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Characterization and mapping of Halophyte vegetation using GIS and Remote sensing technique in Kachchh plane of Gujarat, India

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Introduction

One of the pressures of a burgeoning population is need to increase agricultural production through both irrigated agriculture and the development of land that was previously regarded as marginal. About 8.56 m ha land in India is affected by salt. Out of this, about 1.2 m ha land is in Gujarat which is next to Uttar Pradesh (1.295 m ha). Kachchh, the second largest district of the country, has more than 53% of the total geographical area under *Ranns* (salt-marshy lands).The soil salinity in this region ranges from 3.2 to 32 EC and sodicity from 8.0 to 10.0 pH. The animal husbandry is the major livelihood option of the people of the *Banni* grassland of this region having an area of about 625 km^2. Halophyte grown under the saline ecosystem is the major wild forage source for the animals feed. However, the animals feed mostly on wild forage halophytes grown under the saline ecosystem. Apart from natural salinity, a significant proportion of recently cultivated agricultural land has become saline owing to faulty irrigation practices; this secondary salinization poses direct loss to the crop production. The commercial agriculture now prevalent in the region exploits ground water heavily and encroaches upon grass lands. Heavy grazing pressure on the vegetation including wild halophytes is direct threat to the valuable natural biodiversity of the region. Very meager information on systematic characterization of vegetation in this region is available (Pandya and Sidha, 1987 and GUIDE, 1998). Halophytes have tolerance mechanisms that include ions compartmentalization, and compatible solutes. However, the mechanisms of salt tolerance in these species are not fully understood and not much work is reported in the literature. Halophytes have great potential either for direct agricultural crops uses in saline areas or for the incorporation of their characteristics into existing crop species. They may be useful for grazing or fodder or as ornamental plants and have recently been advocated as a source of oils.

Materials and Methods

Study area: Kachchh district of Gujarat covering an area of 45,652 km², is the second largest district of India. Kachchh literally means something which intermittently becomes wet and dry; a large part of this district is known as *Rann* of Kachchh which is shallow wetland which submerges in water during the rainy season and becomes dry during other seasons. The *Rann* is famous for its marshy salt flats which become snow white after the shallow water dries up each in season before the monsoon rains. The district is also famous for ecologically important Banni grasslands. It is surrounded by the Gulf of Kutch and the Arabian Sea in south and west, while northern and eastern parts are surrounded by the great and little *Rann* of Kachchh (Gupta, 2011). When there were not many dams built on its rivers, the *Rann* of Kachchh remained wetlands for a large part of the year.

Dataset used: IRS-R2 aWIFS data (56m) dated 2013, Resource sat 2, LISS-III (23.5m) rectified enhanced and projected on polyconic/ WGS84 coordinate system using ERDAS Imagine Pro. S/W Ver. 10. Finally using base map as a *.aoi*, area of Kachchh generated using subset tools of ERDAS. Depending on clusters of dominant species IRSP6L4 +Pan data (4 scenes) was used. ERDAS was used for supervised classification of halophytes of the study area. GPS linked Ground truthing (GT) and intensive field survey was conducted at 29 locations mostly in *Rann* areas. Geo-processing of all the information carried out using ARCGIS ArcInfo software.

Results and Discussion

The area under grasslands including degrading rangeland was found 18.6% of which about 5.7% is infested with *Prosopis* but the actual area under grasses on saline was found hardly 3.66% which was also infested with shrubs. GPS based ground trothing (GT) and field survey was conducted in the month of August, 2014. During the field visit total 29 GPS point (mostly in grassland/ *Banni* area) were recorded and ground data were collected. In Greater Rann of Kachchh

(GRK) $EC_{1:2}$ varied from 0.14 to 94.77 dS/m where as in Little Rann of Kachchh (LRK) it was found 0.81 to 59.0 dS/m. Soil pH varied from 7.35 to 9.23 in GRK and 7.73 to 8.3 in LRK with depth-wise increase. Soil organic carbon was very low (0.02 -0.28% in GRK and 0.02 to 0.57% in LRK). Cations generally followed the order Na>Ca>Mg>K. Na content ranged from 22.4 to 51037 ppm. Chloride was the dominant anion (174.6 to 38283 ppm) followed by sulphate (96 to 12515 ppm).

Based on the GIS/RS and GPS techniques major halophyte vegetation map of the study area prepared (Fig. 1). Due to drought condition in the region in the year 2014 very poor initial growth of grasses were found. In the GRK dominating species were *Salvadora persica. Salvadora oleoides, Euphorbia nivulia, Dichanthium annulatum, Sehima nervosum, Cenchrus ciliaris, C. setigerus* and *Panicum antidotale, Paspalum scrobiculatum, Acacia nilotica* and *Capparis aphylla*. *Cerapegia bulbosa, Cressa cretia, Cheno podium sande, Haloxylon recurbum, Haloxylon Salicornicum, Salsola baryosma, Sueda fruticosa, Xygo phylum, simplex, Apriplex strocksii, Scirpus tuberosus and Tamarix dioica* were found in high saline dominated areas. Areas with low salinity support grassland with many grass species, notably *Dichanthium annulatum, Sehima nervosum, Cenchrus ciliaris, Cenchrus setigerus* and *Panicum antidotale*, and the occasional *Acacia nilotica* and *Capparis* species. In the more saline areas, S*alvadora persica* and *Tamarix dioica* were widespread. The mangroves in the coastal zone were mostly poor and disturbed. Peripheral to the Rann, the climax vegetation were found which is a low open type of dry tropical thorn forest interspersed with grassy glades. Several hundred years of intensive grazing and plundering for firewood have reduced this to a low xerophytic scrub dominated by stunted Acacia species and Euphorbia species. Banni grassland is characterized by sparse grasses which is highly dependent on rainfall variation as due to drought condition in the month of August, 2014 banni lands looked like fallow lands. Normally, it was dominating by halophytic grasses of the genera Sporobolus, Dicanthium, Aristida in association with low growing herbs and forbs particularly Cressa species and Sueda species along with tree and shrubs of genera Salvadora, Prosopis, Tamarix and Atriplex etc.

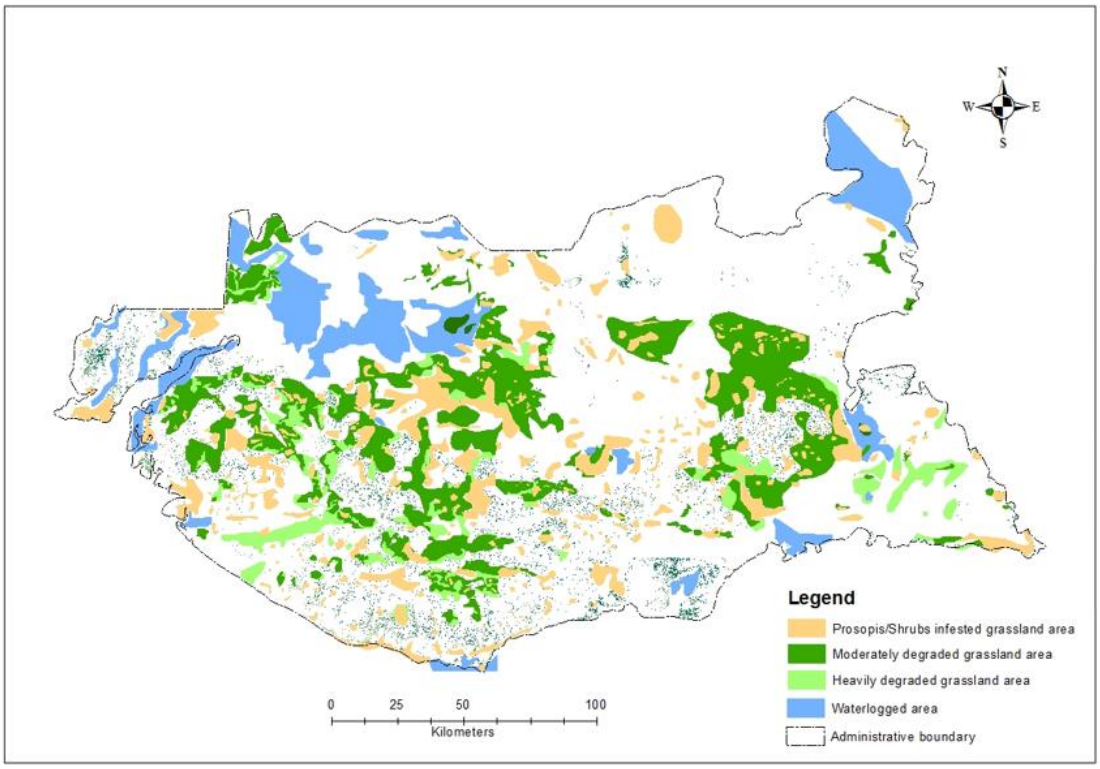

Fig.1: Classified image of Kachchh showing grasslands

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