

Causes of ecosystem degradation in semi arid areas

*Dr. Anoop Kumar
Lecturer- Geography
Government PG College, Khetri
Distt. Jhunjhunu (Raj.)*

Abstract: The problem of desertification in the areas surrounding the desert areas is becoming rampant and at present severely affecting the local natural ecosystem. Surprisingly, the problem has been neglected so far, though it raises alarm to the scientists, administrators and the planners. The spread of desert-like conditions in the semi-arid regions is mainly the resultant of various natural as well as anthropogenic factors involved. No doubt, there is a need of immediate check to be imposed on the prevailing de gradational activities which may be held responsible for the desertification. In an ecologically fragile environment where population is already pressing upon the resources, the continuation of rapid population growth- where other factors remain unchanged- must lead to deterioration of the habitat.

Introduction : One kind of the determination of the habitat is the encroachment of desert-like conditions to marginal areas. It is a kind of extension of typical environmental conditions. The factors which may be held responsible are socio-economic, anthropogenic and hydrological in nature. There are various non-objective reasons for claiming that desertification must be man-made. If desertification results primarily from the impact of individual and societies on the environment, then some action could be taken to correct the problem and avoid further degradation. Salient apparent causes of dry land ecosystem degradation are discussed here.

Over cultivation: Cultivation intensity which may lead to degradation in one or the other form may be termed over-cultivation. In other words, cultivation in excess to what could be sustained by the land is over-cultivation. It is one of the kinds of poor land uses prevalent in the dry regions of our country. Small landholding sizes often results in the tendency of the multiple uses of the available land. Land which may

sustain only single crop annually has to be cropped twice a year, that also on the cost of the meagre inherent fertility of land. It infers that landholding sizes are bound to drop in future also and would compel the cultivators to cultivate excessively in order to survive. Desertification simply does not occur without loss of soil cover, which in turn is provided by plant and animal communities. It is there, at the soil surface we need to look for the cause. Only when the root cause of soil cover loss is addressed can desertification be reversed.

Overgrazing: The dry lands of country are quite rich in livestock and land seems to be pressurized by growing numbers of livestock. Buffaloes, sheep and goats have experienced a great deal of increase over the years while the grazing lands have been shrinking rapidly. Goats are the main culprits of pasture and common land overgrazing. They along with sheep clear the grasslands as if there was nothing green before. Livestock population increase has had diverse impact on the natural ecosystem. The pastures, grasslands and grazing lands has been shrinking and thus the increased number of livestock could not be sustained without harming the monsoon splash and sheet erosion. Overgrazing of degraded pastures/ village common lands leads to soil structure damage as well as semi-permanent to permanent de-vegetation of the tract. Likewise, gauchar lands are an important source of grazing and fodder in the absence of adequate pasture land and a viable policy of fodder development. This has resulted in over grazing and over-extraction of green fodder, leading to degradation through damages to regeneration and compaction of soil. The over-exploitation of the plant cover does not inevitably have to end in the emergence of desertified lands. In heavily grazed areas, selective grazing can lead to a plant cover that is dominated by low quality or even unpalatable plant species. Their low utilization rates often support the emergence of secondary, quite stable floristic compositions so that desert-like features do not emerge. The bush encroachment phenomenon is another indicator of a continuous removal of grass layer due to heavy grazing. Even in severely degraded dry-lands, a high amount of bio-mass can be produced in years with average or above-average rainfall. Due to the decline in palatable plants the grazing lands, however,

experience a qualitative deterioration. A classification of this ecosystem, as intact that would purely be based on the parameters of sufficient soil coverage and high bio-mass production, would convey a totally distorted impression of the actual condition of the grazing lands.

Deforestation: Forest area in drylands of country is meagre. People have been using deadwood of forests as fuel wood and grasses and bushes as fodder for animals. Due to increasing demand, logging and felling continued. Dry lands has been facing fuel wood scarcity for the last two or three decades. Cow-dung is burnt as fuel and field remain deprived of valuable natural fertilizer. Major tree species of the study area has been victim of felling for economic purposes. The two major characteristics of desertification are the degradation of soil and degradation of vegetation. Deforestation makes soil susceptible to wind and water erosion. Also, the animal trampling cause loosening of the structure and ultimately soil is washed away, thus presenting a picture of barren land. Deforestation also results in reduction of amount of humus and gradually the soil becomes completely devoid of organic matter. It is difficult to separate the causes from the effects of deforestation and forest degradation. Some direct causes of deforestation are land clearances for agriculture, other land use changes including unplanned urbanisation, land transfers, different forms of encroachments, over-grazing, uncontrolled and wasteful logging and excessive fuel wood collection. Much of the rural energy for cooking comes from collection of fuel wood from forests or village gauchar lands.

Unsustainable Water Management Practices: Mismanagement of irrigated farming is another major dimension of desertification process in the district. Kharif is about 70 percent rain fed and thus fully dependent upon monsoon while Rabi is mostly irrigated. Farmers obtain most of their income from the Rabi crops. Rainfall being highly irregular and fluctuating, farmers use electric pump sets to extract water from aquifers, With the decrease in fertility, farmers heavily depend upon the fertilizers. For maximum results, fertilizers require reliable supply of water. Thus, farmers employ

powerful motors in order to have good harvests. Imbalances of discharge and recharge in the hydrological resources results in the depletion in resources. Due to several compulsions and pressures the farmers continuously extract underground water without taking into consideration the detrimental effect of it. It invariably results in water table lowering as landholdings witness more than two or three wells in operation within its boundary. Most of the district is plagued by water-table lowering and other related problems are also present. Not only this trend crippled the economic conditions of the farmers, but also has disturbing impact on the local ecosystem.

Due to increasing depth of wells and the electric - motors employed to extract the water, the farmers are on the verge of abandoning the farming. For most parts of the district; Irrigation has become sheer necessity in present situation. Poor and inefficient irrigation practices, over abstraction of ground water, particularly in southern regions of district resulting in salinity etc. are some of major unsustainable water management practices which has led to problems of desertification in the district. Over abstraction of groundwater without compensatory recharge has led to depletion of groundwater table.

Land Use Changes: The main crop-rotations are paddy-wheat, cotton-wheat, cotton-raya, Guar-wheat and Guar-Raya. There is scope for plantation of horticultural plants citrus, ber, guava and aonla etc. Diversion of land from forestry and agriculture to other land uses has been one of the principal causes of land degradation. Diversion of forest lands for non-forestry purposes was curtailed with the enactment of Forest (Conservation) Act, 1980 with the objective of arresting diversion of forest land for non-forestry purposes. Wherever diversion of forest land is unavoidable, for instance for developmental projects compensatory afforestation on non-forest land is mandatory. The other land use change is due to encroachments, through violation of forest boundaries, illegal farming in gauchar lands.

Demographic pressures: The general problem of arid areas with large population is essentially one of human ecology. The inherently limited resources within arid and semi-arid regions set the ultimate limit of production are finally dependent. Furthermore, erratic rainfall results in widely fluctuating production leading to scarcity, which imposes stress on these populations. In general, the population density of both human and livestock in the arid regions is much higher. The density of livestock on grazing lands has increased. The increase of cattle, buffaloes and camels has been very high in arid region. As population increases, the demand on natural resources is further magnified. This has led to further intensive use of land and other natural resources in drier regions. The consequence is an imbalance between the human and animal population on the one hand and plants, water and land resource on the other. As the demand by the first persists and increases, the resources tend to become depleted and, as depletion proceeds, the stress upon them becomes even greater. Thus, a process of progressive degradation of resources is set into operation, which intensifies with drought. If not checked timely and effectively, it leads to loss of vegetation, leading to loss of bio diversity. The barrenness of land affects the hydrological cycle which can affect the rainfall pattern for the region. As the population rises, so does population density, and degradation occurs. Concentration of population is leading to desertification because of overgrazing and over-cultivation in the vicinity. Population pressure is causing great concern as to whether these lands are to support an ever increasing population.

Generally, increase in population and livestock require more land to make use of. More water would be required for agriculture, industry and domestic use. A rough estimate indicates that nearly 1000 tons of water is consumed to produce one ton of wheat and double this quantity is required to produce one ton of rice. Over-exploitation of already meagre resources in arid and semi-arid area may result in widespread environmental degradation. Over cultivation is prevalent as

more and more land is being irrigated by various irrigation methods without any consideration about the deteriorating quality of the natural resources.

Drought and Land Degradation:

Drought is generally a naturally occurring phenomenon due to deficit of rainfall in a region. However, drought effects can be exacerbated due to absence of vegetative cover impacting the hydrological regime. Drought could thus be another causative factor for land degradation. Arid and semi-arid region in the arid areas encounter moderate to severe droughts frequently leads to crop failures and famines. While droughts of transient nature may not cause significant adverse effects on the crop and livestock production, severe droughts of recurring nature lead to lower biomass production, poor grain yields and scarcity of fodder. In areas with restricted growing season and soils of poor water holding capacity, droughts have a significant impact on the total biomass yield. Such situations result in minimal inputs of organic carbon into soils. Even the biomass recycling through leaf litter from perennials is reduced. Furthermore, scarcity during drought years leads to enhanced grazing pressure by the livestock which accentuates the problem of loss of vegetative cover. The process is aggravated if the following year also is a drought year. This way recurrent droughts lead to land degradation mainly through decline in biomass production and depletion of organic carbon (humus) in the soils. It is, therefore, not surprising that some of the most severely degraded land are found in the chronically drought prone areas having shallow and light textured soils.

Dry-land degradation and irregular drought events enhance the risk of poverty by destabilizing vital sources of income that are based on the natural capital of the area. Simultaneously, the decline in natural resources triggers or enhances conflicts between individuals and user groups. The degradation of productive land exacerbates food security measures and triggers internal and trans-boundary migration.

Conclusion: The aggressive exploitation of natural resources endangers water sources, bio-diversity and soil quality. The transformation of dry-lands into agricultural lands

with intensive production system has triggered extensive land degradation also. In dry-lands, rainfall is restricted to a few months. Unpredictable and irregular drought events accelerate the process of human-induced land degradation. Mobility and flexibility were determinative traits of traditional land use systems in dry-lands, and are undoubtedly the consequence of an optimal ecological adjustment to rain-fall induced inter-annual and seasonal fluctuations in the availability of natural resources.

The immigration also of drought-resistant plants into a severely exploited area signals the aridification of a dry-land ecosystem. This process indicates that the affected dry-land ecosystem is drifting into a desertified stage. Simultaneously, the sizes of intact dry-land habitat shrink, slowing down, or even preventing any natural restoration. Although the process of dry-land degradation up to the final stage of desertification is gradual, it can have an immense impact on the socio-economic stability of the affected region due to loss of biological output and the ensuing irreversible ecological damages.

In dry-lands, the concentration of relevant precipitation that fall only in a few months distinctly subdivides the year into a time with possible rainfall and a dry season. Mobility and flexibility of traditional land use systems enabled a dynamic adaptation to the annual and seasonal rainfall induced variations in the biomass production. However, vast and open dry-land areas and a strictly regulated access to the natural resources are indispensable for a mobile animal husbandry system to function.

It is plant material—dead and alive—that provides soil cover, it is loss of soil-covering biomass and the diversity of plant and animal life that leads first to soil exposure between plants and eventually to desertification. Soil cover is dependent on plant and their litter; it becomes apparent that to reverse desertification and all the serious downstream environmental, economic, political and social effects that flow from it, we need to reverse the loss of plant biomass which only can be achieved on any sustained basis by restoring the diversity of plant and animal species as well.

The things to which scientists of all disciplines attribute desertification are over-population, over-grazing and overstocking with livestock, communal tenure of land (tragedy of commons), poverty, ignorance and lack of education, inadequate access to capital and western technical knowledge as well as extension services, and corruption. The list goes on but these are generally considered the prime factors with the first three—overpopulation, overstocking and communal land tenure—being blamed the most.

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