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Wild halophyte plants as potential fodder resource under extreme saline environment of Kachchh, Gujarat, India

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Introduction
Rann of Kachchh in North West India is a unique saline marshy desert. It is described as "a desolate area of unrelieved, sun-baked saline clay desert, shimmering with the images of a perpetual mirage"(Mountfort et al., 1991) and is regarded as the largest salt desert in the world. In the Indian part it stretches in 7505.22 sq. km known as Great Rann and 4,953 sq. km known as Little Rann. The Ranns turns into marshy land by inundated water from runoff during monsoonal rainfall and water driven by forces of winds and tides from Arabian Sea making the area unapproachable especially during June to September and in reminder of months the area remain as a hyper saline desert. Even at these extreme saline conditions certain halophytic plants come up from the native seed bank/ roots once the water gets evaporated as these plants possess some mechanisms to survive salinity even higher than that of sea water (Goswami et al., 2014). Some of these plants are grazed by livestock of the area. Due to uncontrolled grazing by ever increasing livestock population and increasing demand for fuel wood, in these deserts the natural diversity of these halophytes are at stake (Arndt et al., 2004). Information on the diversity of halophytes in the hyper saline desert in relation to varying degree of salinization is not available. Therefore the present study was undertaken to study the distribution of halophyte grasses and non-grasses in Great Rann of Kachchh and their usefulness as fodder resource.

Materials and Methods
Field visits were carried out throughout Great Rann of Kachchh during November 2014. In total 11 sites were selected for study based on survey at 10 km interval. Standard quadrate method was used to sample and identify plants. Soil samples were collected from four different depths (0-5, 0-15, 15-30 and 30-45 cm) at each location and analysed for pH, electrical conductivity, organic carbon and soluble ions. The plant density was calculated and fodder quality was assessed by using standard methods.

Results and Discussion
Soil pH at upper 5 cm ranged from 7.73 to 9.23. Soil pH generally increased down the profile to a depth of 45 cm and highest surface pH (8.3) was noticed in site 7. The soils were low in organic carbon content (0.02 to 0.28% at top 5 cm layer). Electrical conductivity generally increased with site proceeding to India Bridge and ranged from 0.14 to 94.77 dSm⁻¹. The soluble cations followed the order Na>Ca>Mg>K. Chloride was the dominant cation followed by sulphate.

Total of 13 grass species, along with 55 non grass halophytes were identified and collected from different study sites. From site 1, total 45 species of halophytes were observed, with 24 non grasses, 2 sedges and 9 grass halophytes. Some common plants of first site were Abutilon indicum L., Chloris barbata L.and Dichanthium annulatum L. In case of site 2, 11 species were observed with 5 grasses, 2 non grasses. Site 2 was dominated by Aeluropus lagopoides L. (Trin), and Suaeda nudiflora (Wild.) Moq along with three species of Cenchrus namely Cenchrus ciliaris L., Cenchrus setigerus L. and Cenchrus biflorus L. At site 2, Aeluropus lagopoides L. (Trin) recorded density of 1.7 m⁻², Cressa cretica L. 140.4 m⁻² and Suaeda nudiflora (Wild.) Moq 7.4 m⁻². Dominant species in site 3 and 4 were, Aeluropus lagopoides L. (Trin) (density of 33.7 and 33.8 m⁻² respectively), Cressa cretica L. (46.8 and 52.7 m⁻²) and Suaeda nudiflora (Wild.) Moq (2.5 and 3.3 m⁻²). At site 5 the dominant plants were Cressa cretica L. (120.9 m⁻²) and Suaeda nudiflora (Wild.) Moq (1.3 m⁻²). Major halophytes noticed at site 6 m were Cressa cretica L. (100 m⁻²), Suaeda nudiflora (Wild.) Moq (1.56 m⁻²) and Aeluropus lagopoides L. (Trin) (0.22 m⁻²). Site 7 had an EC value of 69.7 dSm⁻¹, where Urochondra setulosa (Trin) C.E.with a density of 5.44 plant m⁻² was observed. The dominant species at sites 8 to 11 were Suaeda nudiflora (Wild.) Moq, Aeluropus lagopoides L. (Trin), and Cressa cretica L. At site 8, Aeluropus lagopoides L. (Trin) was dominant with highest density of 8.4 plants m⁻² followed by Tamartix gallica L. with density value of 0.45 plants m⁻². At the same site
density of *Cressa cretica* L. and *Suaeda nudiflora* (Wild.) Moq were 0.33 and 0.12 plants m\(^{-2}\) respectively. At site 9, *Aristida* sp. showed maximum density with value of 1.83 plants m\(^{-2}\) followed by *Aeluropus lagopoides* L. (Trin) with value of 1.70 plants m\(^{-2}\) and *Suaeda nudiflora* (Wild.) Moq showed a density of 1.2 plants m\(^{-2}\). At site 10 and 11, density of *Aeluropus lagopoides* L. (Trin) increased with values of 16.6 for site 10 and 7.7 plants m\(^{-2}\) for site 11 respectively. In general the dominant species of the study area were *Suaeda nudiflora* (Wild.), *Aeluropus lagopoides* L. (Trin), *Cressa cretica* L., *Cyperus* sp., *Prosopis juliflora* L., *Salvadora persica* L. and *Salvadora oleoides* L.

The salinitywise distribution of halophytes indicated that *Aeluropus* was widely distributed whereas *Sporobolus* was observed upto medium salinity conditions. Non grass halophytes such as *Suaeda* and *Cressa* were widely distributed throughout Rann of Kachchh. *Urochondra* was observed only at areas of higher salinity.

Most of halophytic forages contained moderate amounts of crude protein (5.1 to 14.1%) which it seems fair enough to meet the nitrogen requirements of grazing animals. They also contained high levels of fibre and ash contents, which could limit intake, and digestibility of such forages. Wide variation in composition nutritional quality factors exists between sampling dates and also between sites.

### Table 1: Details of sampling locations and soil properties

<table>
<thead>
<tr>
<th>Site no.</th>
<th>Latitude (N)</th>
<th>Longitude (E)</th>
<th>pH (1:2) 0-15 cm</th>
<th>EC (dSm(^{-1})) 0-15 cm</th>
<th>OC (%) 0-15 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23° 25' 58.1&quot;</td>
<td>69° 39' 42.4&quot;</td>
<td>7.88±0.04</td>
<td>0.15±0.02</td>
<td>0.19±0.01</td>
</tr>
<tr>
<td>2</td>
<td>23° 30' 22.6&quot;</td>
<td>69° 35' 43.2&quot;</td>
<td>8.06±0.09</td>
<td>2.69±0.34</td>
<td>0.24±0.01</td>
</tr>
<tr>
<td>3</td>
<td>23° 35' 5.6&quot;</td>
<td>69° 40' 10.3&quot;</td>
<td>8.32±0.06</td>
<td>27.74±0.71</td>
<td>0.12±0.02</td>
</tr>
<tr>
<td>4</td>
<td>23° 41' 25.9&quot;</td>
<td>69° 42' 50.2&quot;</td>
<td>9.07±0.37</td>
<td>0.57±0.04</td>
<td>0.02±0.01</td>
</tr>
<tr>
<td>5</td>
<td>23° 58' 58.5&quot;</td>
<td>69° 44' 44.2&quot;</td>
<td>8.24±0.03</td>
<td>1.10±0.18</td>
<td>0.15±0.02</td>
</tr>
<tr>
<td>6</td>
<td>23° 58' 25.7&quot;</td>
<td>69° 44' 33.0&quot;</td>
<td>8.14±0.01</td>
<td>83.06±2.76</td>
<td>0.24±0.03</td>
</tr>
<tr>
<td>7</td>
<td>23° 30' 41.8&quot;</td>
<td>69° 39' 21.9&quot;</td>
<td>7.85±0.11</td>
<td>6.79±0.33</td>
<td>0.17±0.02</td>
</tr>
<tr>
<td>8</td>
<td>23° 32' 3.1&quot;</td>
<td>69° 38' 41.7&quot;</td>
<td>7.66±0.09</td>
<td>4.32±0.04</td>
<td>0.16±0.01</td>
</tr>
<tr>
<td>9</td>
<td>23° 34' 6.2&quot;</td>
<td>69° 34' 32.5&quot;</td>
<td>8.00±0.05</td>
<td>11.25±0.6</td>
<td>0.08±0.01</td>
</tr>
<tr>
<td>10</td>
<td>23° 31' 8.1&quot;</td>
<td>69° 34' 6.6&quot;</td>
<td>7.79±0.04</td>
<td>21.92±1.5</td>
<td>0.10±0.02</td>
</tr>
<tr>
<td>11</td>
<td>23° 48' 47.6&quot;</td>
<td>69° 30' 48.5&quot;</td>
<td>8.47±0.25</td>
<td>12.05±0.90</td>
<td>0.22±0.01</td>
</tr>
</tbody>
</table>

Values are mean ± standard error

### Conclusion

Various halophyte grasses and non-grasses grow under extreme saline conditions of Rann of Kachchh. The major halophytes observed were *Aeluropus lagopoides*, *Sporobolus marginatus*, *Urochondra setulosa*, *Suaeda nudiflora*, *Cressa cretica*, *Cyperus* sp., *Prosopis juliflora*, *Salvadora persica* L. and *Salvadora oleoides* L. These halophytes vary in their distribution with respect to salinity of soil. The soil salinity varied from 0.14 to 94.77 dSm\(^{-1}\). The analysis of fodder quality of halophyte plants showed that they contain moderate amounts of crude protein to meet the nitrogen requirement of animals. The study indicates that these halophytes could serve as potential fodder resource especially in salt laden Rann areas.

### References


### Acknowledgement

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