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SOIL MATTERS

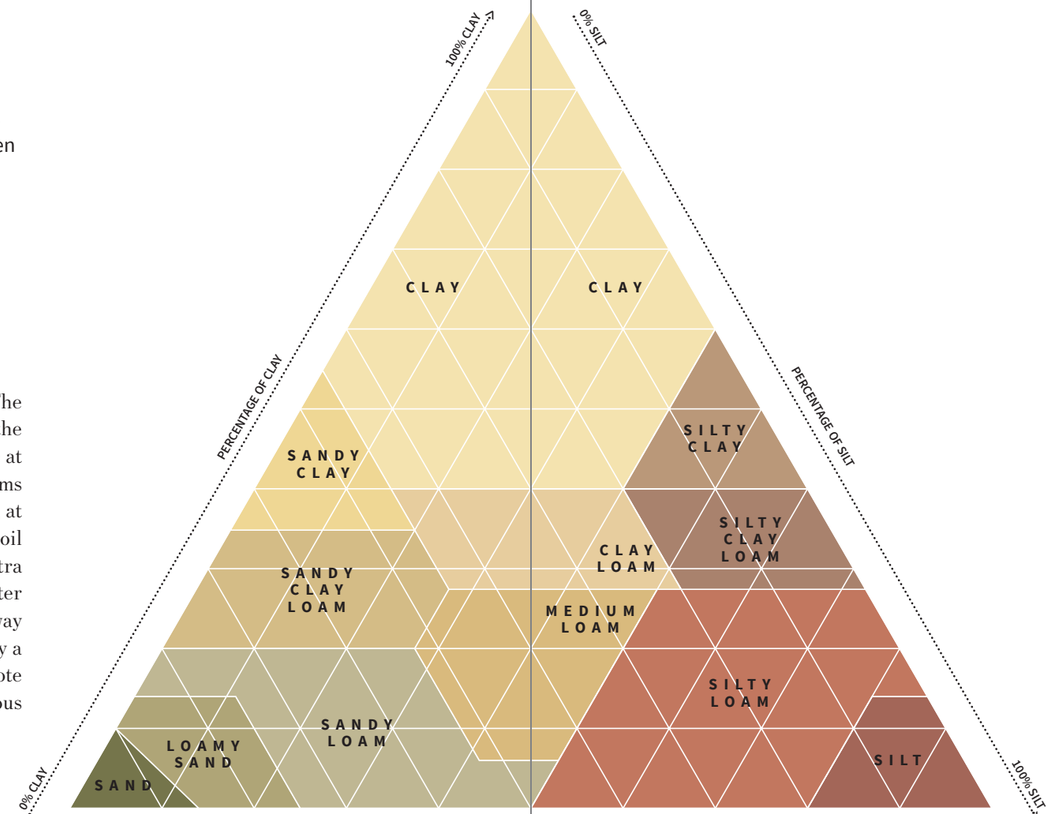
Soil matters, rather it should as much for the landscape architects as it does for the farmers. Soil on the site itself could be a wonderful resource, but being in abundance in nature and found commonly, it has always been a neglected natural resource [just like water]. There is an urgent need to adopt a sensitive approach to deal with it. As professionals, are we in a position to get sensitized and look at this issue proactively?

Prologue

In a bustling urban setting a new building complex is being completed. The planter boxes are ready for the new plants. Once the 'good' soil is put in, the planting can be done, this is a common scene for many of us. Meanwhile at a serene rural setting, of a sleepy village in the Western Ghats, the farms are getting ready for the paddy season. In the background of the farms, at the foothills of the Western Ghats, a JCB is steadily digging away 'good' soil for the urban landscape. Last summer, I was deeply grieved to see an extra truckload of red soil dumped on a neighbourhood street. Apparently, after the plantation activity, the excessively purchased soil was left to wash away with the rains. Concurring with this was the issue of sand mining raised by a student [Masters of Landscape Program] in the riparian zone in the remote villages of the north-western ghats. Disparities of such kinds are of serious concern in the present ecologically vulnerable times.

Present Situation

A recent inquiry by a fellow landscape architect for procuring the best quality of soil for a project in a different state was equally alarming. In urban areas, it's a common practice to procure 'good' soil from 'source' regions for



SOIL TEXTURE TRIANGLE
COMPOSITION OF TYPES OF SOILS BASED ON TEXTURE
SOURCE: Landscape Architecture in India: A Reader, 2013

upcoming landscape projects while the soil on-site is unapologetically disposed of when new construction begins. At other times, existing soil is disposed of for loss of fertility and replaced with 'new' soil. Several instances of such kind can be narrated. Especially during the summer or pre-monsoon, this mass transport aggravates.

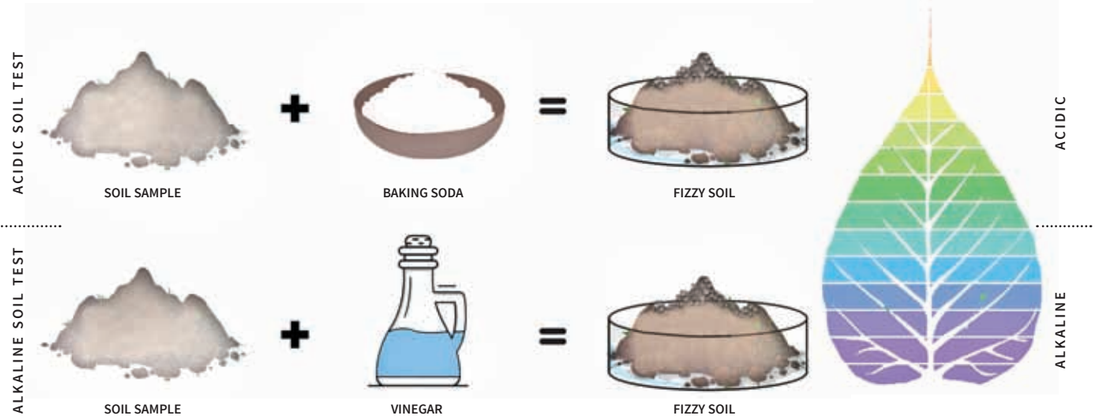
It wasn't a pleasant surprise to find out that this not only happens pan-India but even beyond the boundaries. A natural treasure which has taken years to become nutrient rich in a place is suddenly deracinated within few hours by the use of high-tech machinery. Tragically, like any other natural resource, soil is also an undervalued commodity, largely mishandled by conventional practices, often driven by economic interests. However, when this act starts happening at a large scale, especially in urban areas, the impact of it on the environment rise logarithmically. In the current changing trends, our attention is driven by the use of pesticides and insecticides damaging the soil or the impact of monoculture which extracts the soil to leave it infertile, while ignoring this extensive haulage.

The Edaphics

Land itself is precious while soil is the signature commodity intrinsic to it. It is soil that makes the land banks productive—fertile or barren, ecologically rich or poor, economically viable or not. It is the soil that allows our farms to yield, forests to sustain and keeps our biodiversity intact. It is a determining element/entity that largely contributes to the overall image building of the landscape.

As expert Sujit Chakravarty [Founder of *Prakrit Krishi Tantra*] states that "All soils are good. No soil is bad".

While soil is the media for plant growth, water is the medium that carries nutrients to fuel growth. Air is needed for root growth and the health of soil microorganisms that help supply nutrients. Important attributes of soil which are of concern to landscape professionals are its physical characteristics, chemical composition and biological contents and other essential attributes like electric conductivity, pH value among others. A layer of about 1 to 1.5 m below ground is the root zone which needs to be considered while analyzing soil for various parameters. A simple way to find out the type of soil is to take a handful of damp soil and squeeze it [a day or so after it has rained or the area is watered]. Upon opening the fist, the sandy soil falls apart, while the clayey one forms a dense clump. Dry loam is smooth when you touch it, but it becomes sticky when wet. Loamy or balanced soil is usually soft and breaks into small particles easily, and is both smooth and gritty. A simple 'pH test' with litmus paper can be done to gauge the acidic, alkaline or neutral nature of the soil. Most plants



HOW TO TEST SOIL pH WITH LITIMUS TEST?

grow well in pH ranging between 5.5 and 7. Electrical conductivity [EC] levels indicate rate of nutrient uptake by vegetation while nitrogen and potassium are responsible for boosting plant growth whereas phosphorous is essential for conducting photosynthesis. Presence of macro and micro elements are also essential. A balanced carbon nitrogen ratio is critical for conducive growth of vegetation. The top soil is mostly moist and soft, containing decomposed organic matter which makes it a nutrient rich living material that propagates growth and prosperity. Therefore, while understanding the soil's content and character, it is equally important to look at it as a living entity.

Impacts

It takes more than five centuries for the formation of one-inch layer of topsoil. The removal of vegetation—a single rainfall can wash it away in a fraction of seconds—produces long-term adverse effects for the ecology. Such disturbances on large scales may cause risk of landslides with irreparable damage to flora and fauna.

Soil and leaf litter are major breeding grounds for many faunal species. Many species of snakes, frogs and birds like nightjars, lapwings, larks lay their eggs in soil which hatch just before the monsoon. Ants and termites which form an integral part of the food web have their nests in the soil. Some species of butterflies inhabit the leaf litter on the forest floor. The transportation of such rich soil causes disturbance to this fragile world. Varieties of native ferns, grasses, shrubs are lost when the soil is disturbed, affecting the food chain.

In recent years, several faunal species including anuran ones are being discovered in the Western Ghats. Every few days, when large tracts of land are cleared of top soil, there is a chance of losing out on undiscovered fauna—an irreparable loss.

SOILS IN LITERATURE, OTHER STUDIES AND CLASSIFICATIONS

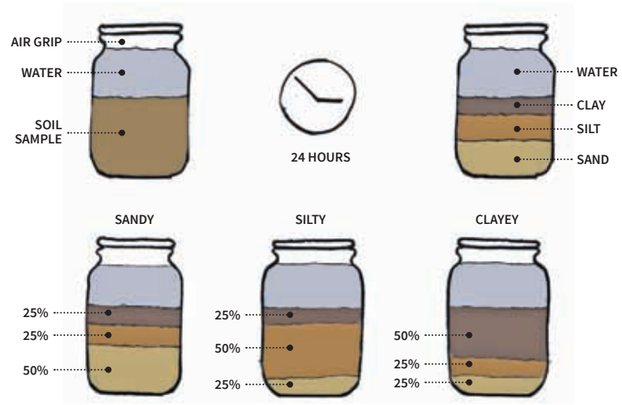
In modern times various properties of soil are explored for functional purposes which is a more direct relationship with it. Earlier cultures shared a very different relationship with it.

In ancient times, geographical distribution by Surapal's *Vrikshayurveda* [an ancient Sanskrit text on the science of plant life] is a systematic composition starting with the glorification of t rees and tree planting. It mentions *jangala* [arid], *anupa* [marshy] and *samanya* [ordinary – suitable for all kinds of vegetation] as different types of soils.

Ancient literature records also show an elaborate classification of soils into 12 categories which are based on fertility, nature of terrain and irrigation.
1. *Urvara* [fertile] 2. *Ushara* [barren] 3. *Maru* [desert] 4. *Aprahata* [fallow] 5. *Shadvala* [grassy] 6. *Pankikala* [muddy] 7. *Jalaprayah* [wetland soil] 8. *Kachchaha* [land contiguous to water] 9. *Sharkara* [full of pebbles] 10. *Sharkaravari* [sandy] 11. *Nadimatruka* [river-fed] 12. *Devamatruka* [rainfed]

Other important mentions of soil types include in *Rig-veda* [productive and non-productive soils] and in *Sangam* Tamil literature where they are classified as *mullai* [forest], *kuringi* [hills], *marudham* [cultivable] and *neithal* [coastal]. There was also further classification on the basis of suitable crops.

In Indian history, there are many studies of Indian soils done by scholars like Volckar [1893], Leather [1898], Schokalskaya [1932], Wadia [1935], Champion [1936], Basu [1937], Vishwanath and Ukil [1944], Chatterjee, Krishnan and Raychaudhary [1954]. In 1957, National Atlas & Thematic Mapping Organisation NATMO [Kolkata] published a soil map of India that included 6 major groups and 11 broad types. The National Bureau of Soil Survey and the Land Use Planning, an Institute under the Indian Council of Agricultural Research [ICAR], classified the Indian soils as per the United States Department of Agriculture [USDA] Soil Taxonomy.



IDENTIFY YOUR SOIL TYPE

Way Forward

Traditional soil management practices are the product of centuries of accumulated knowledge refined wisdom and experience perpetuated over generations. These practices evolved within the framework of local technical possibilities. They enliven the soil, strengthen the diversification of natural resources and maintain the production levels in accordance with the carrying capacity of agro-ecosystem without damaging it. Most of these practices can be easily incorporated or applied in current landscape development and land management practices as well.

Stock Piling or Stack

Good practice is to remove and store the topsoil on the construction site before any work starts. It can be 'treated' [improving texture and fertility]till the project is completed and then be used for the plantation work. One way of doing this is to add organic matter to the soil in the form of dry leaves, well- formed compost or farm manure. Allowing germination of 'weeds' on the stored soil heap and putting back the grown plants into the soil [before flowering] is another way in which organic matter and microbes can get added. Weeds are good indicators of certain components present in the soil—amaranth is indicator of nitrogen rich soil, dandelions indicate poor and compacted soil, but rich in potassium. Adding organic matter increases the water-holding capacity of the soil reducing its overall water requirement.

Control Erosion

The best way to control erosion is by establishing vegetation of permanent seeding which provides stabilization, shields the soil from any adverse impact, decreases velocity of storm water flow and hardens it. For immediate protection of top soil, mulching with wood chips, straw and gravel are useful and helps retain moisture. Care needs to be taken that mulch doesn't wash away by run-offs. Various structures like earth dikes, silt fencing, sediment traps and sediment basins maybe constructed to divert water or filter media. Such embankments allow settling of sediment from storm water.

Improve Soil Fertility

Adding organic compost is the most ideal solution for improving soil fertility. It is reliable and ecologically and economically sustainable. Unlike the chemical fertilizers, it contributes to a harmless toxin free produce that is safe for human consumption as well as for the environment. Nitrogen rich manure like cow dung may be added to the soil for other nutrients. Urban areas are attempting to sort out waste and these are locally composted. Hopefully, in the near future it will help us generate more organic compost to match our consumption levels.

Optimise Irrigation

Back cotton soil is highly clayey and hence has a high moisture retention capacity, it swells and becomes sticky when watered and shrinks and develops cracks during the summer. It has a high content of humus but is low in nitrogen and phosphorous. As a corrective measure, adding leaf litter as mulching material increases the organic content. With this water retention,the capacity of the soil increases for a longer period of time, hence less quantity of water is required. Lateritic and sandy soils do not retain water. Therefore irrigation may be done at slow speed with increased frequency at regular intervals. By using irrigation techniques to their optimum, we can further boost the soils' potential.

Go Organic

Neo-vernacular techniques are gaining back their importance in farming practices from which we can learn. Vermicompost, kitchen compost, dry fallen leaf litter compost, cow dung manure, farmyard manure and mulching of leaf litter are economical and ecologically friendly ways to treat any type of soil.

Traditional methods of altering the chemical properties of soil by supplying cow urine through irrigation can be applied in commercial projects as well. A peculiar mixture of cow dung slurry with jaggery and cow urine in certain proportions, colloquially called *Jeevamruta*, is now gaining popularity in contemporary organic farming practices. It has, time and again, proven to be the ideal organic manure as opposed to chemical-free fertilizers favourable for enriching soil. Such practices can be adopted in horticulture to contribute towards a sustainable environment.

PREPARATION OF JEEVAMRUTA

Plants suitable for the region, presence of pollinators, presence of microorganisms in soil are all other agents in addition to soil which are responsible for a healthy growth. Careful selection of native plants reduces stress on environment and its future maintenance while preventing an unaffordable loss of nature. Land is a precious commodity. Soil, although being abundance in nature, has always remained a neglected natural resource. As landscape architects, we are uniquely placed in the professionals who work in close connect with nature as well as people while playing a significant role in the development sector. Thus the onus lies upon us to sensitively integrate this understanding into our day to day practice while shaping the environment at large. Not just limited to soil, but studying similar such cyclic patterns of resource utilization in nature need to be revisited while planning our future environments.

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