Land Resource Data Storage Devise
for Sustainable Agricultural Planning

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A geographic information system (GIS) has been an important tool for geo-referencing soil information system (Geo-SIS). Therefore such an organized information system would not only store the datasets for posterity but will also improve our understanding of biophysical processes in terms of relationship among them in the soil environment. There are reports of decline in fertility and productivity of the soils due to changes in some dynamic soil properties in the irrigated Indo-Gangetic Plains (IGP). Black soil region (BSR) on the other hand is underutilized due to their inherent soil, climate and management related problems in this rainfed (mostly) zone. Therefore, information on soil characteristics is important to exploit the underutilized potential of the region to fulfill our commitment to food and other requirements to the increasing population. To support natural resource management, collation of data and their storage for easy retrieval is all about the purpose of this article.

Methodology for Database Development

Use of SOTER (Soil and Terrain digital database) was done as framework for developing this information system. The SOTER concept is based on the relationship between the landscape and soil systems. Terrain information is geographic component indicating the topology of SOTER unit and attribute data gives spatial unit characteristics stored in a set of relational database management system (RDBMS) files. The basic data required for the construction of a SOTER unit are topographic, geomorphological, and geological and soil map at the scale of 1:250,000 to 1:1 m as layers accompanied by sufficient analytical data for soil characterization and mapping. In SOTER, the mapping units are given unique identification codes for easy data access. The soil component information is stored in three tables *viz.* soil component, profile and horizon table. The profile and horizon tables show information data for each soil with the exact location, morphological and other characteristics laboratory data of each horizon. The database stores all necessary information and is user-friendly.

SOTER was developed by the International Soil Reference and Information Centre (ISRIC) The Netherlands in association with other
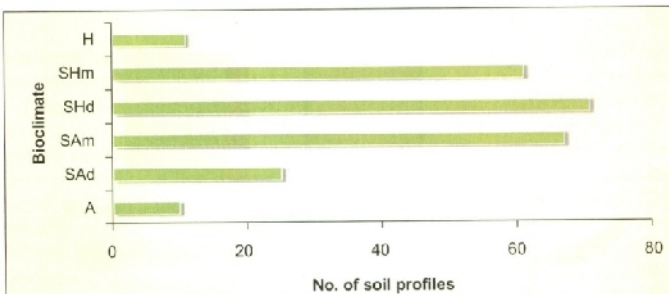
Distribution of various spots (number of soil profiles) in different bioclimatic system

In the last 2-3 decades, soil information has become increasingly important for many disciplines to address the conflicting pressure on limited land resources. In addition to farming community, civil engineers and agricultural engineers, environmentalists, urban planners, disaster managers and policy makers also need soil information. Though a wide range of information on soils are available in scattered and unorganized format, the modern day information system of any natural resources requires its location in terms of time and space and exact referencing or geo-referencing of important spots has become very necessary. Therefore, soil information with exact co-ordinates can be used for developing such systems.

Table 1. Available information at a glance

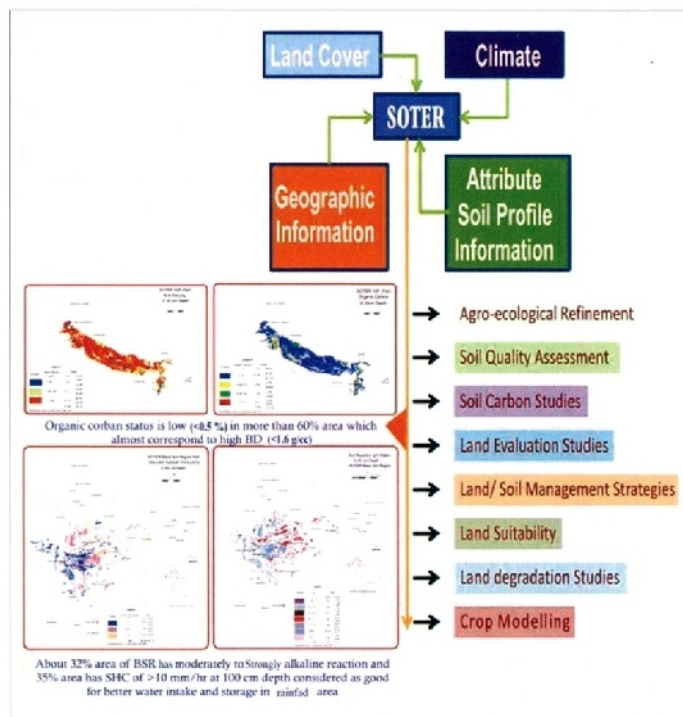| Properties Site characteristics	IGP No. of observations	BSR No. of observations	Physical Properties	IGP No. of observations	BSR No. of observations	Chemical Properties	IGP No. of observations	BSR No. of observations
Observation no	144	101	Sand	856	505	pH	850	505
Series and/or Local name	144	101	Silt	852	505	EC	541	466
Slope	144	101	Clay	852	505	$CaCO_3$	377	343
Erosion	144	101	BD	766	503	OC	852	501
Runoff	144	101	sHC	809	491	Exchangeable Ca	754	505
Drainage	144	101	Moisture retention 33kPa	52	503	Exchangeable Mg	741	495
Morphological Properties			Moisture retention 100kPa		503	Exchangeable Na	751	495
Horizon	857	505	Moisture retention 1500kPa	52	503	Exchangeable K	751	494
Depth	857	505	AWC	52	503	CEC	767	505
Texture	857	505				BS	767	505
Coarse Fragments	857	505						
Roots	857	505						
Effervescence	857	505						

international organizations.

Development of SOTER Database

The geographic data for both the IGP and BSR was developed from 1:1 m scale soil map of India. A recently revised estimate of the area of the IGP and BSR are 52.01 m ha and 76.4 m ha respectively. The IGP is subdivided into 8 agro-eco regions, 17 agro-eco subregions (AESR) and 6 bioclimatic regions depending upon major physiography, climate and length of growing period. The BSR has 10 AER and 37 AESR and is distributed mainly in eight states with some sporadic occurrence in non-traditional areas. Soil information for IGP and BSR was developed from the master database of about 840 soil profiles and information collated from the published literature were geo-referenced. The information on soil, site, and land use of 245 profiles from different bioclimatic regions (Table 1) were entered in the database along with 82 climate station data as per SOTER procedure.

Utility of SOTER Database

The advantage of any database in GIS environment is that the measured data can be displayed in both tabular format and spatially with theme maps. These theme maps are important for understanding the resource base, rationalizing use of these natural resources and prepare plans for development and better utilization of a specific area. The database has many other applications such as inputs for refinement of agro-ecological regions and sub-regions, carbon sequestration studies, land evaluation, soil erosion studies soil quality studies, carbon, crop modelling and climate change research. Thus using the base map of the IGP and BSR and the corresponding SOTER database, a number of thematic maps were prepared which can be used as a ready reckoner for development of a particular area for better utilization.

SOTER database and its application

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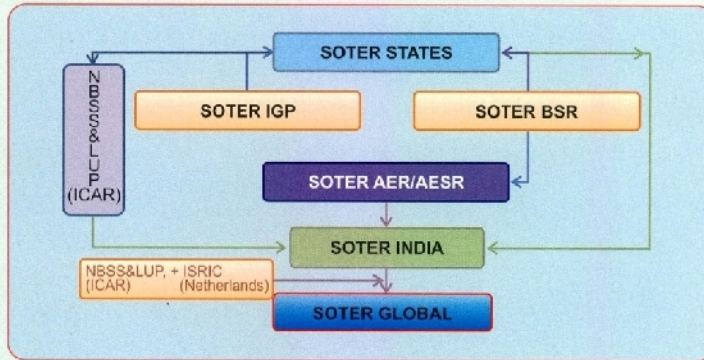
SOTER : Way ahead

SUMMARY

A robust database in internationally accepted SOTER framework has been developed for two agriculturally important food production zone of India. It includes land as well as soil characteristics viz: physical, chemical, morphological and climate information for selected spots which can be used for agriculture and many other planning purpose of land resources. Theme maps can be developed for planning resource utilization. Database can be upgraded with newly acquired datasets. This warehouse of organized soil and land resource information would form the basis for the development of a SOTER database for the entire country. This can be updated with the recent and relevant data. It is expected that this robust data in a structured framework can remain as a national and international reference database and can be utilized by many users.

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Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

—**Committee on World Food Security**