TERI Base Paper

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Reversing land Degradation in India

Nature and extent of land degradation:

The earliest assessment of the area affected by the land degradation was made by the National Commission on Agriculture in 1976 at 148 million hectares (mha) i.e. 45% out of a Total Geographical Area (TGA) of 328 mha, followed by 175 mha by the Ministry of Agriculture (Soil and Water Conservation Division). The National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) estimates projected an area of 187 mha as degraded lands in 1994, and revised it to 147 M ha in 2004.

The National Wasteland Development Board (NWDB) in 1988 estimated an area of 123 mha (37.5% of TGA) under degraded/wastelands based on National Remote Sensing Agency (NRSA) satellite data of 1984-85. The NRSA used remote-sensing technology, identifying land-use and physical condition of the surface features for mapping non-agricultural areas (presently non-arable) on 1:50,000 scale. NRSA (now NRSC) has been updating its data, notably in 2003 and 2006, and the latest data is available in the "Wastelands Atlas of India 2010". A 13-fold land classification system was adopted initially in 1985 for mapping at 1:50,000 scale. A modified classification system, with 23 classes to better indicate the severity of degradation was adopted in 2006. The NRSA data enables identification of wastelands and their location up to village and micro-watershed levels. The "top down" and "bottom up" approaches of NRSA and NBSS&LUP data was partially harmonized (incorporating causative factors) with respect to 114mha (34.75 of TGA) of degraded/wastelands. (**Annexure 1**).

Desertification:

Department of Space (DOS) has evolved a utilization programme of space technology for societal benefits viz., National Natural Resources Management System (NNRMS) which caters to the needs of various Ministries as well Central and State Departments. At the behest of the Ministry of Environment and Forest, ISRO's Space Applications Centre, Ahmedabad along with partner institutes took up the task of inventory and monitoring of desertification and land degradation of the entire country using Indian Remote Sensing Satellites (IRS) data. Data for the time frame 2011- 13 and 2003-05 in GIS environment were analysed and a "Desertification and Land Degradation Atlas of India" has been brought out in June 2016. On-screen visual interpretation of the data in GIS environment on a scale of 1:500,000 have been carried out. ISRO plans to work further towards desertification and land degradation vulnerability modelling as well as preparation of action plans (1:10,000/1:4,000 scales) using high resolution IRS data.

ISRO's analysis of the remotely sensed data reveals that 96.40 mha area of the country is undergoing a process of land degradation i.e., 29.32% of the TGA of the country during 2011-13, while during 2003-05 the area undergoing process of land degradation is 94.53 mha (28.76% of the TGA). There is a cumulative increase of 1.87 mha area undergoing process of desertification/land degradation in the

country (constituting 0.57% of the TGA of the country) during the time frame 2003-05 and 2011-13. The change analysis carried out for 2011-13 and 2003-05 time frames indicates that around 1.95 mha land has been reclaimed and 0.44 mha land has been converted from high severity to low severity degradation class, indicating improvement. On the other hand, around 3.63 mha of productive land has degraded and 0.74 mha land has converted from low severity to high severity degradation class. The most significant process of desertification/land degradation in the country is Water Erosion (10.98% in 2011-13 and 10.83% in 2003-05). The second most significant process is Vegetation Degradation (8.91% in 2011- 13 and 8.60% in 2003-05), which is followed by Wind erosion (5.55 % in 2011- 13 and 5.58 % in 2003-05). The results are however not strictly comparable with the NRSA data as the classification system and the broad methodology for the desertification/land degradation mapping by ISRO is based on three elements, viz., land use, process of degradation and severity Level, rather than the 13-fold or 23-fold classification.

Land degradation and desertification drivers and causes:

At a broad level, the driving forces behind land resources may be described as follows. Some of the drivers are natural, others are anthropogenic. Even the natural drivers may have anthropogenic influences which may modify or exacerbate the drivers and the impacts:

- Wind erosion
- Water erosion (fluvial, meteoric)
- Chemical (natural occurrence of alkaline chemicals, movement of subsoil chemicals (e.g. salinity) to the surface, as well as artificial addition of chemicals, including fertilizers or industrial pollutants)
- Physical (waterlogging, geomorphological changes caused by mining or other activity).

Direct anthropogenic influences and drivers include:

- Agriculture, and related activities
- Livestock related activities (grazing)
- Biotic pressures (for fuelwood and fodder and MFP)
- Land Use changes (urbanisation, mining, infrastructure etc.)

Annexure 2 gives a synoptic view of the natural resource base and the drivers which operate to create pressures.

Soil erosion by wind and water which removes topsoil with its organic content, as well as acidity, alkalinity/salinity of the soil which makes the soil toxic for agriculture and other uses are the principal causes for land degradation. Waterlogging, due to natural flooding as well as irrigation, is another significant cause of degradation, both by inundation, and in some cases, by bringing up subsoil toxic chemicals (evaporites) to the soil surface.

As agriculture uses 141 million hectares out of 328.7 mha of the country, faulty land and water management practices in agriculture significantly contributes to land degradation. There is enough

scientific evidence to show that intensive irrigation and high chemical use (fertilizers, pesticides, etc.) adds to degradation and that certain subsidies (such as provision of free electricity and free irrigation water) worsen the situation. Rainfed agriculture spans several agro-ecological regions and constitutes 60% of total cropped area.Soils in rainfed areas, particularly the drylands, are subject to a prolonged double exclusion, being unable to gain from full use of chemical fertilizers and receiving no support for locally validated fertility enhancing practices like crop residue incorporation, composting, farm yard manure application, etc.

While judicious management of common lands which are generally not brought under agriculture can avoid erosion and other complex degradation problems, sustainable use of common land and revitalisation of degraded common lands requires deep community level commitments, which may be lacking given the social inequalities and competition for access to scarce resources.

In India, the poor and tribal communities in the vicinity of forest areas depend quite heavily on forest produce for all aspects of their day to day life, and their rights have been recognised in the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. The dynamics of balancing the need to protect and develop forests—for their ecological services and the requirement of ensuring that those with traditional rights in forest areas have adequate support—is a complex process. As per the State of Forest Report 2017, the total forest and tree cover is 24.39 % of the geographical area of the country including forest cover of 21.54%. Degraded forests (scrub with less than 10% forest cover) occupy over 46,000 sq km. There has in fact been an increase in total cover since the previous assessment; with 6778 sq.km increase is in forest cover and 1243 sq.km in tree cover. There has however, been a decrease in forest cover in some areas, particularly the North East. The main reasons for the decrease are: Shifting cultivation; biotic pressures (grazing, fodder, fuelwood and MFP removal); Diversion of forest lands for developmental activities and mining; and Agriculture expansion.

Evolution of land resource management policies and approaches:

Though the subjects of “land”, “agriculture” and ”water” are subjects with the States as per the Constitution, the concerns for arresting and reversing land degradation and desertification have been reflected in many of the national policies for nearly 40 years. Current policies and key legislations (many of them revised versions of earlier policies) include The National Water Policy 2012; National Forest Policy 1988; National Agricultural Policy 2000; Forest (Conservation) Act 1980; Environment (Protection) Act 1986; National Environmental Policy 2006; National Policy for Farmers 2007; National Agro-forestry Policy 2014 etc. which have enabling provisions for addressing these problems.

Most importantly, the Constitution of India was amended in 1992 to provide for the implementation by Panchayati Raj Institutions (PRI) of activities relating to land improvement, soil conservation, social forestry, and maintenance of community assets.

Following the setting up of the United Nations Convention to Combat Desertification (UNCCD) in 1996, the Ministry of Environment, Forest & Climate Change (MoEF&CC), which represents India in UNCCD, set up a “Desertification Cell” as a multi-institutional mechanism for India’s reporting to UNCCD related to

implementation of Indian programmes for combating desertification and land degradation. The Ministry also prepared an India-National Action Programme in 2001 for combating desertification for all the relevant stakeholders, both at national and international level, to take appropriate action in addressing the problems of desertification for achieving sustainable development.

In line with these policies and programmes (and the predecessor policies on the subject) the Government of India has been formulating Centrally Sponsored Schemes to assist States in addressing issues of sustainable land management and reversing land degradation. A significant part of the funding goes towards capacity building, knowledge creation and management and management mechanisms. The Government has also set up or sponsored a large number of research and techno-academic institutions in support of the policy directions. In addition, several States have made investments in programmes to address state-specific land management issues; and the World Bank and other multi-lateral agencies have provided funds to States for afforestation, wastelands reclamation and watershed development. In order to ensure cohesion and uniformity of approach, the National Rainfed Areas Authority (NRAA) set up in 2006 in the Planning Commission, in consultation with the stakeholding Ministries, brought out a "Common Guidelines for Watershed Development Projects" in 2008.

A brief overview of the Centrally Sponsored Schemes is as follows:

- The Drought Prone Areas Programme (DPAP) was launched in 1973-74 to tackle the special problems faced by areas constantly afflicted by drought conditions. 972 blocks of 195 districts in 16 States were covered under the Programme. The Desert Development Programme (DDP) was launched in 1977-78 to mitigate the adverse effects of desertification. 235 blocks of 40 districts in 7 States were covered under the Programme.
- Employment Generation programmes have focussed on creating, enhancing and maintaining community assets and the natural resource base particularly of the Common Pool Resources(CPRs): National Rural Employment Programme/Rural Landless Employment Guarantee programme (NREP/RLEGP) (1976), Jawahar Rozgar Yojana (JRY)(1989), Sampoorna Grameen Rozgar Yojana (SGRY)(2001), and the Mahatma Gandhi National Rural Employment Guarantee Scheme(MGNREGS)(2005).
- In 1985, the Government, expressing concern over the increasing degradation of land, launched a programme for halting and reversing land degradation and set up the National Wastelands Development Board (NWDB) under the MoEF in 1985. A National Land Use and Wastelands Development Council under the Prime Minister was also set up. The Integrated Wastelands Development Programme (IWDP) was launched in 1989-90, and it subsumed the DDP and DPAP (as well as the "shifting agriculture" scheme of the North-East).The scheme was transferred in 1992 to the newly created Department of Wastelands Development (renamed Department of Land Resources in 1999) under the Ministry of Rural Development.
- The Scheme of Soil Conservation in the Catchments of River Valley Project and Flood Prone Rivers (RVP and FPR): This was launched in Third Five Year Plan (1961-62);subsumed in the Rashtriya Krishi Vikas Yojana(RKVY) in 2014

- Reclamation and Development of Alkali and Acid Soils (RADAS): This programme was launched in the 7th Five Year Plan (1985-86);subsumed in RKVY
- National Watershed Development Programme in Rainfed Areas (NWDPRA) was launched in 1990-91 in 99 rainfed districts in 25 States.
- Integrated Watershed Development Programme (IWMP) was launched in 2008-9 in place of IWDP, with an aim to restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water and create sustainable livelihoods for asset less. NWDPRA subsumed.
- National Mission for Sustainable Agriculture (NMSA):- NMSA, launched in 2010, is one of the eight Missions under the National Action Plan on Climate Change (NAPCC). It seeks to address issues regarding 'Sustainable Agriculture' in the context of risks associated with climate change by devising appropriate adaptation and mitigation strategies.
- Green India Mission GIM) ; GIM launched in 2015 is another of the eight Missions under the National Action Plan on Climate Change (NAPCC). It is aimed at "protecting, restoring and enhancing India's diminishing forest cover and responding to climate change", and subsumes many of the funding elements of the ongoing national afforestation programmes. In addition, the Compensatory Afforestation Fund Act, 2016 provides for levy of certain fees on diversion of forest land and the utilisation of the accruals for afforestation activities related to reducing biotic pressures on forest peripheries.
- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) The major objective of PMKSY, rolled out in 2015, is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies (More crop per drop), enhance recharge of aquifers. The IWMP has been incorporated as the Watershed Development Component of PMKSY and is expected to fund undertake rain water conservation, construction of farm ponds, water harvesting structures, small check dams and contour bunding etc. (However, the incorporation of IWMP into PMKSY may reduce its focus on dryland areas, and much will depend on the ability of programmes like MGNREGS to fill the void).

Evolution of approaches to sustainable land management and reversing land degradation:

The evolution of schemes and programmes to address the various aspects of land degradation actually reflect the progressive acquisition of knowledge and development of improved packages of practice, as well as the shifts in focus based on national priorities. Some of the key milestones along this process include:

- Shift from farm-plots under DPAP in the initial stages, to area based treatments
- Adoption of watershed approach and planning based on micro-watersheds; use of remote sensing data and spatial data in planning at micro-watershed level

- Integrated treatment incorporating contouring, gully plugging, vegetative as well as engineering based solutions for soil-moisture conservation, covering agricultural as well as non-agricultural lands.
- Adoption of ridge-to-valley approach by including forest lands; Joint Forest Management (JFM) and Social Fencing by involving local communities.
- Integrated farming based approach incorporating fodder and fuelwood supply, farm-forestry and agro-forestry and silvi-pastures; stall feeding, improved chullahs etc.
- Focus on water management, aquifer recharge and water budgeting as well as crop planning
- More systematic incorporation of technical aspects; spearhead team(SHT) and watershed development team(WDT) based approaches
- Focus on social aspects: participative planning at micro-watershed level; transect walk; Constitution of Watershed Committee under the Gram Sabha; Water User Association development; social audit.
- Incorporation of livelihood related activities and development of micro-enterprises; involvement of Self-Help Groups(SHGs); programmes such as Mahila Kisan Sashaktikaran Pariyojana (MKSP) focusing on increasing skills and capabilities women farmers with a view to increasing sustainability.
- Adoption of climate-adaptation related solutions both with regard to floods and intense precipitation as well as temperature and moisture stress, and orienting employment generation programmes like MGNREGA in this direction.
- Reducing degradation by increasing local "circularity" of material and energy flows eg Zero Budget Natural farming and other similar models.
- Increasing the role of Panchayati Raj Institutions (PRIs) and ensuring "convergence" between Government programmes and programmes executed by PRIs including employment generation programmes.
- Need based local planning by placing untied budgets with PRIs (14th Finance Commission award).

Unfinished Tasks and the way forward:

Though it would seem that there has been very substantial development with regard to the national imperative of checking land degradation, the visible impact of programmes on the ground is clearly less than impressive. A provisional diagnostic would suggest:

- Insufficient coverage by government programmes for addressing land degradation primarily because of funding constrains but also because of management and technical capacity constraints. This leads to sub-optimal treatment of the degradation. The nature of post-treatment arrangements including capacity building of the local stakeholders to prevent further degradation is also inadequate.
- Need to focus on more sustainable agricultural practices. Depleting ground water, spread of problem soils (acidic, saline & alkaline), loss of soil organic carbon (SOC) and yield plateaus manifest the different dimensions of the problem and challenge. There is a need to promote agro-ecology based agricultural practices, which implies a blend of modern agricultural science

and indigenous knowledge systems. The agronomic practices should facilitate revitalization of small farms with emphasis on diversity, synergy, recycling and integration. The essence of agro-ecology based agriculture is, that it reconciles optimally the economic demands on the system with the ecological sustainability (or the carrying capacity).

- Perverse incentives such as free power for groundwater pumping ;nitrogenous fertilizer subsidy; Minimum Support Price(MSP) only for a few crops (thus influencing crop choice) etc etc may be causing degradation of additional areas .
- Regulatory provisions in respect of land may also have unintended negative consequences for sustainable land management. Tenancy legislation brought with the objective of "land to the tiller" is now impeding the recording of de-facto tenancies. Lack of official record prevents unrecorded tenants from accessing agricultural credit, making capital investments in land development and benefiting from schemes such as "*Rythubandhu*" (which provides an area rather than a crop based subsidy). In fact up-to-date, easily accessible land records can improve sectoral efficiency in many other ways as well. Ceiling legislation brought to ensure more equitable land distribution also acts as a barrier for large-scale land leasing and scientific management of lands and introduction of new crops and related technologies with more sustainable outcomes, which may not be otherwise possible given the small and fragmented land holding pattern and high levels of rural poverty, particularly in dryland areas.
- Inadequate capacity at local levels (Panchayats) to plan and execute land development programmes in many States. The Watershed Committees of the Gram Sabha have not emerged as potent agents of change, and are not able to ensure regulation of common resources like common lands and water. In many States the small size of the Gram Panchayat is a binding constraint on the technical and management capacity potential.
- Insufficient development of community-led or community-based institutions to articulate concerns, and ensure sustainable practices particularly in relation to Common Pool resources, such as common land, water etc. This also includes issues relating to women SHGs and the MKSP initiatives, which need not be mainstreamed more vigorously.

The Government had brought out a draft Land Utilisation Policy in 2013 which advocates the revival of the National Land Use Council and similar policy and institutional mechanism at the State level. The draft Policy recognises that proper land use planning must be based on sound scientific, and technical procedures, and land utilisation strategies, supported by participatory approaches that empower people to make decisions on how to appropriately allocate and utilize land and its resources comprehensively and consistently catering to the present and future demands. A comprehensive land utilisation policy framework that recognises land-related impacts of climate change and promotes impact-mitigative and adaptive action is essential for sustainable land management.

Government has also created a National Rainfed Areas Authority (NRAA) with the mandate of networking and coordination with the key Ministries of Agriculture & Farmers Welfare, Rural Development, Water Resources, Environment & Forests and Panchayati Raj. The Authority is required to prepare a perspective plan, outlining the national strategy and road map for holistic and sustainable

development of rainfed farming areas; coordinate and bring convergence within and among agricultural and wasteland development programmes being implemented in rainfed areas of the country.

In the last analysis sustainable management of land (and water) resources has to be by, and in close collaboration with, local communities. It is no coincidence that the few outstanding examples of sustainable management are all traceable to visionary local leadership supported by the host communities and assisted by public policies for sustainable use of resources, infrastructure creation, knowledge accretion and transmission, and development of entrepreneurship. Checking and reversing land degradation has to be essentially based on self-regulatory practices with regard to sustainable use of resources and energy. The task of public policies must include incentivisation of such regulation.

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Annexure 1

Degraded and wastelands of India (in mha)

Water Erosion		
Loss of top-soil	13.25	Mainly agricultural areas
Gully formation	8.31	Wastelands and partly agriculture
Ravines	2.06	Mainly wastelands
Wind Erosion		
Loss of top soil	3.76	Mainly agricultural areas
Over blowing	1.89	Partly agriculture and partly wastelands
Terrain deformation	3.24	Mainly wastelands
Chemical Degradation		
Salt-affected soils	6.73	Partly agricultural and partly wastelands
Land degradation due to acidity	16.03	Mainly agriculture areas and partly wastelands
Physical Degradation		
Waterlogging		
Surface ponding	1.66	Mainly wastelands
Subsurface waterlogging	4.75	Mainly agricultural areas
Veg. Degradation with Water Erosion	40.16	Mainly wastelands
Others		
Mining and industrial waste	0.13	Wastelands
Barren rocky/stony waste	6.46	Wastelands
Snow covered area/ice caps	5.58	Wastelands
Total area	**114.01**	

Source: Degraded and Wastelands of India: Status and Spatial Distribution (ICAR)

Notes: 1. Statistics encompasses degraded lands in agricultural areas and wastelands;
2. The results given in this table are preliminary y, and are based on the incomplete information. Further studies on the harmonization of the area statistics have been taken up inter-institutionally.

Annexure 2

The natural resource base on which the main drivers operate to create pressures

- **India has 2.4% of world's land area, 4% of world water resources but 17% of human population and 15% of livestock**
- Though agriculture accounts for only 14% of India's GDP, over 50% of the population relies on agriculture as main source of income.
- **Land and Water**:
  - Out of total geographical area of 328million ha, ICAR estimates that 120 mill ha is affected by various types of degradation, including water and wind erosion (94 mha), soil acidity (18mha), alkalinity/sodicity (3.7mha).
  - 5.3 billion mt of soil gets eroded each year, of which 29% is lost to the sea, and 10% is deposited in reservoirs; rest is shifted from one place to another.
- **Land ownership**:
  - Marginal holdings (<1ha) account for 67% of all holdings and 22% of area
  - Small (1.00-2.00ha) account for 18% of all holdings and 22% of area
  - Semi-medium (2.00-4.00ha) accounts for 10% of all holdings and 23% of area
  - Medium and large together account for 5% of all land holdings and 32% of area
  - Average size of holding has gone down from 2.82 ha in 1970-01 to 1.16 in 2010-11.

  Per capita availability of land under agriculture has decreased from 0.5ha in 1950 to 0.18 ha in 2001

- **Cropping intensity**:
  - Total area under crops: 195 mha
  - Net area sown: 140mha
  - Cropping intensity: 135%
  - Area under food crops: 141mha
  - Net irrigated area 63 mha (42%)

- **Irrigation and water use efficiency**:
  - Irrigation potential:140mha (58.5 mha from major and medium); 81.5mha minor (including 64mha from groundwater and 17.4 mha from surface water)
  - According to a survey, only 3% of India's some 8.5 million tube-well owners used drip or sprinkler irrigation.
- **Rainfed area farming**
  - Spanning several agro-ecological regions constituting 60% of total cropped area**,** the rainfed areas represent the geography with the largest concentration of poverty and backwardness. Rainfed agriculture supports an estimated 40% of population (484million) and has a large share of cropped area under rice (42%), pulses (77%), oilseeds (66%) and coarse cereals (85%). Harbouring about 78% of cattle, 64% of sheep and 75% of goats rainfed areas cater to most part of the meat market in the country.