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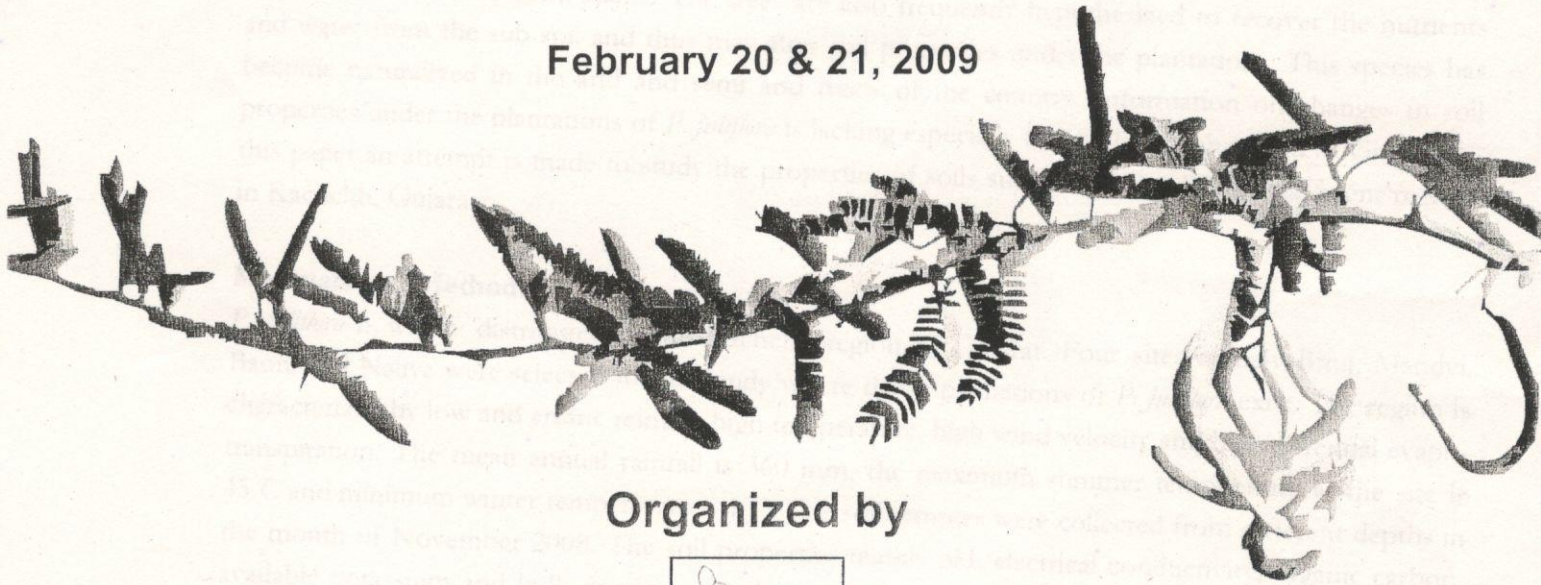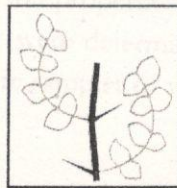# Proceedings of the National Symposium on

PROSOPIS: ECOLOGICAL, ECONOMIC SIGNIFICANCE AND MANAGEMENT CHALLENGES

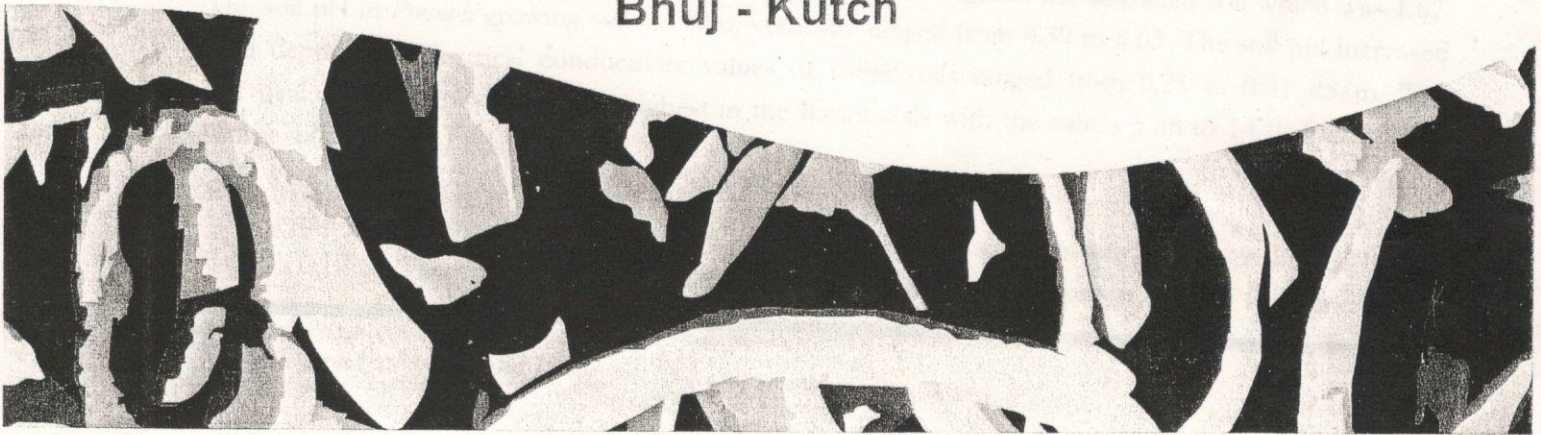## February 20 & 21, 2009

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Dynamics of Soil Properties and Carbon Stock under *Prosopis juliflora* in Different Regions of Kachchh, Gujarat

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Introduction

Prosopis juliflora, popularly known as mesquite (USA), vern or vilayati babul (India) form a dominant woody element in the arid and semi-arid regions of the world. It is a fast growing, hardy, drought resistant species with an extensive lateral root system that can penetrate as deep as 20 m (NAS, 1980). The tree has a very great potential in view of the increasing demand and realization for energy and food production from arid zone plants. The trees are also frequently hypothesized to recover the nutrients and water from the sub soil and thus may alter soil properties under the plantations. This species has become naturalized in the arid and semi arid tracts of the country. Information on changes in soil properties under the plantations of *P. juliflora* is lacking especially for the Kachchh region of Gujarat. In this paper an attempt is made to study the properties of soils supporting *P. juliflora* in different regions in Kachchh, Gujarat.

Materials and Methods

P. juliflora is widely distributed in the Kachchh region of Gujarat. Four sites namely Bhuj, Mandvi, Banni and Naliya were selected for the study where dense plantations of *P. juliflora* exist. The region is characterized by low and erratic rainfall, high temperature, high wind velocity and high potential evapo-transpiration. The mean annual rainfall is 360 mm, the maximum summer temperature at the site is 45°C and minimum winter temperature is 1°C. The soil samples were collected from different depths in the month of November 2008. The soil properties mainly pH, electrical conductivity, organic carbon, available potassium and bulk density were determined as per standard procedures (Black, 1965). Soil bulk density was estimated using a core sampler of volume 171 cm^3.

Results and Conclusion

The soil bulk density in the upper 5 cm, under plantations of *Prosopis juliflora* in Bhuj, Mandvi, Banni and Naliya was 1.46, 1.53, 1.54, 1.38 Mg m^3, respectively, as against the degraded soil which was 1.67. The soil pH in *Prosopis* growing soils in Bhuj vertically ranged from 8.39 to 8.63. The soil pH increased with depth. The electrical conductivity values of these soils ranged from 0.25 to 0.31 dS/m. The electrical conductivity values were highest in the Banni soils with the values 5.88 to 14.10 followed by Naliya soils (1.33 to 1.42 dS/m).

Among the sites under *Prosopis* plantations, the organic carbon content was lowest in soils of Naliya (0.05 to 0.19%). The organic carbon content decreased sharply with depth in soils of Bhuj and Banni

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and no regular distribution was noticed in soils of Naliya and it was almost uniformly distributed in Mandvi soils. The lowest organic carbon content was recorded in degraded soils (0.03 to 0.14 %). The carbon stock in the upper 5 cm soil layer was more in the Bhuj (32.85 t/ha), followed by Banni (20.02 t/ha), Mandvi (16.07) and Naliya (13.11 t/ha). The carbon stock in degraded land without plantation was 11.69 t/ha. The total carbon stock in the 100 cm soil follows the order Bhuj> Mandvi>Banni>Naliya>degraded land.

The lowest available potassium content of 193.1 kg/ha was recorded in the lower most layer of Mandvi soil. In soils under *Prosopis* in Bhuj the potassium content ranged from 200.79 to 377.40 kg/ha, in Banni 481.5 to 596.1 kg/ha. The study revealed that the plantations of *Prosopis* helped to maintain and improve the soil properties under different eco-regions in Kachchh region of Gujarat. The soil properties vary under various eco-regions.

Table 1. Ranges of soil properties in the upper 1 m layer under *P. juliflora* in different regions of Kachchh, Gujarat

Location	pH (1:2)	EC (dSm^{-1})	Bulk density (Mg m^3)	Organic carbon (%)	Carbon stock (t/ha)	K$_2$O (kg/ha)
Bhuj	8.39-8.63	0.24- 0.31	1.46-1.83	0.22-0.58	32.85-274.50	200.79-377.40
Mandvi	7.91-8.20	0.95-1.42	1.43-1.53	0.19-0.21	14.30-168.72	193.1-376.3
Banni	7.90-8.10	5.88-14.10	1.18-1.54	0.13-0.29	19.72-121.50	481.5-596.1
Naliya	7.9-8.81	1.33-1.42	1.33-1.42	0.05-0.19	8.28 - 42.60	297.9-426.1
Degraded land without plantation	8.63-9.46	0.25-0.48	1.67-1.86	0.03-0.14	6.30- 33.48	200.79-268.8

References

NAS- National Academy of Sciences (1980). Firewood crops: Shrubs and tree species for energy production. *National Academy Press*, Washington, D.C.

Black CA (1965). Methods of Soil Analysis, Part-2, American Society of Agronomy, Wisconsin, USA.