# Evaluation of variation in water quality affected from land use changed: A case study on Gorgan Rod River, in the south-west of Caspian Sea, Iran

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## ABSTRACT

In this paper, principal component analysis (PCA) and hierarchical cluster analysis (CA) methods have been used to investigate the water quality of Goegan Rod (Iran) and to assess and discriminate the relative magnitude of anthropogenic and ''natural'' influences on the quality of river water. Electrical conductivity, total dissolved solids, bicarbonate, chloride, total hardness, calcium, potassium, sodium, sodium adsorption ration, sulfate, pH and magnesium as physicochemical variables have been analyzed in the water samples collected every month over a ten-year period from 6 sampling stations along of Caspian sea that is under the influence of anthropogenic and natural changes. Exploratory analysis of experimental data has been carried out by means of PCA and CA in an attempt to discriminate sources of variation in water quality. PCA has allowed identification of a reduced number of mean2 varifactors, pointing out 67.3% of changes. CA classified similar water quality stations and indicated Basir Abad and Aghghala as the most polluted one. Haji Ghochan, Gonbad, Tamer and Ghazaghli respectively had lower pollution. A Scree plot of stations in the first and second extracted components on PCA also gave us a classification of stations due to the similarity of pollution sources. CA and PCA led to similar results, though Basir Abad and Aghghala was identified as the most polluted station in both methods. CA gave us an overview of the problem and helped us to classify and better explain the PCA results. The Gorgan Rod River which joins the Caspian Sea resulted in sedimentation problems that are a growing threat to human health and the sea is considered. If these changes continue, there will be a serious threat to the entire ecosystem's health.

*Key words: CA; Land Use Change; North of Iran; PCA; Water Quality*



| Component Matrix | | |
|---|---|---|
| | Component | |
| | 1 | 2 |
| TDS | .987 | -.043 |
| EC | .988 | -.041 |
| pH | .061 | .459 |
| Hco | .267 | -.582 |
| Cl | .967 | -.040 |
| So | .964 | -.033 |
| Ca | .927 | -.205 |
| Mg | .968 | -.096 |
| Na | .989 | -.007 |
| K | .526 | .126 |
| SAR | .956 | .127 |
| PNa | .373 | .688 |
| T-Hard | .905 | .140 |

| Rotated Component Matrix | | |
|---|---|---|
| | Component | |
| | 1 | 2 |
| TDS | .988 | -.001 |
| EC | .989 | .002 |
| pH | .041 | .461 |
| Hco | .292 | -.570 |
| Cl | .967 | .002 |
| So | .964 | .008 |
| Ca | .935 | -.165 |
| Mg | .971 | -.053 |
| Na | .988 | .036 |
| K | .521 | .149 |
| SAR | .950 | .168 |
| PNa | .343 | .703 |
| THard | .898 | .179 |



Scree Plot