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VIEWS AND EXPRESSIONS
(I)
Policy issues for Sustainable Land Management

The concept of sustainable management is drawn from the publication of 'Our Common Future' (WCED, 1986) and is interpreted in multiple ways, depending on the resource dealt with. The practical approach to understand sustainable development is as maximization of net benefits of economic and social development subject to maintaining the services from the quality of natural resources over time (Munasinghe and McNeely, 1995). When the sustainability principle is applied to Land Management It is the land use that is ecologically suitable and economically viable, implying that it is within the carrying capacity. It has been suggested that Sustainable Land Management (SLM) has to combine technologies, policies, and activities aimed at integrating socioeconomic principles with environmental concerns so as to simultaneously maintain or enhance production and services (productivity), reduce the level of production risk (security), protect the quality/ potential of natural resources and prevent soil and water degradation (protection), be economically viable (viability) and socially acceptable (acceptability) and these five goals- productivity, security, protection, viability and acceptability- are the pillars of sustainable land management (Smyth and Dumanski, 1995).

Land Management cannot be seen in isolation, separated from the life on land. A definition developed at the 1992 Earth Summit identified Sustainable Land Management as “the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions” (Motavalli *et al*., 2013). Since the land use has to be integrated with the livelihood of people surviving on the land, it has to be compatible with the requirements of their health, nutrition, education, leisure, employment, and overall livelihood of the people. Therefore, even an economically viable land use may be incompatible with sustainability if the use is for purposes which do not promote food security or healthy living.

India being an agrarian economy, the land resource assumes a critical role in affecting the livelihood of the majority of the population. Sustainable Land Management in the Indian context would include not only the land but all the resources located on it and their use, such as agriculture, animal husbandry, fisheries, forestry, water, minerals and so on. For managing these resources sustainably, certain policy suggestions are made below.

Agriculture: India's arable land area is 155.37 million ha and is the second largest in the world, after the United States of America (World Bank data- macrotrends.com). Agriculture though accounting for only 14 per cent of the economy, contributes to 42 per cent of total employment. In India, about 70 per cent of rural households depend on agriculture for livelihood, and 82 per cent of these farmers are small and marginal, who need credit for cultivation (FAO). Among the agricultural crop, India is the largest producer of pulses and jute, and the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. India is now among the top ten agricultural produce exporters in the world. In spite of these achievements, hunger and undernourishment are considerable with 30 per cent people living in poverty, indicating lack of linkage between agriculture and nutrition. Improvements in agriculture need to improve nutrition and reduce poverty, in order to make the land use sustainable, and in that context the following need attention:

1. In agriculture, there is a need for improving and sustaining the productivity through practices such as crop diversification, mixed cropping, crop rotation, optimum water use and improving water use efficiency, integrated pest management and integrated nutrient management.
2. The cereal centric agriculture should diversify to millets, which have better nutritional benefits. Cultivation of millets which will be in dry lands would help in putting those lands to optimum use. India is already a leader in millet production with 20 per cent share of the world, over nearly 14 million ha. The cultivation of millets suffered a setback during the cereal-based Green Revolution period, and this needs to be corrected. The major millets produced are pearl millet and sorghum. The land area under millets needs expansion especially in the context of the recent thrust on millet use, during 2023 the International Year of Millets.
3. The drylands can be used for oilseed production, to meet the demand which is now being fulfilled

through imports. Since oilseeds are cultivated mainly on marginal lands under rainfed conditions, the area can be easily expanded with crops such as groundnut, rapeseed and mustard, soybean, sunflower, sesame, safflower and niger which yield edible oil. This would offset the need for the import of palm oil from Southeast Asian countries or even the proposed expansion of palm oil plantations in the biodiversity rich regions of Northeast India or the Andaman and Nicobar Islands. Any area expansion of oil palm can be in non-forest areas that are suitable.

4. The tree borne oil seeds, such as sal, mahua, karanj, neem, wild apricot, etc., need to be promoted on marginal lands, which would supplement the oil production, and also add to the green cover. The non-edible oil seeds with export potential, such as, castor and linseed also suit such lands, and need to be promoted.
5. Land under crops that are known to be harmful to human health, such as, tobacco should be gradually brought down and phased out. Though India is the second largest producer of tobacco after China and Brazil, and provides livelihood to 36 million people and earns foreign exchange besides providing considerable tax revenue, the environmental impacts and loss suffered due to health hazards are not fully quantified. The energy intensity of the cultivation, harvest, transport, processing, manufacture of products and their packaging, etc., which are destined to go up in smoke ultimately, is not worth spending. The entire crop is destined to add to smoke and pollution, consuming precious energy and water in the process of cultivation and processing. The health hazards posed to the tobacco farmers, processing hands and the consumers in terms of cancer, coronary artery disease and chronic obstructive pulmonary disorder, all attributable mainly to tobacco use and the resulting loss of productivity and health spending are to be factored in, to evaluate the sustainability of this land use. Looking for alternative crops, such as, oil seeds or oil palm, cotton, vegetables, etc., will be a viable land use.

Animal husbandry : It is a major livelihood option in most of the rural areas, providing dairy products, meat, wool, and leather besides use in agriculture and transport. Nearly 20 million people are dependent on animal husbandry, and almost two-third of livelihood in rural areas depends on it. India has the world's highest livestock which stands at about 537 million, as per the 20th Livestock census of 2019. It is first in the total buffalo population and second in cattle and goats. It is the second largest poultry market in the world. India is the largest producer of milk in the world accounting for 23 per cent of the world's total output, standing at 210 million metric tonnes in 2020-21 with a target to achieve 300 million MT by 2023-24 (GOI, 2022).

Animal husbandry impacts land use by means of grazing lands, fodder farms and feed production, required to maintain the large livestock population. The major sources of fodder are crop residues, cultivated fodder and grass from forests, pastures, grazing land and wasteland. Currently, there is a deficiency of 35.6 per cent green fodder, 10.95 per cent dry fodder and 44 per cent concentrated feed materials (Singh *et al*., 2021), and improving the situation needs sustainable land use for fodder production. The following are the policy suggestions for the improvement of the sector in terms of its land use.

1. Non-cropped areas in agricultural land need to be used for cultivating fodder crops, such as, maize, berseem, oats, Napier and cowpeas. At present fodder occupies just 4 per cent of the cultivable land in the country.
2. The rice-wheat cultivation system can be diversified to fodder on a rotational basis, which will prevent nutrient depletion of the soil by intensive rice or wheat cultivation, and also enhance fodder availability for the cattle.
3. Alternate sources such as Azolla, Moringa leaves and tree fodder can help enhance fodder availability.
4. Of nearly 500 million tonnes of crop residues produced in the country about one-fifth is burnt annually. This must be restricted and put to use as fodder.
5. The productivity of the natural grasslands can be improved to support animal husbandry.
6. The degraded and eroded lands can be brought under fodder cultivation to check erosion and conserve soil and water, while simultaneously meeting the fodder demand. The nitrogen fixing trees with deep roots and forage grasses can be used in reclaiming such lands.
7. The bunds and embankments of rivers and canals can be used for planting grasses, which will stabilize these structures and also produce fodder.
8. Grasses can be used in sand stabilization programmes to supplement the grass available to cattle in the area.
9. Hydroponic fodder production can supplement the availability of fodder, without impacting land resources. This needs to be expanded on a large scale.

Inland fisheries: The river systems occupy a combined length of 29,000 km forming a rich resource of fishes. Besides that, around 2.36 million ha of land is covered by tanks and ponds where the culture-based fishery is predominant. The present inland fish production is about 8.9 million tonnes, which is about 62-65 per cent of total fisheries production. India is the third largest fish producing country in the world, accounting for 7.56 per cent of global production, and the fourth largest exporter.

Around 28 million people are employed in this sector (Jacob *et al*., 2020). This land use is under pressure due to ecological damages. Sustainable land use in inland fisheries needs the following:

1. Most of the inland water bodies are choked with aquatic weeds, which need to be removed for a healthy population of fishes to thrive.
2. The waterbodies also receive a large amount of domestic sewage and chemical pollutants from agriculture and industries from the adjoining cities and towns, leading to eutrophication and loss of aquatic life. Sewage treatment and reuse of water are a necessity.
3. Reclamation of waterbodies for other land uses, such as, housing or agriculture which is quite prevalent needs to be checked.
4. Though modifications of inland waterbodies by embankments, construction of dams and channels and inter-basin connections have improved transportation, flood control, hydropower generation, fisheries and agriculture, they have disrupted the links between waterbodies and groundwater leading to salinization in coastal regions, adversely affected the biodiversity of fishes and birdlife, promoted access to exotic fishes and weeds, and resulted in the loss of mangroves in the regions of confluence with the sea. The negative effects of man-made modifications in inland water bodies need to be mitigated.
5. Recently the Indian Council of Forestry Research and Education has prepared Detailed Project Reports for rejuvenation the of 13 river systems across the country, through forestry interventions. Similarly, an action plan for rejuvenating the rivers by reduction of pollution has also been prepared by the State Governments through the Pollution Control Boards. These plans need to be implemented in the right earnest, to improve one important land use which has repercussions on other land uses as well.
6. Ecological farming practices promoting the use of biofertilizers and biopesticides, use of chemical fertilizers only to the extent required based on soil analysis and integrated farming systems linking agriculture- fisheries- forestry can provide some relief to the stressed water bodies.

Forestry: The total forest and tree cover in India is 80.9 million hectares, which is 24.62 per cent of the geographical area of the country (FSI, 2021). Though the forest and tree cover is steadily on an increasing trend as revealed by the statistics, the increase is largely due to plantations outside the forest area; the natural forests are either reducing in area or density indicating continuous degradation. Forests are under pressure due to encroachments, shifting cultivation, infrastructural development especially roads and buildings in hitherto densely forested areas, grazing and forest fires. The following policy guidelines need consideration in the management of the forest resources:

1. A clear policy on forest land use is required. Area needs to be set aside for Protection, Production and Restoration. In the forest area set aside for protection, which may include the Protected Areas, catchments, biodiversity rich areas, etc., densification of forest cover through natural regeneration should be the norm. In those areas which are reserved for production, intensive management can be undertaken to enrich the forests with species in demand, soil and water conservation works and fertilization with compost. The areas to be restored will include those areas degraded by mining, floods, erosion, alkalinity/ salinity, etc., where bringing the area under green cover should be the objective.
2. Even the non-forest areas should also have a clear land use policy to support agriculture, agroforestry, farm forestry, habitation, urban facilities, industrial use, etc. The large stretches of land along the Highways, Railways and Defence Estate should be brought under green cover to the extent possible. Urban greening, especially of public spaces besides roof-top gardens, vertical gardens and school kitchen gardens need to be created for the mitigation of pollution and also to meet the nutrient requirements of the people.
3. Maximum loss of primary forests is happening in the North-eastern region of the country. One of the reasons is the lack of proper land tenure. The de jure ownership of land rests with the Government while de facto occupation and claims are with the communities, in some States and this needs to be settled, if the remaining areas are to be protected. In community owned forest areas, as in most of the States of Northeast India, proper forest land use policy has to be evolved and the land managed through Working plans, irrespective of ownership.
4. The regeneration of forests is affected by grazing and fire. Grazing leaves unpalatable species to regenerate profusely. Fire affects the susceptible species leaving the fire-hardy species to regenerate. Thus, these factors can change the composition of the forests, even though the regeneration may appear adequate and forests sufficiently stocked. The absence of pollinators, lack of sufficient breeding individuals, inbreeding depression, seed predation and recalcitrance of seeds are other factors that affect the regeneration of selected species. Therefore, regeneration of forests needs to be assessed through species specific estimates for necessary remedial action.
5. The major demand for wood is for construction followed by furniture. Nearly 80% of timber goes for construction. With increasing requirements from

the housing, tourism and hospitality sectors this demand is likely to go up. Timbers used are mainly teak (50%), mahogany, cedar, shisham, mango (20%), sal and deodar (10%) (Shrivastava and Saxena, 2017). Special missions need to be evolved for these species to be incorporated into agroforestry systems, with high yielding varieties.

6. Total timber production is estimated at 70.9 million cu.m. per year excluding fuelwood which is 385.25 million cu.m. The consumption is 69 million cu.m. per year excluding 333 million cu.m. of fuelwood (Shrivastava and Saxena, 2017). Timber production needs to be increased to reduce the use of metals, plastics, glass and composites in construction and furniture, as they are produced by destructive mining activities and employing highly energy intensive processes. The use of timber will help in locking up carbon in durable products and thus help in mitigation of climate change.
7. The fallow lands and wastelands can be put to use for the production of timber and non-timber forest produce, which can come up on such marginal lands. However, this has to be done after properly defining and identifying what are fallow lands or wastelands. Otherwise, scrub forests and grasslands which are unique ecosystems on their own may get classified as wastelands, and get diverted for plantation activities.
8. Whenever the non-timber forest produce collected is a fruit, seed, root, tuber or rhizome the collection is destructive and affecting the genetic quality of the populations and their long-term survival. The tendency is to collect the best and leave the inferior one for regeneration which leads to continuous genetic erosion. The collection needs to be organized and rotated across forest blocks, allowing for the regeneration of the crop. Indiscriminate and excessive collection of non-timber forest produce is one of the main reasons for forest degradation, and therefore, efforts should be made to popularize their cultivation, rather than wild collection.
9. Fuelwood and fodder plantations need to be raised in forest fringe villages, to reduce the pressure on forests for grazing and fuelwood collection. In private lands, high value agroforestry with timber such as, sandal, red sanders, agarwood, rosewood, etc., can be promoted, so that area under green cover can be enhanced.
10. One of the main reasons for poor regeneration of forests is the presence of invasive weeds. The weeds are best eliminated by either composting or use as fuel. Creating economic interests in these weeds through the manufacture of furniture, handicrafts, etc., will only perpetuate their presence in the system. Converting weeds into fuel briquettes and burning would reduce the fuel demand from the forests. Collection of weeds through purchase from people, can provide employment to people in forest fringe villages, and also promote regeneration of the native species. The Forest Development Agencies that already exist under the Joint Forest Management programmes can be employed for this purpose. The herbaceous weeds can be composted and used to enrich the soil and the woody weeds can be pulverized and turned into fuel briquettes. A programme linking the mechanical removal of weeds from forests and agricultural areas, and their conversion to either fuel briquettes or compost for use in rural households and industries can eliminate the weeds, reduce the pressure on forests for fuelwood and enrich the agricultural ecosystem with organic material. The purchase of weeds can provide income to the local communities and will incentivize removal of weeds.
11. For all the plantation activities and production of quality planting stock, the primary requirement is the availability of quality seeds or quality vegetative material for multiplication, called collectively as Forest Reproductive Material (FRM). These are not sufficiently available, as the area under seed orchards, seed production areas, vegetative multiplication gardens, tissue culture labs, etc., are not sufficient enough to meet the demand. These need to be established and spread over the country. A system of certification of the FRM and compulsion to use them needs to be introduced, if the productivity of the plantations has to improve. Superior planting material combined with intensive silviculture can only harness the benefit of tree improvement.
12. A programme of linking solid waste management, composting and restoration forestry can be formulated, to compost all the biodegradable waste in major cities and use that in the form of compressed bricks, tiles or pellets for covering the degraded areas, viz., mine dumps, mined areas, ravines and eroded areas adjoining any city or township. This can help restoration of the organic matter over the degraded land, which on its own will help revival of vegetation over the area. If required, this can be supplemented by sowing of grass slips and seeds of herbs or shrubs which can restore the area through ecological succession. This can be implemented through Forest Development Agencies.
13. The aquatic weeds can be easily eliminated and also used, if collected and dumped on degraded sites. They cannot survive on land and will decompose adding humus to the soil that is deficient in organic matter. Regular collection from aquatic bodies and dumping on the ground would help build up soil in those eroded and degraded sites, which will recover gradually without any further intervention.

Urban land use: According to 2011 census, the total urban population of India was 377 million, constituting 31.16 per cent of the population. It is now projected as 35.9 per cent in 2022. If the census definition of urban area is relaxed to consider settlements with more than 5000 inhabitants as urban, 47 per cent of population can be treated as urban. As per the norms adopted by the World Bank, 55.3 per cent of population in India is urban. Satellite images of built-up areas show nearly 63 per cent of India as urban. Notwithstanding these variations depending on the method of classification, India is urbanizing fast, and it is estimated that by 2030 more than 400 million people will be living in cities in India. Though cities occupy only 3 per cent of land area their contribution to economy is 60 per cent, with corresponding environmental and social problems related to water and sanitation, overexploitation of groundwater, poor health, pollution, slum creation, congestion, crime and poverty aggravated by increased levels of inequality (Aijaz, 2017; Shaban *et al*., 2020). In order to tap the positive effects of urbanization but mitigate the negative aspects, the following needs attention.

1. Urbanization should be inclusive with proper planning on land use, setting apart areas for housing, recreation, commercial activities, education, transport, etc., discouraging encroachments and promoting secure and legal tenure over land.
2. Infrastructure and basic services should be available to all with proper spatial connectivity and economic inclusion, ensuring access to education and health and decent employment.
3. The slums that have already developed need to be phased out in a gradual manner, acquiring the land and adding planned housing and infrastructure, with adequate attention to safe water supply, garbage disposal, sewerage, transport and connectivity, access to education and health and addition of greenery. Restorative planning is required on a war-footing, if the urban land use is to be made productive adding value to the economy as well as the environment.

All terrestrial life on earth is dependent on that thin crust of earth called land. Appropriate and wise use of this land is essential, if life has to sustain on this earth. In land use the primary requirement is to apportion the land for different uses, based on the requirement of all life on earth, and not just the human needs. Since the human beings are the dominant feature of the Anthropocene, how they use the land decides how the future of this earth is going to be. India being the second largest country in terms of human population, which is soon to become the first, what India does in terms of land use, is going to have global implications. It is time that the major land uses are made systematic and eco-friendly, based on certain policy suggestions made above, for the benefit of not just the mankind, but entire life on earth.

References

Aijaz R. (2017). *Measuring urbanization in India.* ORF Issue brief No. 218. Observer Research Foundation, New Delhi.

FAO. https://fao.org/india/fao-in-india/India-at-a-glance. Retrieved 22.2.2023.

FSI (2021). *India- State of Forest Report,* Forest Survey of India.

GOI (2022). *Economic Survey 2021-22,* Ministry of Finance, Government of India.

Jacob C.T., Krishna Kumar, N.K., Lal K.K., Govindakrishnan P.M., Singh R.K., Mohindra V., Tyagi L.K., Singh A., Chandran R., Suresh V.R., Rana J.C. and Jena J.K. (2020). Inland aquatic resources of India and the ecosystem services management-status, issues and some policy suggestions. 2019-20. ICAR-NBFGR and The Alliance of Bioversity International and CIAT.

Motavalli P., Nelson K., Udawatta R., Jose S and Bardhan S. (2013). Global achievements in sustainable land management. *International Soil and Water Conservation Research*, **1**(1): 1-10.

Munasinghe M. and McNeely J. (1995). Key concept and terminology of sustainable development. In: Defining and measuring sustainability- the biogeophysical foundations. (Munasinghe M. and Shearer W. Eds.). The United Nations University and the World Bank. **137**-143.

Shaban A., Kourtit K. and Nijkamp P. (2020). India's urban system: sustainability and imbalanced growth of cities. *Sustainability*, **12**: 2941; https://www.doi.org./10.3390/su12072941

Shrivastava S. and Saxena A.K. (2017). Wood is good- but is India doing enough to meet its present and future needs? A status report by Centre for Science and Environment.

Singh D.N., Bohra J.S., Tyagi V., Singh T., Banjara T.R. and Gupta G. (2021). A review of India's fodder production status and opportunities. *Grass and Forage Science*, 00.1-10. https://doi.org/10.1111/gfs.12561

Smyth A.J. and Dumanski J. (1995). A framework for evaluating sustainable land management. *Canadian Journal of Soil Science*, **75**: 401-406.

WCED (1986). Our Common Future, Oxford University Press. World Commission on Environment and Development.

World Bank. https://www.macrotrends.net/countries/IND/india/arable-land retrieved 22.2.2023

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