Land use and Agrarian Relations

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2 authors:

Francis Kuriakose
Erasmus University Rotterdam

Deepa Kylasam Iyer
University of Cambridge

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Francis Kuriakose and Deepa Kylasam Iyer

'The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little.'

Franklin Delano Roosevelt

Land is a finite resource and there is conflicting and competing demands on it. For 80% of the world, agriculture land is the primary source of life and livelihood. India holds 2.4% of the world's geographical area (328.73 mha) but supports 17.5% of the world's population. India is home to 18% of the cattle population of the world while owning a mere 0.5% of the total grazing area. Of the total 328 mha (total geographical area), land-use statistics is available for approximately 305 mha (93%) of the total land. 228 million ha (69%) of its geographical area falls within dryland that encompasses arid, semi-arid, dry and sub-humid land as per Thornthewaite classification.

India is blessed with a wide range of soil pattern, each particular to the locale. The alluvial soil (78 mha) that covers the great Indo-Gangetic Plains, the valleys of the rivers Narmada and Tapti (Madhya Pradesh), the Cauvery Basin (Tamil Nadu) supports cereals, oil, pulses, potato and sugar cane. The Black Cotton soil (51.8 mha) found in Maharashtra, Gujarat, Madhya Pradesh, Uttar Pradesh, Karnataka, Rajasthan and Andhra Pradesh supports cereals, cotton, citrus fruits, pulses, oil seeds and vegetables. The red soil of South India and Madhya Pradesh, West-Bengal and Bihar supports rice, millets, tobacco and vegetables. The laterite soil (12.6 mha) and desert soil (37 mha) are not found suitable for agriculture.

Water is a resource precious and scarce in India. The variability of precipitation spatially and in quantity can be inferred by the fact that rainfall has been recorded as low as 1oo mm in West Rajasthan and 9000mm in Meghalaya in North Eastern India. India receives 4000 cubic kilometre of precipitation in the country in its 35 meteorological sub-divisions. Of this amount, only 50% is put to benefit due to topographical and other constraints. The fact that water is crucial to agriculture in a country that has 68% of its net cultivated area as rain-fed, can hardly be exaggerated. Of the total cultivated area of 142 mha, 97 mha is rainfed. The full irrigation potential of the country has been revised to 139.5 mha out of which 58.5 mha is watered by major and minor irrigation schemes, 15 mha by minor irrigation schemes and 40 mha by groundwater exploitation. India's irrigation potential increased from 22.6 mha (1951) to 90 mha (1995-96) but water usage efficiency is a meagre 30-40%. That is why more than 50% of the total cultivated area is still rainfed. The state of soil and water that mainly determine land and its utility in agriculture is of prime importance to maintain sustainable development. We need to define and examine land use pattern with an emphasis on a viable land use policy taking the above factors into consideration.

Land Use Pattern

Land Use Pattern is determined by physical, economical and institutional framework, ie the action and interaction of the physical characteristics of land, the economic factors like capital and labour, location of land with respect to factors of infrastructure like transport and institutional framework that determines the inter-relation between all the factors involved. In other words, land use pattern is a complex phenomenon determined by the dynamic equilibrium of factors of agrarian relations, economic development, infrastructure and policy making. It is the synthesis of physical, chemical and biological process on one hand and human process on the other.

The pattern of land use in India can be determined by looking at the post independence scenario. Till 1949-50, land area was divided into a five-fold classification. This was inadequate to meet the agricultural demands as there was lack of uniformity in definition and scope of classification. Hence it was difficult to compare and utilise the classification to improve the existing land pattern. To break up the existing tracts of land into smaller constituencies for better utility and monitoring, The Technical Committee on Co-ordination of Agricultural Statistics (Ministry of Food and Agriculture) recommended a nine-fold use of land in the country. There was the area under agriculture that was the mainstay of farmland. Three-fourth of this area was shared by the states of Bihar, Gujarat, Madhya Pradesh, Karnataka and Maharashtra with Maharashtra topping the chart with the highest percent of the net sown area. The area under non-agricultural use comprised the land under water, land used for the construction of buildings, roads, railways and barren agricultural land. The area under forest was 76.52 mha (State Forest Department, 1999). It was classified as Reserve, Protected and Unclassed. Using Remote Sensing Technology, it was ascertained that the actual forest cover was only 63.73 mha. The ownership of forest land was left to the Government of India and community clans wherever applicable. The per capita availability of forest land was 0.08 hectares whereas the optimum area of land required for meeting the basic needs was 0.47 hectares. This immense pressure on forest cover led to the search of potential areas for expansion of forest cover in culturable land tracts. 13.94 mha of the total land form wetland, fallow land and land put to other uses. Forests form an important part of land use. Land allocation for forestry include forest land and land allotted for agro forestry, farm woodlots, wind belts, shelter belts, avenue trees, urban forests, homestead forests and sacred groves. The state of Natural forest in India can be deciphered from table 1.

Table 1
State of Natural Forests in India

Area of Natural Forest	51.73 mha
Total growing stock in Natural Forest	2431.30 million cu.m
Total biomass in Natural Forests	4805.7 million tonnes

Source: NFAP, MOEF, Government of India, 1999

Forests in India show the greatest variation and range depending rainfall topography and climactic factors. Forests are both a resource and a habitat and of the 16 detailed forest types given, 38.2% is topical deciduous forests and 30.2% is moist deciduous. The benefits of natural forests include soil protection, fertility, water flora and fauna conservation, microclimate, genetic resource conservation, use of genetic breeding and bio-technology, integrated watershed management and regeneration of eco-systems.

11 mha of the total land comes under permanent pastures and grazing lands. Rajasthan, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh and Orissa cover 75% of the grazing land in India. The forests of India support 40% energy needs of the country out of which 80% needs are in the rural region and 30% fodder needs of cattle remain significant. The live stock statistics of India given in the table is relevant in this context. It is evident that as land remains constant, the increasing livestock population and their needs could be met only with judicious planning and sustainable use of land.

Table 2
Livestock population in India

Year	Total livestock population in (000)	Cattle (in ooo)
1977	369,645	180,140
1982	419,742	192,453
1987	445,286	199,645
1992	470,860	204,584

Source: Agricultural Statistics at a glance, 2001, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. Note that livestock includes cattle, buffalo, sheep, goat, horse, pig, donkey, mule, camel, yak and 'mithun'.

Area under Common Property Resource (CPR) includes the land that caters to the basic needs and services of the vulnerable sections of the rural poor. This includes village forestry, grazing and watershed drainage to help the farmers in crisis. CPRs should not be confused with wasteland. Whereas CPRs have property rights in the land allocated, wasteland is the ecological characteristics coined to initiate developmental programmes for the recovery of degraded lands irrespective of property rights. Velayutham (2000) has shown that the area under CPR has diminished during the period 1950-1997. Grazing pressure, land degradation resulting from a burgeoning cattle population that increased from a livestock population of 292 million to 462 million during the period resulted in the gross erosion of CPR changing them into wastelands.

Case for Land Use Policy

The way land is used as a means for life and livelihood is not just dependent on the direct users, it is exposed to a wider realm and is decided by all the factors directly and indirectly involved. One of the main problems that is faced today is the depletion of the quality of land and land degradation. Approximately 5-7 million hectares of usable land is lost every year through land degradation. The relative influence of land degradation is 39% in Asia. This translates to half a billion people in the developing world with no irrigation facilities, 400 million living on soil unsuitable for agriculture, 200 million on slope dominated regions and 130 million in fragile forest eco-system. 73 % of the earth faces severe and significant problems in agricultural investment while trying to sustain a rising population. A recent pioneering study by three UN agencies including FAO, UNDP and UNEP estimate the severity and cost of land degradation in South Asia to be 2% of the Gross Domestic Product of the region and 7% of the agricultural output. The statistics given below reaffirm the finding.

Table 3
Extent of Land degradation in India (area)

Source of Erosion	Area in mha
Water	103.90
Wind	13.10
Physical Agents	12.23
Chemical Agents	10.30
Other Agents	7.20

Source: National Bureau of Soil Survey and Land Use Planning

The rising trend in land use degradation can be attributed to the following reasons

1. Deforestation
2. Inadequate land use

3. Unsustainable farming and grazing practices
4. Demographic pressure
5. Lack of adequate technology implementation
6. Markets and legal instruments
7. Climate fluctuation

Demographic Pressure

Demographic pressure is one of the foremost reasons of land degradation as increasing population puts more pressure on arable land, grazing, forestry, wild life, tourism and development. Not surprisingly, population pressure affects 35% of the productive land. The population demands for food, fuel and employment is going to double in the next five decades. This will involve expansion of fragile marginal lands for utility in developing countries as poverty is endemic and institutional capacity for land management is weak. Urbanisation and industrialisation outstrips land capacity. There are serious concerns about land, environmental degradation, decreased productivity and growth rate in the developing world. The population of 1.3 billion living on fragile land is set to double. The vulnerable segment of the population notably the rural poor with moderate assets, land, tradition social capital, human capital and indigenous knowledge are not developed by the institutions. These invisible millions living in disperse settlements in an informal economy are not picked up by the development juggernaut. They lay neglected along with the environmental distress signals.

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Land degradation as a result of External features

The net value of land is the sum of two factors- the present value of the revenue stream and the present value of the terminal value of land. There are a number of factors that diminishes the value of land. Intensive farming practices are the foremost among these. Green revolution in India brought in petrochemical technology, pest intensive agricultural method, cross breeding and single species forest plantations which were mindlessly adopted from other parts of the world. Over application of nitrates has led to groundwater contamination, soil degradation and an imbalance in micro nutrients. The extension of area under irrigation has jumped from 19% to 38% in terms of net sown area in four decades. This has led to water logging and salinity. National Remote Sensing Agency and Forest Survey of India has brought out the fact that 60% of the total area under cultivation is degraded. More than one source of irrigation has increased the salinity and alkalinity of soil. Low precipitation coupled with unscientific use of water and drainage facilities take a toll on water resources. Improper cropping patterns and intensive farming practices degrade the quality and value of land.

The consequences of large scale land degradation are two-folded

The on-site costs-The technological break through that the Green Revolution offered led us to produce short duration high yielding crops. Intensive land use, increased area under irrigation, prolific use of chemicals to raise the efficiency of production also brought in on-site costs like soil erosion, alkalinity, salinity, micro nutrient deficiency, water logging, depletion and contamination of ground water.

The off-site costs-The off-site costs include river and dam siltation, damage to roadways and sewers, siltation of harbours and channels, loss of reservoir storage, disruption of stream ecology, damage to public health and increased frequency of flooding.

Policy Intervention

The rationale for policy intervention should be based on two factors

i) The significance of off-site costs as a result of land degradation

ii) The costs of on-site degradation even when it is not apparent in the immediate context

This requires a foresight and vision for long term sustainable development through policies, action and awareness brought out through education, training and extension programmes. The objective of the policy intervention should be the following

i) Restore efficiency to meet the growing consumption needs

ii) Suitable mechanism for scientific management, conservation and development of land resource

iii) Expansion of forest cover to restore ecological balance

iv) Conjunctive use of surface and ground water

v) Preservation of agricultural land

The Integrated Approach

For effective and efficient use of land we need eminently practical plans for land use management. This is included in the integrated approach. To reduce the conflicts and to make trade-offs link social and economic development with environmental protection, sustainable development is the key. The essence of integrated approach is the sectoral planning management. There are a number of issues to consider while adopting approaches and policies. For land use pattern through sectoral approach, we need to plan linkages, formulate economically viable project for each sector and use technology. This would include making Land Use Atlases, system database on land utilisation and management, computerised and updated land records at district, state and national levels. Better legal, political and administrational will is also the key.

Effective reclamation is needed to check degeneration. This can be done through effective watershed management, reduction of regional imbalances and diversification of land use.

We need strict laws for land use conversion, survey of land based on climate, water and soil particulars to improve investment and training orientation, publicity and awareness based on local needs. Effective reclamation is needed to check degeneration. This can be done through effective watershed management, reduction of regional imbalances and diversification of land use. Preventive measures on adverse effects from industrial wastes and effluent and development of agro-based industries are also keys to developing an integrated approach.

To monitor the better use of land, Remote sensing satellite technology like Geographical Information System and Global Positioning System can be used. One of the problems frequently encountered while measuring the loss of land value is the difficulty in measurement itself as there are so many variables involved. Empirical or process based models have to be so complex to take into consideration the effects of all the variables. One of the methods is to estimate long term average annual soil loss from arable land using Universal Soil Loss Equation (USLE) or its revised form (RUSLE). There are various mathematical simulation models based on physical process involved in soil detachment, transportation and deposition. Use of Iso-erosion rate map (Singh et.al, 1992) is an example. Soil erodability factor can also be measured. Loss of soil value due to land degradation is needed to understand the environmental costs of agriculture. Production approach that assesses the impact, preventive cost approach that focuses on conservation and defensive expenditure and replacement cost approach that relies on the cost of restoration are the different ways to measure this. There are various econometrics models that can include and evaluate the inputs for alteration and cropping pattern. In India, soil and land survey conducted by Department of Agriculture and co-operation developed land degeneration mapping in the eighth five-year plan through District Information System where soil information system of 30 districts in diverse agro-climactic zones were formulated. Similarly, the Department of Land Resources, Ministry of Rural Development has brought out the Wasteland Atlas of India 200o after studying different types of degraded wastelands in the country.

Reclamation of wasteland is one of the most important aspects of sustainable land use. Agrarian practices can be modified for reclaiming wasteland. For example, application of gypsum consecutively for three years with reduced application in the second and third year will reduce salinity. Integrated watershed management is a preventive method in which soil and water is conserved and cropping pattern is altered to improve land use. Percolation of water into subsoil, reduction of surface water run-off, elimination of soil erosion and increase water availability are the chief aims of such sustainable management practices. For attaining these objectives, check dams along gullies are constructed, bench terracing, contour bunding, land levelling, planting grass along the contours, good vegetal cover on the watershed are deployed. Difference can be brought through Governmental Intervention and policy making. The Soil and Water Conservation Division, Ministry of Agriculture plans to manage 86mha under 30 projects through Integrated Water Management. 30,000 hectares of shifting and semi-stable land dunes have been treated with shelter belts and strip cropping as a conservation measure (TERI Report, 1997).

The National Land Use and Wasteland Development Council (1985) was set up with the objective of formulating a National Policy and Perspective Plan for Conservation and Management of Land Strategy. It is time to set right some policies unsuitable for sustainable development. For example, the governmental policy of heavily subsidising electricity for tube well irrigation and chemicals led to poor land quality and eventual abandoning of land. Similarly, the New Economic Policy that encouraged relaxation on land acquired by Non Resident Indians, conversion of agricultural land into non-agricultural land, ceiling of agricultural land holdings eventually led to distorted market value due to speculation. The encouragement given to export oriented agriculture and concessions given to agro-processing industry adversely affected Indian agriculture by increasing the investment costs. Rational Policies to face regional imbalances should be brought in. The commitments of Tropical Forestry Action Plan, World Food Programme, UNCED led Forest Principles and the Government of India's National Conservation Plan should be adhered to. Rational Pricing Policy combined with resource efficiency in agro-processing industry is the need of the hour.

Economic incentives for soil conservation practices, conjunctive use of chemicals with biological inputs, classification of Land use statistics and studying the land use impact on agriculture will help at the macro level. Use of remote sensing technology to study different dimensions of the problem is mandatory. Legislation is in place for conservation of bio-diversity and forests but not to protect soil relations. Such gaps in law should be filled in with appropriate legal protection. New technology and crop management practices should emphasise the integrated systems approach. Meaningful farm research practices will address the concept of linking agriculture with environment. The aim of agriculture should be sustainable crop production with enhanced production envisioned for the long term. Diversification of agriculture should be encouraged. Farming oilseeds and pulses in place of cereals and horticulture wherever applicable demand less water and encourage crop rotation. This permits an understanding of agro climatic conditions, favourable topographic conditions, efficient land use, conservation of soil and maximum use of land resources. Integration of farm forestry with agro forestry will reduce the tremendous pressure on land. Growing a combination of species like agri- silviculture, farm and grove system will make management approach complementary, improve biomass production, regeneration of land resources and increased generation of employment and income.

Thus integrated and sustainable land use comprises prioritisation of critical land sensitivity, understanding land use and forest response, integrated strategy for forest and pest management, diversification of agriculture, crop combination, use of people's indigenous knowledge to attain food and nutritional security, increased productivity and address the environmental concerns. This is the way forward towards an evergreen revolution.

[Francis Kuriakose is former Assistant Professor of Commerce & Management, Mar Ivanios College, University of Kerala, Thiruvananthapuram and Deepa Kylasam Iyer is a contributing Editor with a web portal based in Paris for the people of indian origin.]