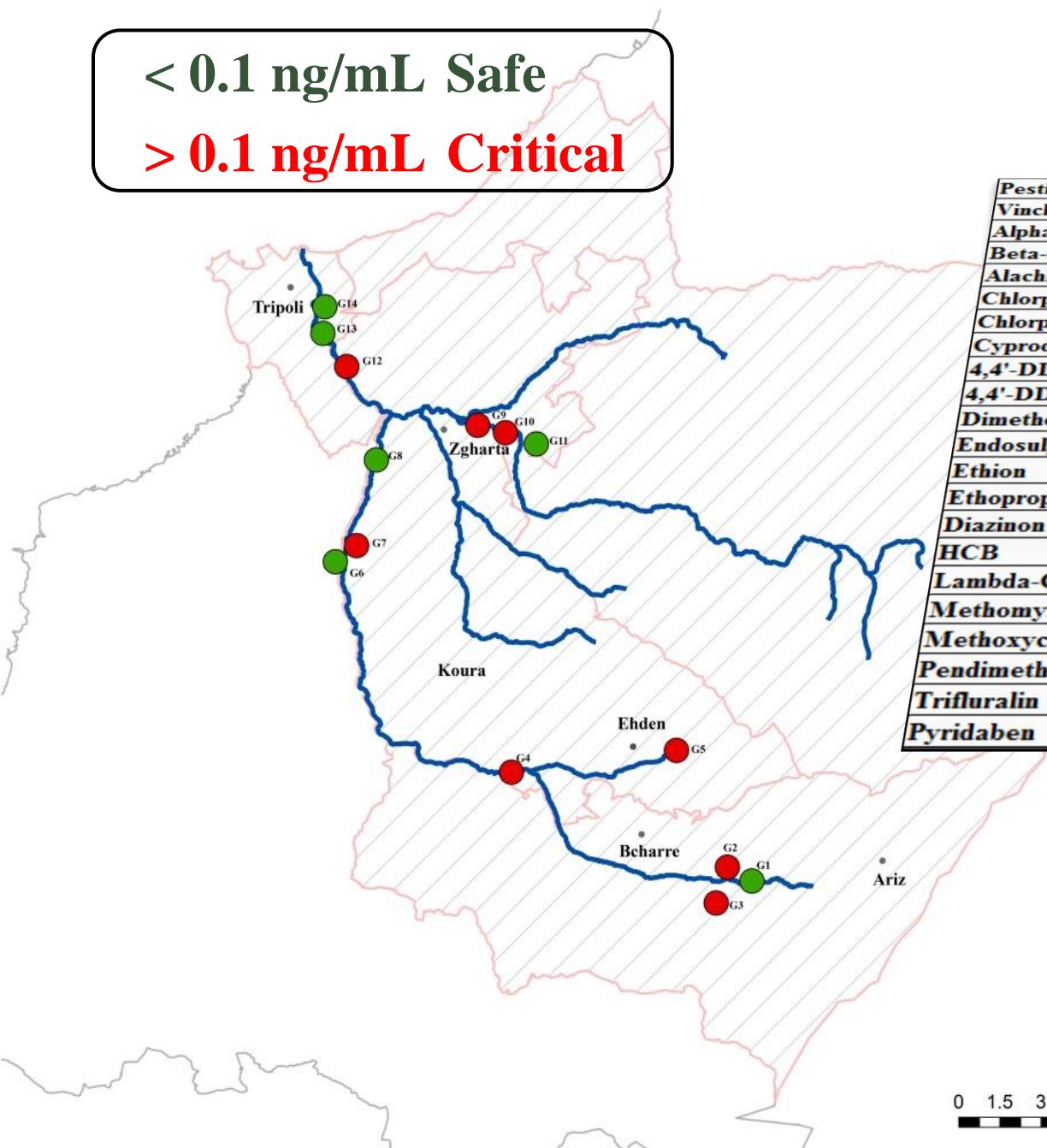
B1+B4= sp1
B2+B5= sp2
B3+B6= sp3



Mapping of Contaminated Groundwater Sites

< 0.1 ng/mL Safe

> 0.1 ng/mL Critical



Legend

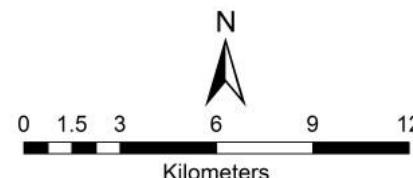
HCB (ng mL⁻¹)

- 0 - 0.1
- > 0.1

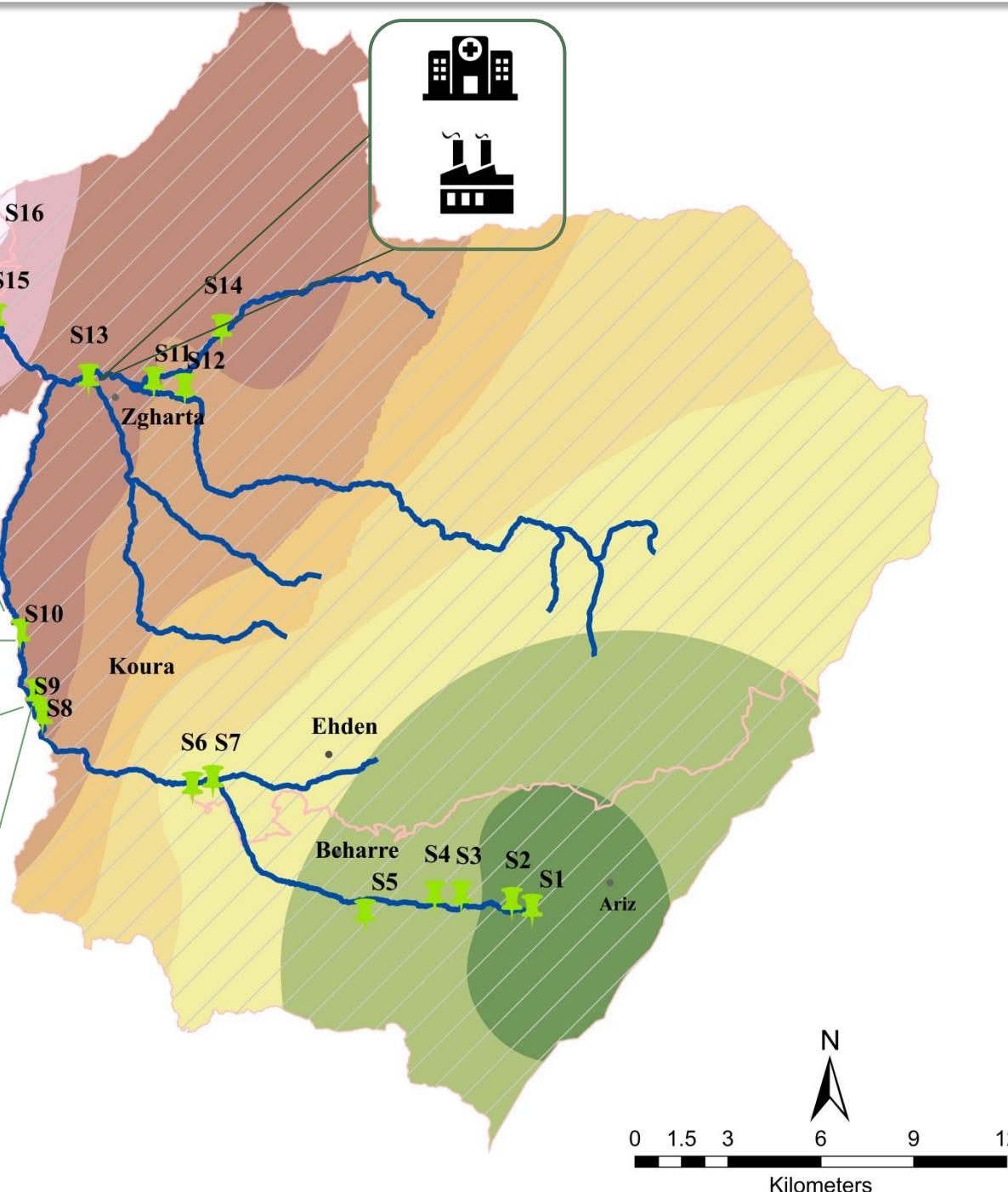
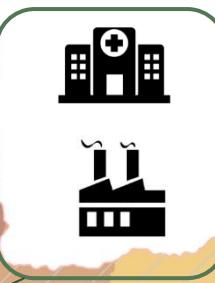
— Abou Ali River

■ Study Area

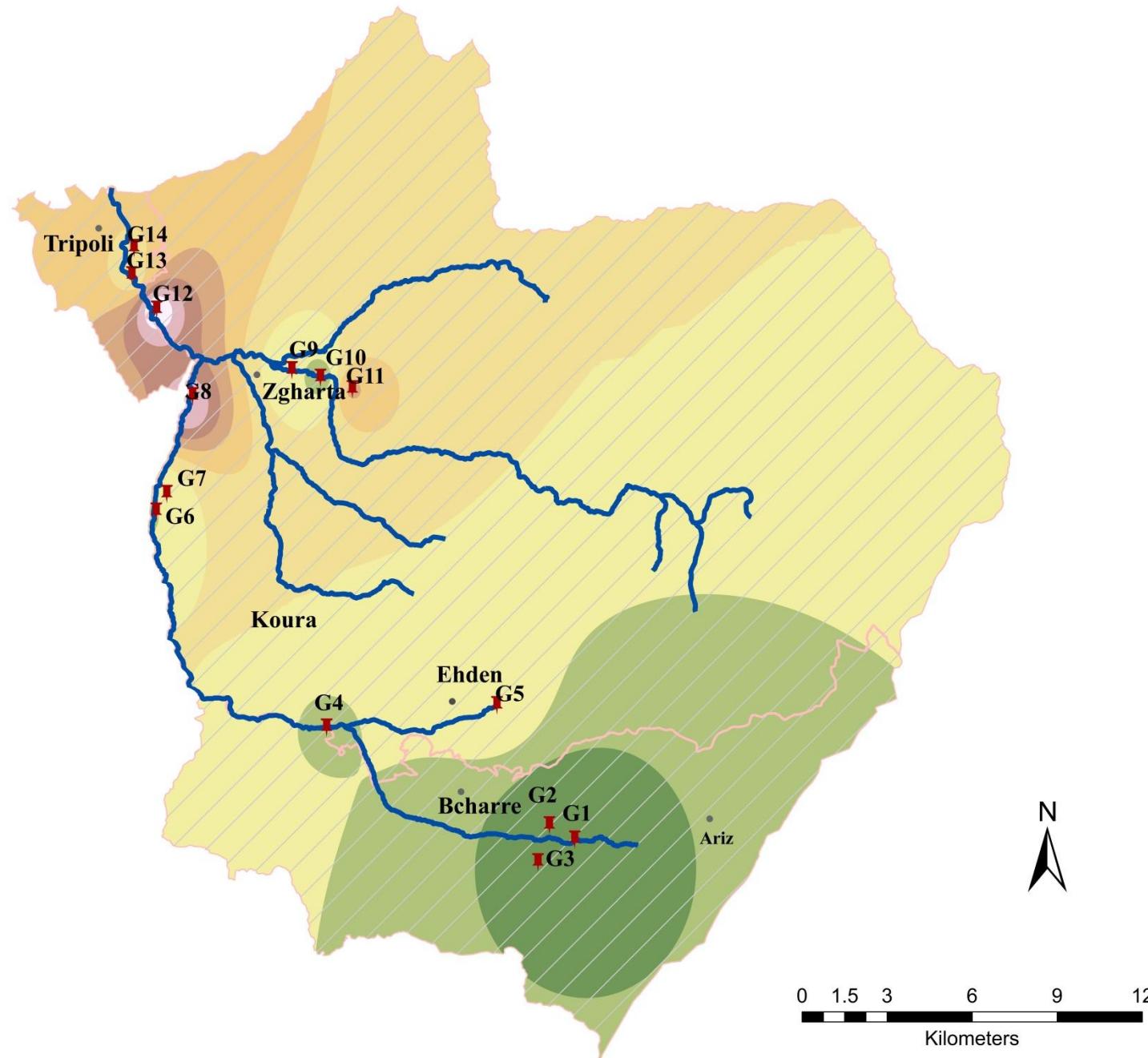
□ Mohafaza



Distribution of PAHs by Sampling Sites in Surface Water Samples

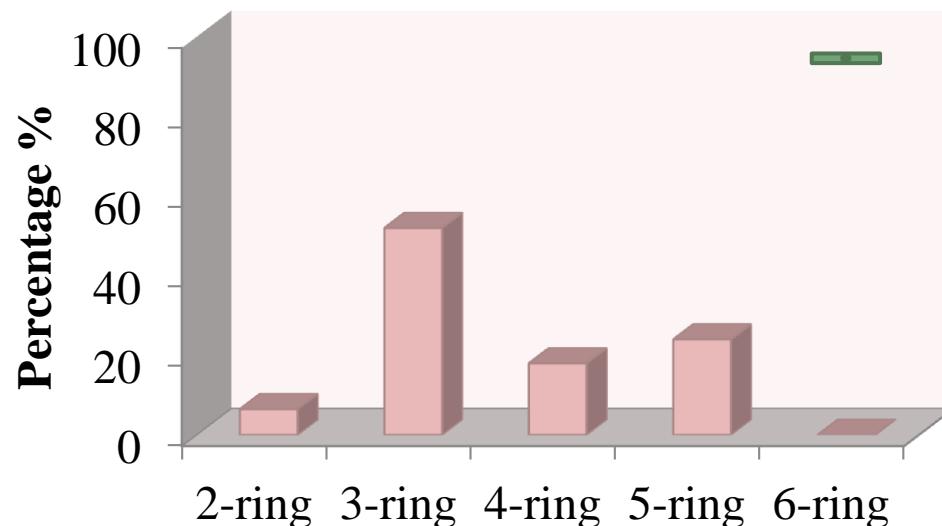
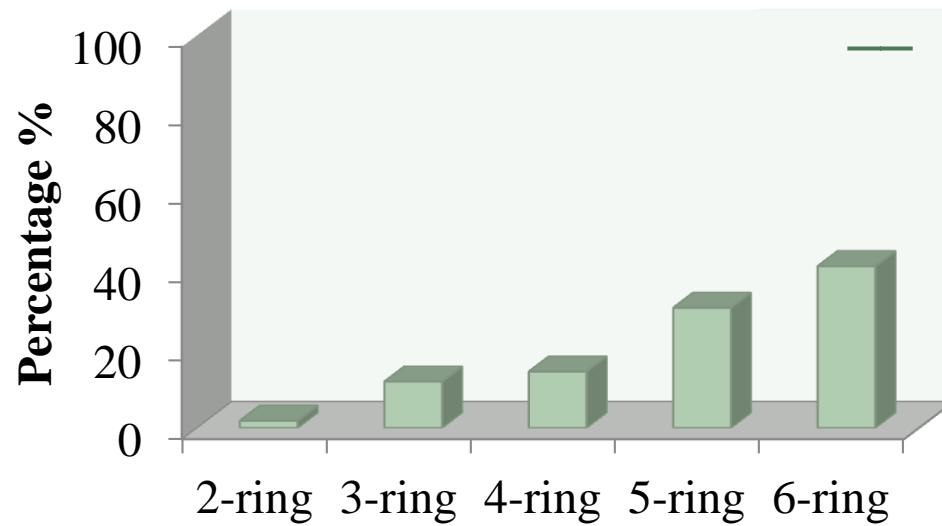


Distribution of PAHs by Sampling Sites in Groundwater Samples

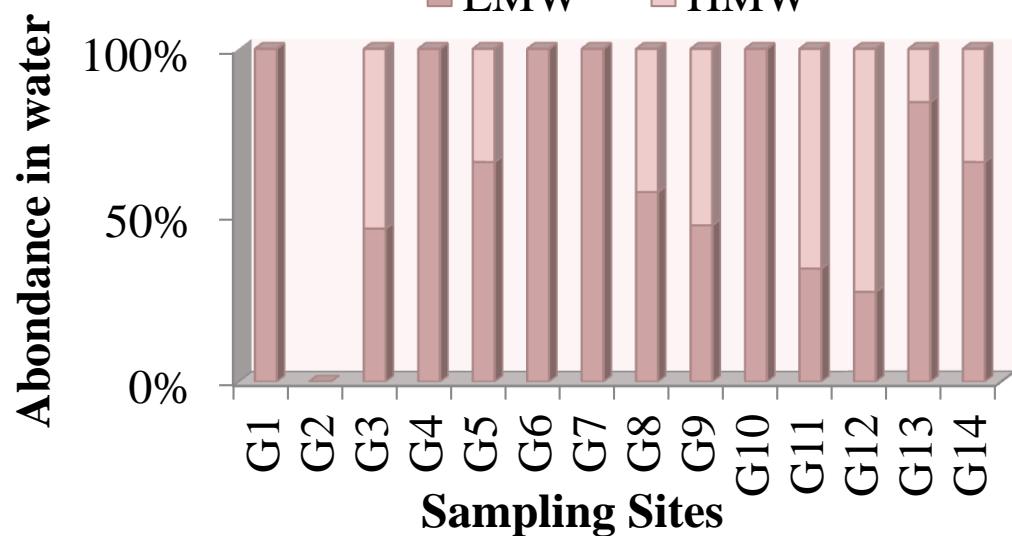
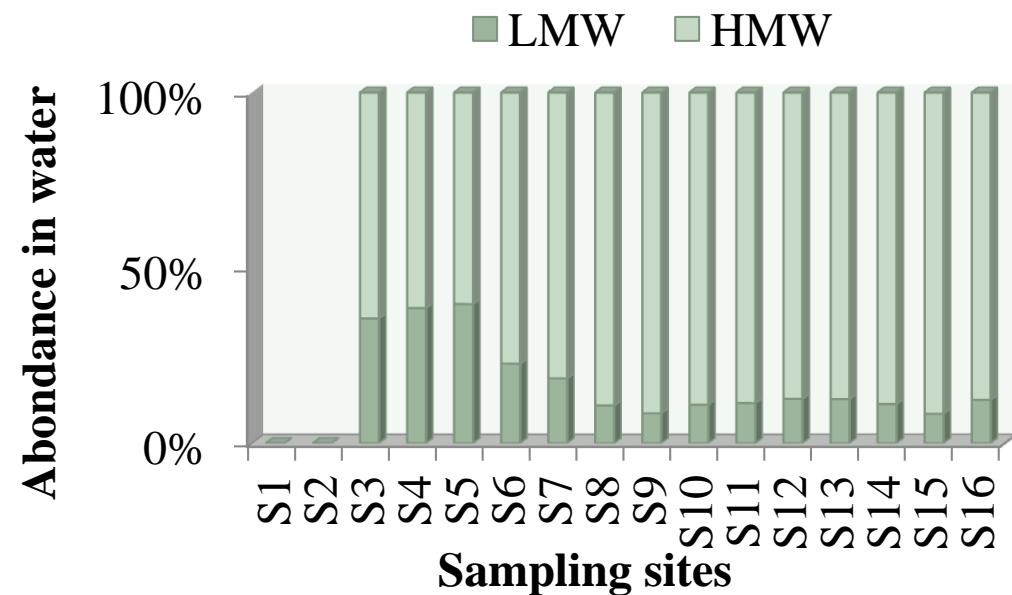


Composition Profiles of PAHs

a. Number of rings



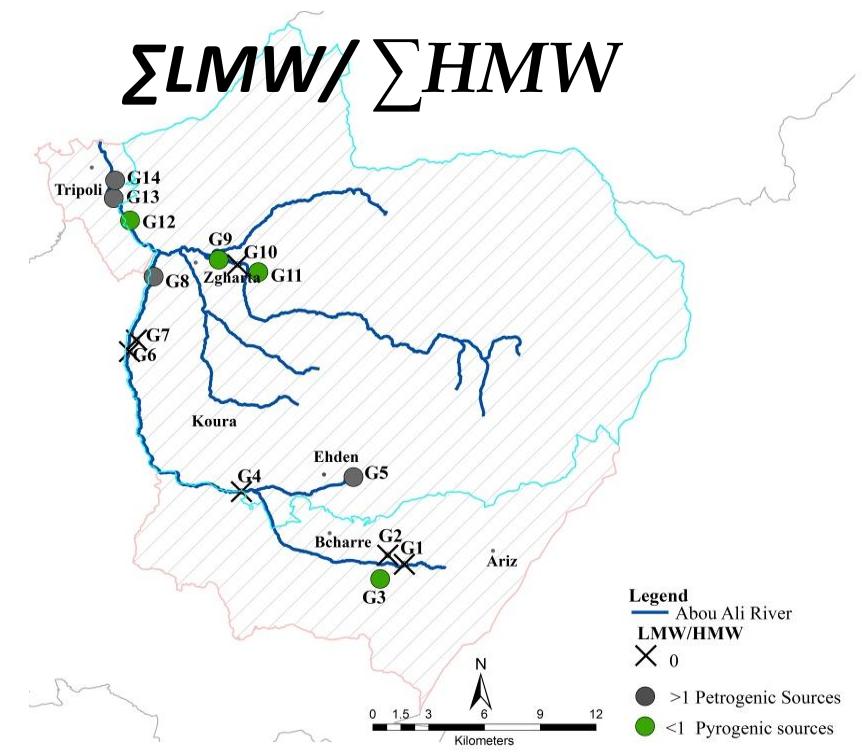
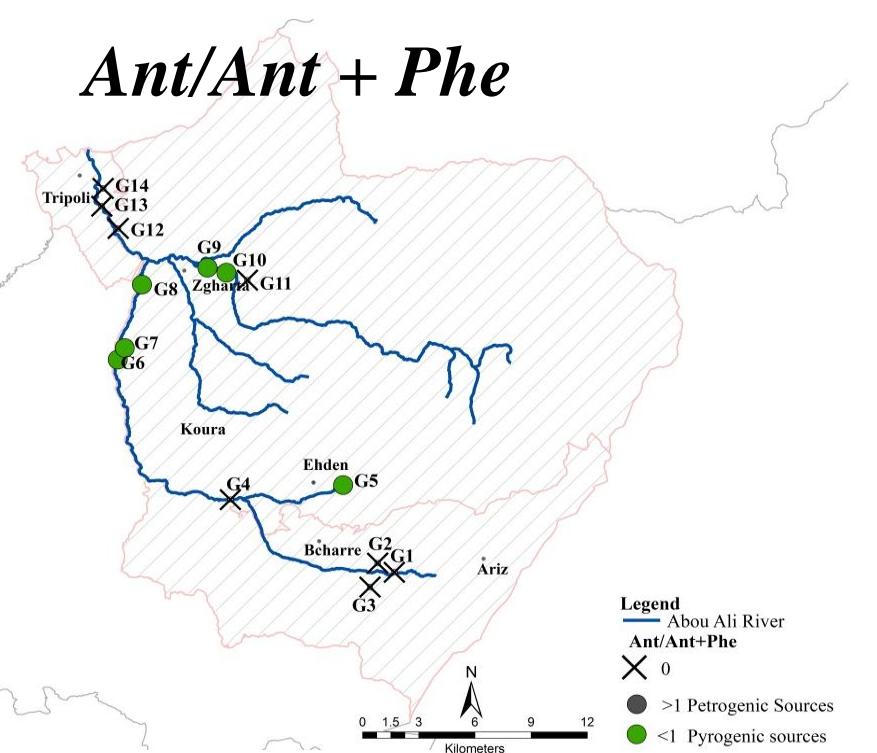
b. Molecular weight



Sources of PAHs in Ground Water Samples

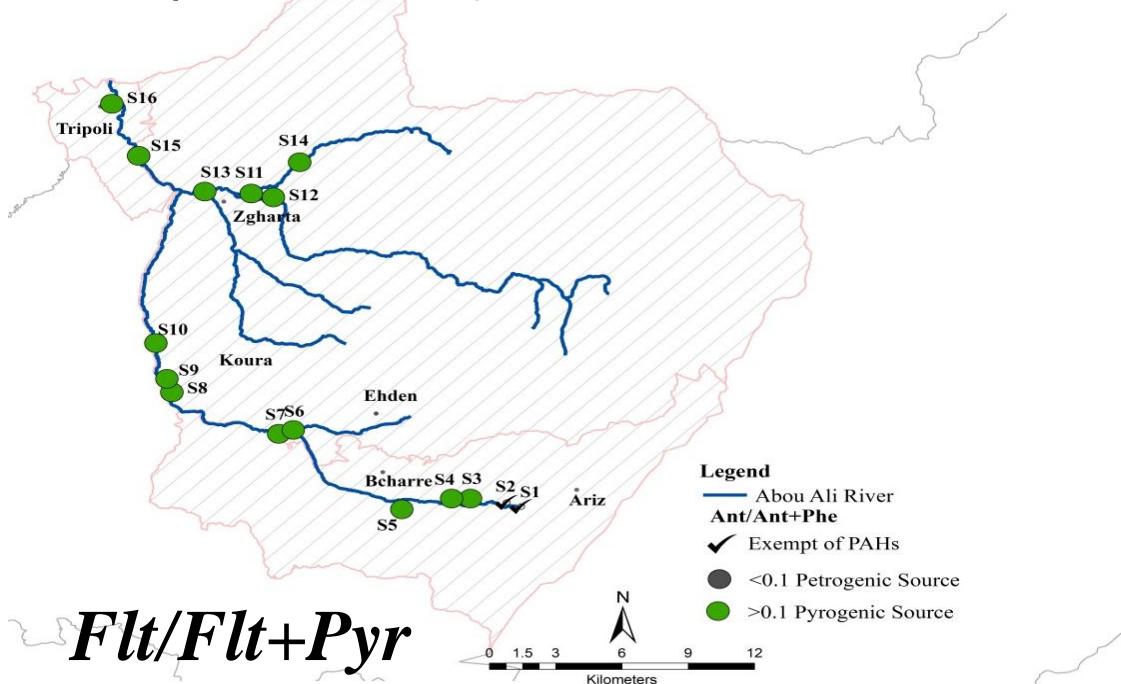
PAHs isomers pair ratios of specific sources

Source	DR1	DR2	DR3	DR4
	Ant/ Ant+Phe	Flt/ Flt + Pyr	BaA/ BaA + Chr	$\Sigma LMW/\Sigma HMW$
Petrogenic	<0.1	<0.4	<0.2	>1
Wood and coal combustion		>0.5		
Coal Combustion			0.2-0.35	
Pyrogenic	>0.1	0.4-0.5		<1
Vehicular emissions and combustion			>0.35	

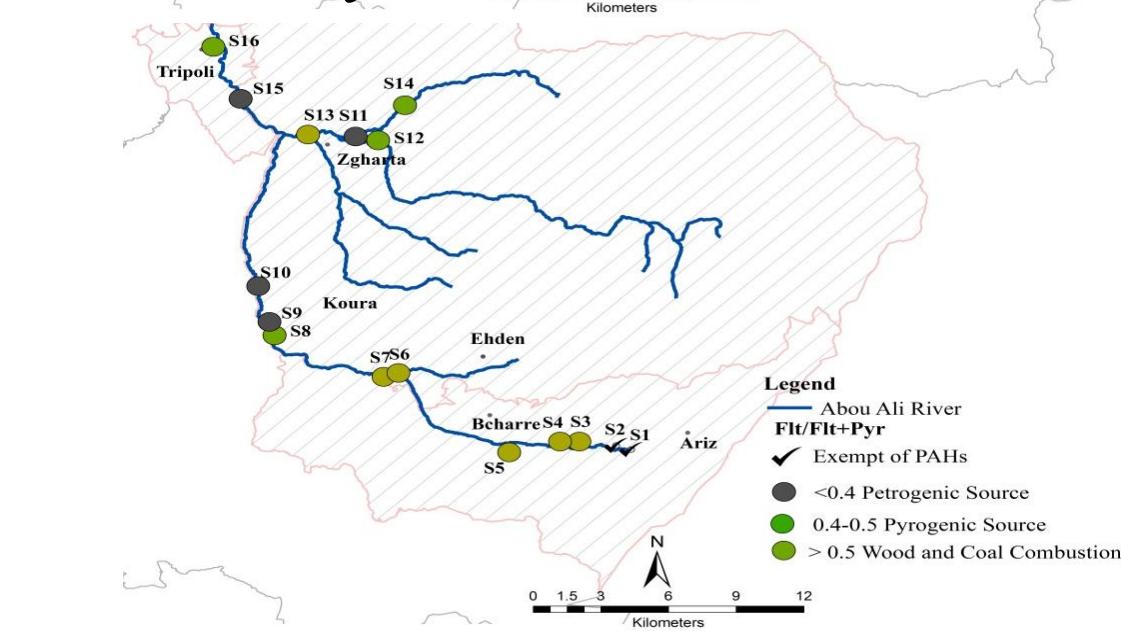


Sources of PAHs in Surface Water Samples

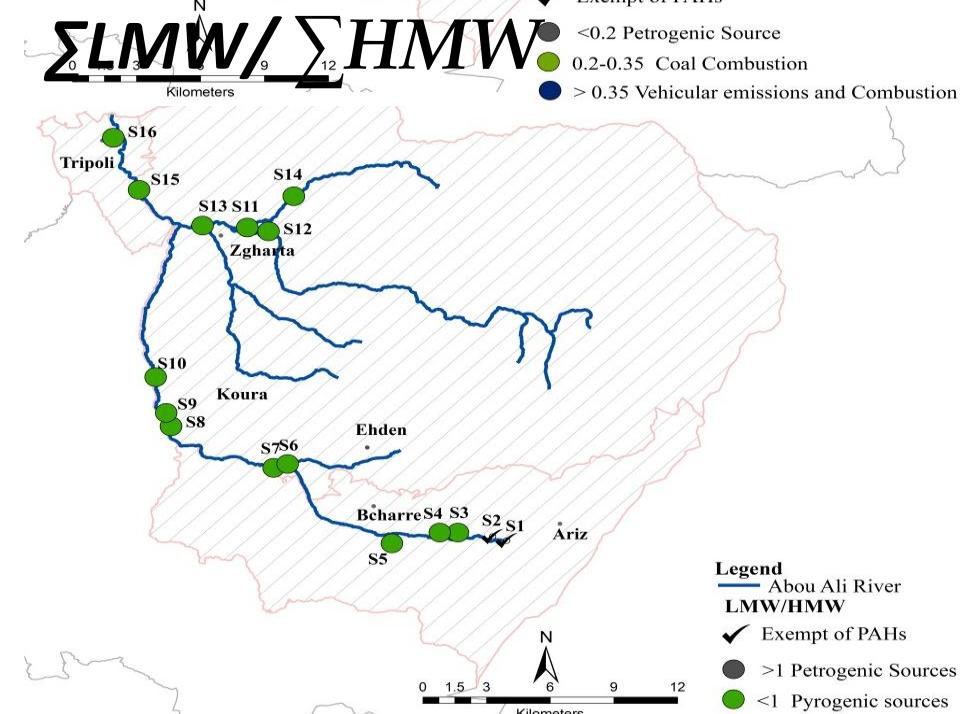
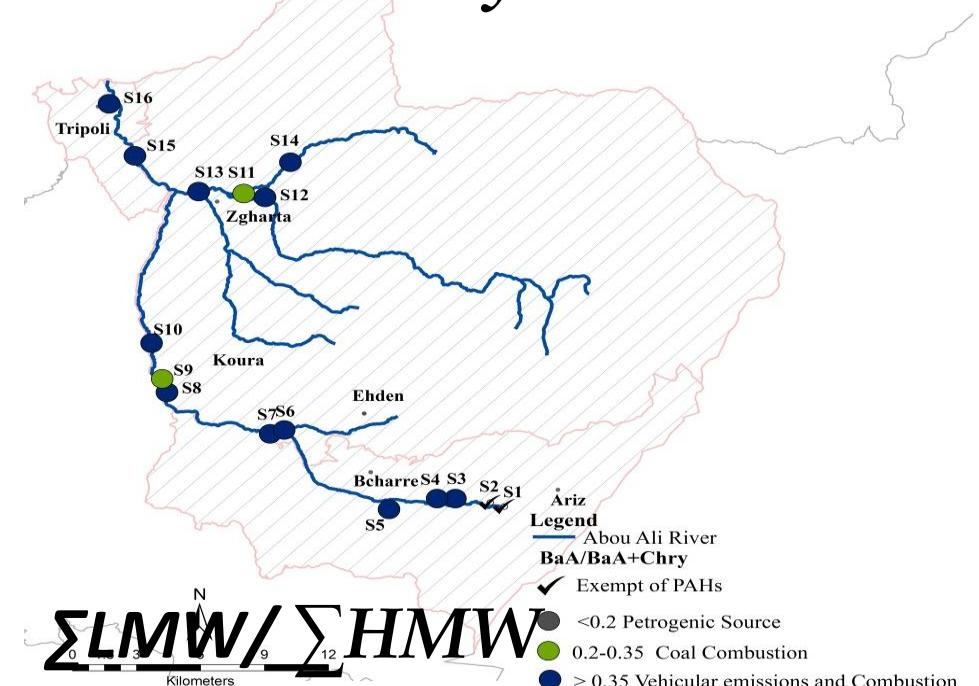
Ant/Ant + Phe



Flt/Flt+Pyr



BaA/BaA+Chry



Conclusions & Perspectives



The water quality along the watershed of Abou Ali River was studied:

- A.** Surface water : Considerable contamination by PAHs and Pesticides was noticed especially at the lowest part of the river.
- B.** Groundwater: Absence or low PAHs concentrations by PAHs were noticed while some points were critically contaminated by one or more of the studied pesticides.



Topics in progress as a continuity for this research

- Monitoring of inorganic chemical contaminants  
- Study of the occurrence and distribution of heavy metals. 
- Study of microbiological contamination of surface and groundwater 
- A GIS-based groundwater and surface water pollution assessment by physical, chemical and microbiological contaminants.

Topics related to environmental pollution monitoring:

-  Monthly monitoring of PAHs in the same sampling sites to study spatio-temporal distribution
-  Study of the occurrence, distribution and sources of PAHs in the sediments, air and rain
-  Seasonal monitoring for pesticides in the watershed of Abou Ali River,
- Essays on the use of passive sampling devices for the continuous monitoring of pesticides in river

*Shall Abou Ali River be clean one day?
Like this !!*



Questions?