JWARP> Vol.3 No.10, October 2011

OPEN ACCESS

# Analysis of the Suitability of Surface Water for Irrigation Purposes: The Southwestern and Coastal River Systems in Ghana

PDF (Size:3332KB) PP. 695-710 DOI: 10.4236/jwarp.2011.310080

## Author(s)

Sandow Mark Yidana, Patrick Asamoah Sakyi, Gareth Stamp

## ABSTRACT

Surface water basins all over the world are very crucial in irrigation industries. Irrigation schemes are particularly crucial in the agricultural economies due largely to the fact that global climate change has led to drastic changes in rainfall patterns. As a result, rain-fed agriculture alone is no more sustainable and irrigation schemes are being encouraged as poverty reduction/eradication strategies in the developing countries. This study was conducted to assess the overall controls on surface water resources in the coastal and south-western river basins in Ghana, and determine the suitability of these surface waters for irrigation activities. Multivariate statistical methods were applied to data on the physico-chemical parameters from the coastal and southwestern river basins. This study finds that the quality of surface water from these basins is controlled principally by leachate of chemicals from solid and mine wastes, the chemistry of rainfall, weathering of underlying silicate mineral-rich rocks and sediments, agricultural and domestic wastes. All the parameters are within the acceptable national concentration ranges for most domestic and industrial purposes. Sodium adsorption ratio (SAR) was used to assess the quality of water from the two basins for irrigation activities. The SAR values for all the months and years sampled are lower than 4 and the electrical conductivity values are equally low due to generally low ionic concentrations. When plotted on the Wilcox diagram, the data for all the months for the two years of the study, plot within the "excellent to good" category, suggesting that water from the area is of acceptable quality for irrigation activities.

## KEYWORDS

Coastal Basins, Southwestern Basins, Multivariate Analysis, Sodium Adsorption Ratio, Electrical Conductivity

## Cite this paper

S. Yidana, P. Sakyi and G. Stamp, "Analysis of the Suitability of Surface Water for Irrigation Purposes: The Southwestern and Coastal River Systems in Ghana," *Journal of Water Resource and Protection*, Vol. 3 No. 10, 2011, pp. 695-710. doi: 10.4236/jwarp.2011.310080.

## References

[1] A. M. Al-Bassam and Y. A. Rumikhani, "Integrated Hydrochemical Method of Water Quality for Irrigation in Arid Areas: Application to the Jilh Aquifer, Saudi Arabia," Journal of African Earth Sciences, Vol. 36, No. 4, 2002, pp. 345-356.

[2] L. V. Wilcox, "Classification and Use of Irrigation Water," US Department of Agriculture, Circ. 696, Washington DC, 1955.

[3] S. M. Yidana, "Groundwater Classification Using Multivariate Statistical Methods: Southern Ghana," Journal of African Earth Sciences, Vol. 57, No. 5, 2010, pp. 455- 469. doi:10.1016/j.jafrearsci.2009.12.002

[4] R. S. Ayers and D. W. Westcot, "Water Quality for Agriculture," FAO Irrigation and Drainage Paper, No. 29, Rev. 1, 1985.

[5] S. M. Yidana, D. Ophori and B. Banoeng-Yakubo, "A Multivariate Statistical Analysis of Surface Water Chemistry Data—The Ankobra Basin, Ghana," Journal of Environmental Management, Vol. 86, No. 1, 2008, pp. 80- 87. doi:10.1016/j.jenvman.2006.11.023

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[6] S. M. Yidana, "The Hydrochemical Framework of Surface Water Basins in Southern Ghana," Environmental Geology, Vol. 57, No. 4, 2009, pp. 789-796. doi:10.1007/s00254-008-1357-2

[7] B. Banoeng-Yakubo, S. M. Yidana and E. Nti, "An Evaluation of the Genesis and Suitability of Groundwater for Irrigation in the Volta Region, Ghana," Environmental Geology, Vol. 57, No. 5, 2009, pp. 1005-1010. doi:10.1007/s00254-008-1385-y

[8] S. M. Yidana, B. Banoeng-Yakubo and T. M. Akabzaa, "Analysis of Groundwater Quality Using Multivariate and Spatial Analyses in the Keta Basin, Ghana," Journal of African Earth Sciences, Vol. 58, No. 2, 2010, pp. 220- 234.doi:10.1016/j.jafrearsci.2010.03.003

[9] Center for Scientific and Industrial Research (CSIR), "Water Quality Monitoring of the South Western and Coastal River Basins," Annual Water Quality Monitoring and Assessment Report, 2007, 62 Pages.

[10] K. B. Dickson and G. Benneh, "A New Geography of Ghana," Longman, London, 1980.

[11] J. C. Davis, "Statistics and Data Analysis in Geology," John Wiley & Sons Inc., New York, 1986.

[12] C. Güler, G. D. Thyne, J. E. McCray and A. K. Turner, "Evaluation of the Graphical and Multivariate Statistical Methods for Classification of Water Chemistry Data," Hydrogeology, Vol. 10, No. 4, 2002, pp. 455-474. doi:10.1007/s10040-002-0196-6

[13] V. Cloutier, R. Lefebvre, R. Therrien and M. Savard, "Multivariate Statistical Analysis of Geochemical Data as Indicative of the Hydrogeochemical Evolution of Ground- water in a Sedimentary Rock Aquifer System," Journal of Hydrology, Vol. 353, No. 3-4, 2008, pp. 294-313. doi:10.1016/j.jhydrol.2008.02.015

[14] H. F. Kaiser, "The Application of Electronic Computers to Factor Analysis," Educational and Psychological Measurement, Vol. 20, No. 1, 1960, pp. 141-151. doi:10.1177/001316446002000116

[15] USSL, "Diagnosis and Improvement of Saline and Alkali Soils," USDA, Handbook 60, 1954, p. 147.

[16] D. Kosich, "Ahafo Mine Cyanide Spill Prompts NGOs to Question International Cyanide Code Validity," Mine- Web. http://mineweb.com/mineweb/view/mineweb/en/page72068?oid=96302&sn=Detail 3rd May 2010.

[17] M. Jalali, "Salinization of Groundwater in Arid and Semi-Arid Zones: An Example from Tajarak, Western Iran," Environmental Geology, Vol. 52, No. 6, 2007, pp. 1133-1149. doi:10.1007/s00254-006-0551-3