

# Assessment of Shallow Groundwater Nitrate Concentrations in Typical Terrestrial Ecosystems of Chinese Ecosystem Research Network (CERN) During 2004-2009

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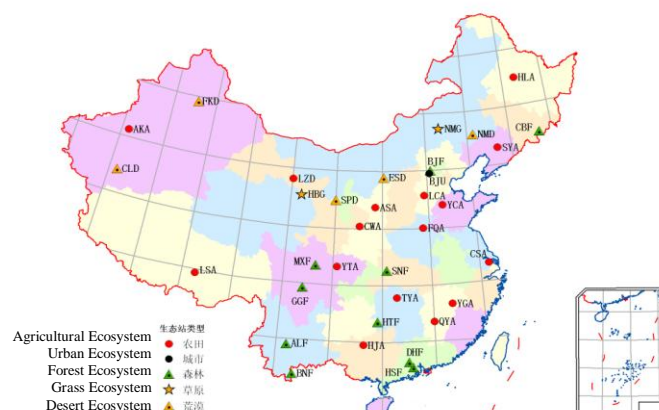
**Key words:** Chinese Ecosystem Research Network (CERN); nitrate concentration; land use type

The Chinese Ecosystem Research Network (CERN) has become one of the largest long-term monitoring and research networks in the world. The network consists of 40 field stations, covering almost all of the typical ecosystems in China including cropland, forest, grassland, desert, marshes, lakes, bays and urban ecosystems. The nitrate-N ( $\text{NO}_3^-$ -N) concentrations of 38 shallow groundwater wells from 31 of the typical terrestrial ecosystems on the CERN were assessed using the monitoring data from 2004 to 2009.

The results showed that the average values of  $\text{NO}_3^-$ -N concentrations were significantly higher in agricultural ( $4.85 \pm 0.42 \text{ mg L}^{-1}$ ), desert (oasis) ( $3.72 \pm 0.42 \text{ mg L}^{-1}$ ) and urban ecosystems ( $3.77 \pm 0.51 \text{ mg L}^{-1}$ ) than in grass ( $1.59 \pm 0.35 \text{ mg L}^{-1}$ ) and forest ecosystems ( $0.39 \pm 0.03 \text{ mg L}^{-1}$ ). Nitrate was the major form of nitrogen, with between 56 to 88 % of nitrogen in the nitrate-N form in the shallow groundwater of desert (oasis), urban and agricultural ecosystems. Nitrate-N concentrations for some agricultural ecosystems (Changshu (CSA), Yingtan (YTA), Fengqiu and desert (oasis) ecosystems (Cele (CLD), Linze (LZD), Akesu (AKA)) exceeded the  $10 \text{ mg L}^{-1}$  World Health Organization drinking water standards between 14.3 and 84.6% of the time. Significant seasonality was found in some agricultural ecosystems and the Beijing urban ecosystem using the relatively high frequency monitoring data, with the higher nitrate concentrations usually found during summer and winter months. The monitoring results indicated that the shallow groundwater of agro-ecosystems was contaminated by agricultural management practices, i.e. fertilization, while the shallow groundwater of forest-ecosystems under natural condition presented no contamination from human activities.

Recently, dual stable isotope fingering technique of nitrate ( $\delta^{15}\text{N}_{\text{nitrate}}$  and  $\delta^{18}\text{O}_{\text{nitrate}}$ ) in shallow ground water, surface water and precipitation were employed to identify the sources of nitrate in typical terrestrial ecosystems in (Beijing (BJU), Yucheng (YCA), Qianyanzhou (QYA), Changshu (CSA)). The results will be helpful for managing diffuse pollution and eutrophication in typical agricultural and urban ecosystems.

**Figure 1.** Distribution map of terrestrial ecological stations in Chinese Ecosystem Research Network (CERN)



**Table 1.** Long-term monitoring indices for water quality of terrestrial ecosystems in CERN

Water Type	Monitoring Indices	Monitoring Frequency
Flowing Surface water	pH, Salinity, $\text{CO}_3^{2-}$ , $\text{HCO}_3^-$ , $\text{K}^+$ , $\text{Na}^+$ , $\text{Ca}^{2+}$ , $\text{Mg}^{2+}$ , $\text{Cl}^-$ , $\text{NO}_3^-$ , $\text{SO}_4^{2-}$ , $\text{PO}_4^{3-}$ , total	2 times year <sup>-1</sup> -24 times year <sup>-1</sup>
Still Surface Water	N, total P, COD, DO; Fe, Mn, Pb, Zn, TOC in wetland	
Shallow Groundwater		
Precipitation	pH, Salinity, $\text{SO}_4^{2-}$	4 time year <sup>-1</sup> -24 times year <sup>-1</sup>

**Table 2.** Nitrate-N and total N concentrations of groundwater on typical terrestrial ecosystems of CERN during 2004-2009 ( $\text{mg}\cdot\text{L}^{-1}$ )

Ecosystem Type	<i>n</i>	$\text{NO}_3^-$ -N Mean ( Standard Error)	Total N Mean ( Standard Error)	$\text{NO}_3^-$ -N/TN/ %
Desert (oasis) ecosystem	109	3.72 ( 0.42) a	5.01 ( 0.66) b	74
Agricultural ecosystem	656	4.85 ( 0.42) a	8.68 ( 0.60) a	56
Urban ecosystem	92	3.77 ( 0.51) a	4.27 ( 0.55) b	88
Grass ecosystem	39	1.59 ( 0.35) b	4.95 ( 0.47) b	32
Forest ecosystem	243	0.39 ( 0.03) c	1.65 ( 0.13) c	24

Note: Means in same column followed by the different letters are statistically significant at  $p < 0.05$ .

## References

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