Avy metalshe of level in kin-e-vars reservior in Zanjan province

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ABSTRACT: The distribution of heavy metals in kin-e-vars reservior in Zanjan province was studied. In the peresent study some heavy metal (pb, zn, cd, cu) were seasonly determined. Heavy metal level in water were analyzed by 797 VA Computrace Metrohm covering the highest turbulent and non-turbulent flow periods. The average concentrations of, lead, zinc, cadmium and copper was investigated and the result showes that the total metal levels are within WHO safety limits as such do not reflect impaired suitability of the water. Cd, Pb, Zn, and Cu, were determined in water sample. The results showes that concentration of Zn is higher than other elements, In summer and spring concentrations of Cd is higher than Zn (34.576 ppb) in the crest of the dam. Average concentration of Zn (17.98 ppb) is higher than Cd with (6.04 ppb) Pb with (0.84 ppb), and Cu with (1.38 ppb). Results showed that metal concentration follow the order Zn > Cd > Cu > Pb.

The relative levels of the metals at the entry points and spillway reflect the source, the path and stopover of the tributaries of the dam, thus the variation in the amount of metals at each point.

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KEYWORDS: Heavy metals; pollution; kin-e-vars dam; Zanjan province; GIS; Iran

1. Introduction

Nowadays, there are more than 500,000 large dams in the world (Downing et al., 2006). This is a huge number of aquatic systems, especially considering the water volume they store (Downing et al.,2006). Compared with the second half of the 20th century, the rate of dam construction in developed countries has slowed down during recent years (Gleick, Shiklomanov and Rodda, 2003), probably because floodable land is now getting scarce (Downing et al., 2006). However, a resurgence in dam construction it is almost unavoidable due to future dependences on water supply for the economic growth in developing countries(World Commission on Dams, 2000)Dams are sinks for heavy metals that continuously wash off rocks and soils that are directly exposed to surface waters. The common sources of heavy metals are from dead and decomposing vegetation, animal matter, wet and dry fallouts of atmospheric particulate matters and from man's activities. The role of trace metals in biochemical life processes of aquaticplants and animals and their presence in trace amounts in the aquatic environment are essential. However, at high concentrations, these trace metals become toxic(Wufemet al,2009).

Heavy metal contamination in rivers is a major waterquality issue in many fast growing cities. This is because improvements in water and sanitation infrastructure havenot kept pace with population growth and urbanization inmost developing countries (Mintz and Baier, 2000, akota et al,2008).

The pollution of the aquatic environment with heavy metal has become a worldwide problem during recent years, because they are indestructible and most of them have toxic effects on organism. Among envioronmental pollutant, metals are of particular cocern due to bioaccumulate in aquatic ecosystems. Heavy metal concentration in aquatic ecosystems are usually monitored by measuring their concentration in water, sediment and biota(Akoto et al,2008).

Heavy metals such as copper, iron, chromium and nickel are essential metals since their play an important role in biological system, whereas cadmium and lead are non-essential metals, as they are toxic, even in trace amounts. For the normal metabolism os the fish, the essential metal must be taken up from water, food or sediment. These essential metals can also produce toxic effect when the metal intake is excessively elevated.

In aquatic environments most trace elements appear in insoluble forms, due to oxygenation processes and sorption through organic and mineral fraction of sediments. In stagnant reservoirs trace metals appear in soluble forms (Cd, Zn) or as incorporated in Correspondence to: Dr. R. Dobrowolski small fixed parts (Cu, Hg) or even support in designed proportions in solvable and associated forms (Pb).

The aim of this paper was determining trace metals content in superficial water in kin-e-vars dam in zanjan provience.

2.Materials and Methods

Area Descriptions

Area of this study is Kin-e-Vars reservoir in the Zanjan province in Iran. Zanjan located in North West in Iran. Kin-e-Vras Reservoir is located over the river of kin-e-vars in Abhar city. It is located on the 36°7⁄ North latitude and 49° 4⁄East longitude and supplies the fresh water for domestic and agricultural uses in Abhar and Khoramdare cities. Dam covered an area of 373.5 km2 with a maximum depth of 45m. accses path to recived this dam is pathyway Abhar-Gheidar. Five sampling stations were chosen along the Kin-e-Vars Dam water.

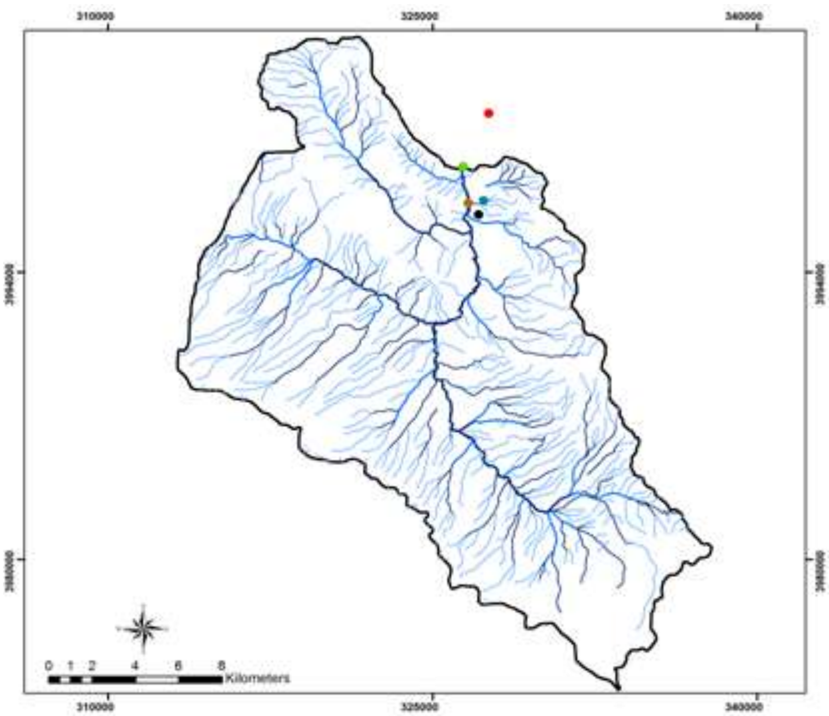


Fig. 1. The map of the kin-e-vars reservior(Zanjan, Iran) with points of sample collection of superficial water .scale:1:31000

3.Sampling and sample preparation

Superficial water was collected from 5 locations (Fig.1) of the kin-e-vars reservior in 4 season(spring, summer, fall and winter).

The sampling bottles were pre-conditionedwith 5% nitric acid and later rinsed thoroughly distilled de-ionized water. At each sampling site, the polyethylene sampling bottles were rinsed at least tree time before sampling was done. Pre-cleaned polyetylene sampling bottles were immersed about 10 cm below the water surface about 0.5 L of water samples were taken at each sampling sites. Samples were acidified with 10% HNO3, placed in ice bath and brought to the laboratory. The samples were filtered through a 0.45 µm micropore membrane filter and kept at 4ºC until analysis. The pH of water was determined using digital analyzer model HQd field Case HACH.

Determination of the element in all samples was carried out by 797 VA Computrace Metrohm , this method was showed in table 1. And finally the GIS softeware 9.3 was used to represent data.

Table1. method of measuring heavy metal by 797 VA Computrace Metrohm

parameters	Heavy metals
	Cu, Zn, Cd and Pb 3
Working electrode	HMDE
Drop size	4
Stirrer speed	2000 rpm

Mode	DP
Purge time	300 s
Deposition potential	-1.15V
Deposition time	90 s
Equilibrium time	10 s
Pulse amplitude	50 mV
Start potential	-1.15 V
End potential	0.05 V
Voltage step	6 mV
Voltage step time	0.1 s
Sweep rate	60 mV/s
Peak potential	-0.10, -0.98, -0.56, -0.38 V

4.Result and Discussion

Trace metals contents in superficial water, in 4 season in 5 sample sites are presented in Tables 2-6. And beside of this fig 2 – fig 5 represent distribiution of trace elements in 5 sample sites in 5 season

Table 1. Trace metals content in input of kin-e-vars Reservoir

Inpu of dam

	Content ppb			
sample	pb	zn	cd	cu
spring	1.673	14.384	3.145	1.233
summer	0.205	16.83	3.139	0.921
fall	0.448	20.609	1.765	1.236
winter	0.976	17.15	2.75	2.673
Min	summer	spring	fall	summer
Max	spring	fall	spring	winter

Table 2. Trace metals content in crest of kin-e-vars Reservoir

Crest of dam

	Content ppb			
sample	pb	zn	cd	cu
spring	1.434	32.58	2.4	1.724
summer	1.434	32.58	2.4	1.724
fall	1.089	14.175	1.765	1.554
winter	0.536	12.287	2.795	0.869
Min	winter	winter	fall	winter
Max	Summer,spring	Summer,spring	winter	Summer,spring

Table 3. Trace metals content in Margine1 of kin-e-vars Reservoir

Margine of dam1

	Content ppb			
sample	pb	zn	cd	cu
spring	Nd	22.824	1.84	1.33
summer	0.693	16.5	2.82	0.721
fall	Nd	20.441	7.22	2.318
winter	1.024	12.636	3.18	0.927
Min	Fall,spring	summer	spring	summer
Max	winter	spring	fall	fall

Table 4. Trace metals content in Margine2 of kin-e-vars Reservoir

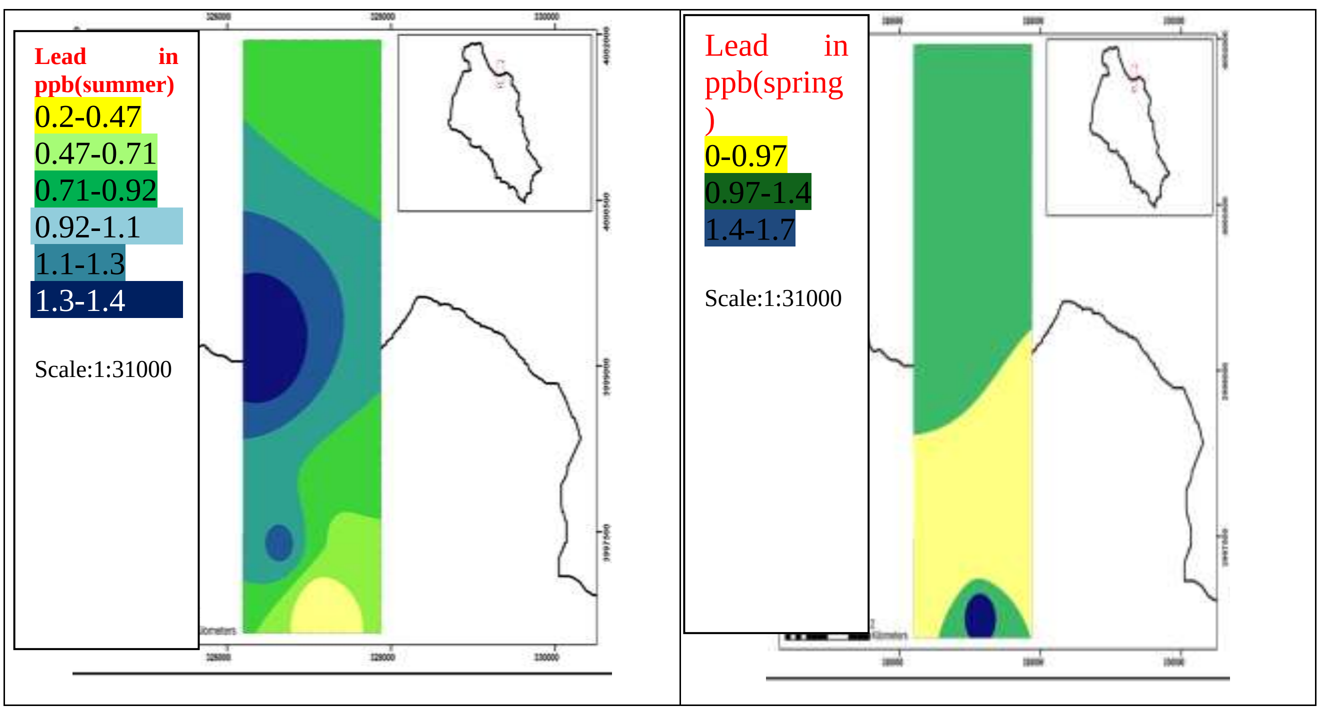
Margine of dam2

	Content ppb			
sample	pb	zn	cd	cu
spring	0.204	18.246	0.743	1.21
summer	1.173	13.592	1.084	1.084
fall	1.206	18.347	2.473	1.764
winter	1.143	13.549	2.672	0.882
Min	spring	summer	spring	winter
Max	fall	winter	winter	fall

Table 5. Trace metals content in output of kin-e-vars Reservoir

Output of dam

	Content ppb			
sample	pb	zn	cd	cu
spring	1.442	29.89	2.35	2.224
summer	0.724	10.653	6.585	0.779
fall	0.756	12.636	13.404	1.511
winter	0.772	10.33	6.291	0.943
Min	summer	winter	spring	summer
Max	spring	spring	fall	spring



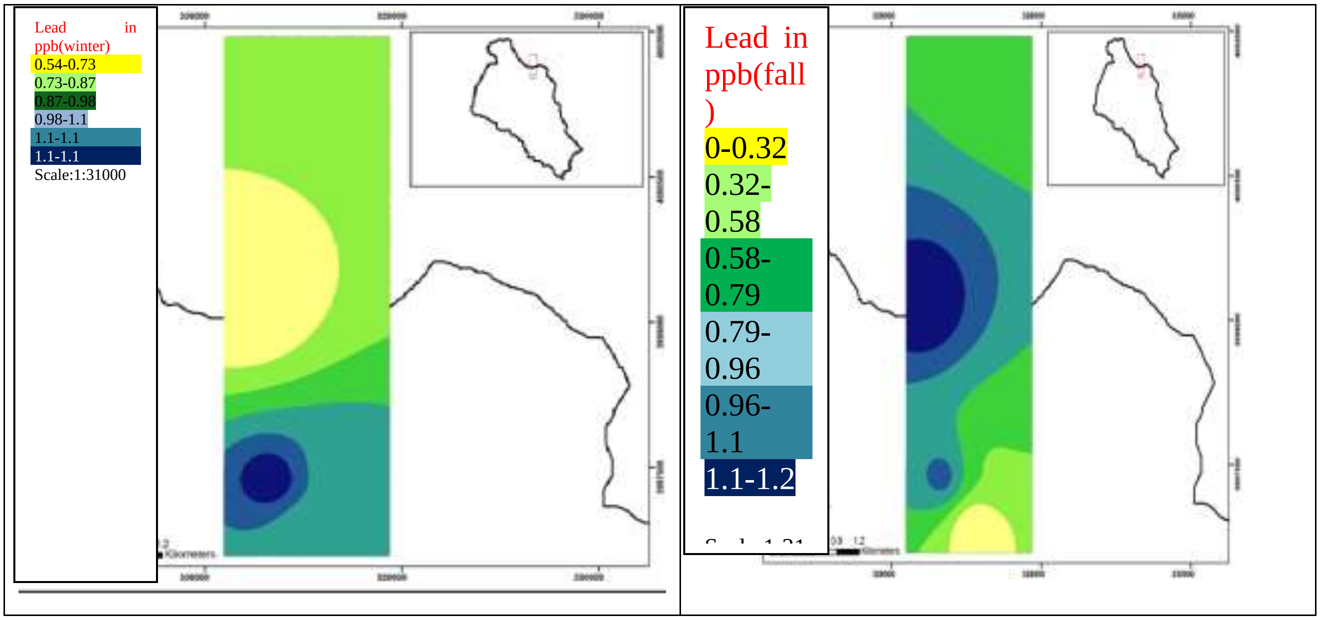
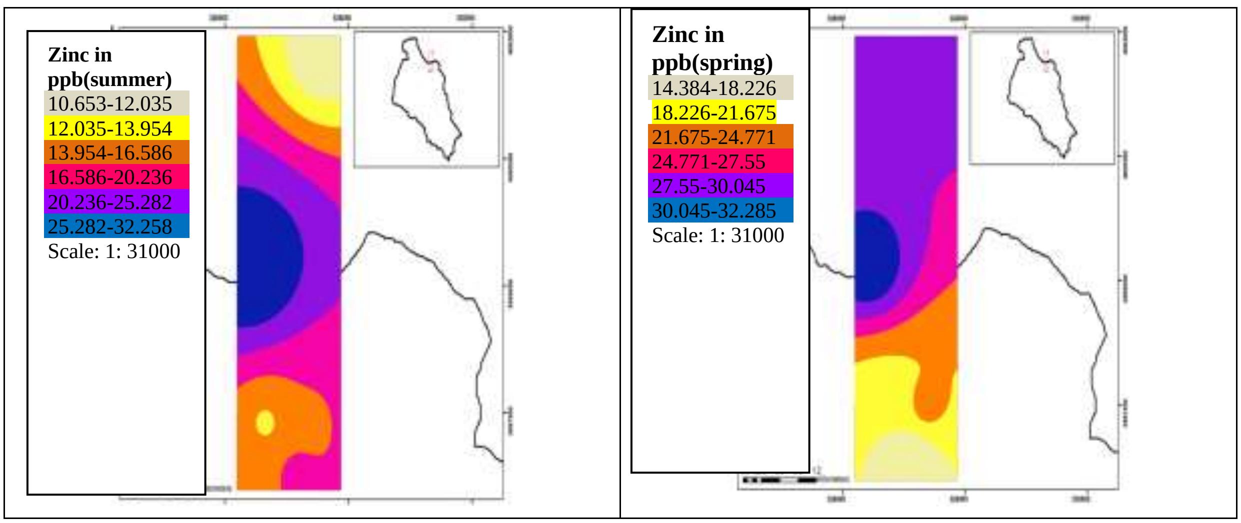


Fig. 2.Concentration of Pb in ppb with GIS softe ware



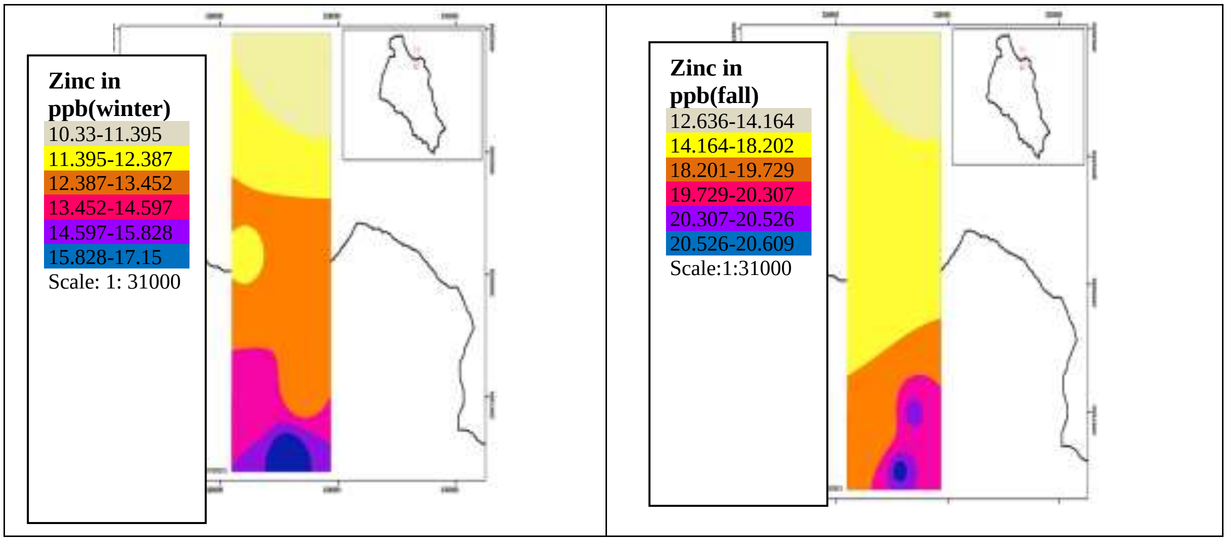


Fig.3. Concentration of nZ in ppb with GIS softe ware

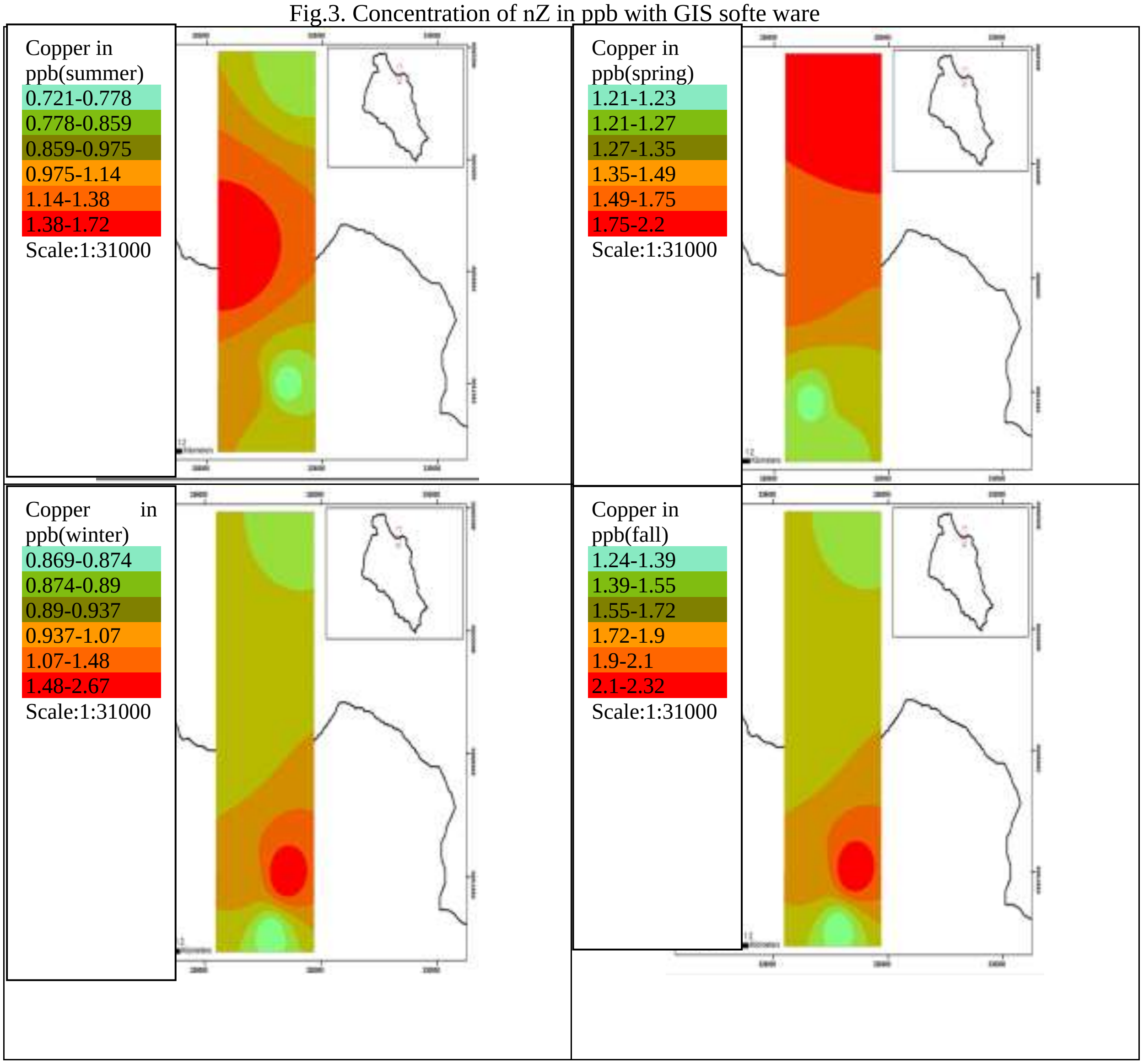


Fig .4. Concentration of Cu in ppb with GIS softe ware

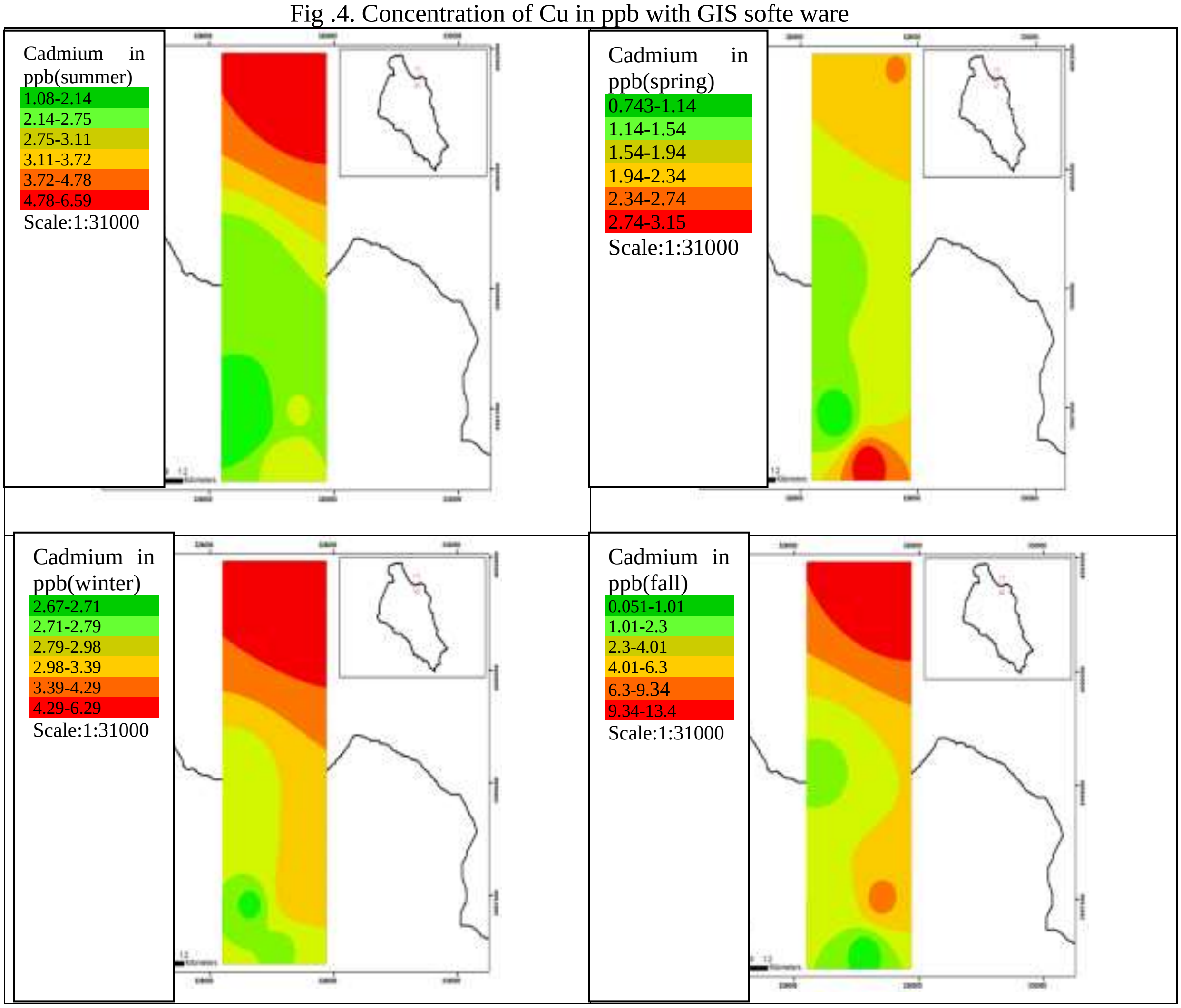


Fig .5. Concentration of Cd in ppb with GIS software

5.Conclusions

Reservoir building usually involves large economic and environmental costs. Reservoir location, governing hydrological conditions, adequate design of dam outlets, and the floodable basin forest handling constitute crucial aspects strongly influencing the stored water quality and quantity. These factors should be carefully anticipated and evaluated during the reservoir design stage before the dam construction. After construction, solving any structural inadequacy or water quality problems could be very difficult or simply unfeasible. In this context, The results showes that concentration of Zn is higher than other elements. Average concentration of Zn (17.98 ppb) is higher than Cd with (6.04 ppb) Pb with (0.84 ppb), and Cu with (1.38 ppb). Results showed that metal concentration follow the order Zn > Cd > Cu > Pb. For all the metals studied the average level found in the reservoir were below the value set by the World Health Organisation (WHO, 1984) as a result, the dam is harmless to both aquatic and human life.

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