

# **SUSTAINABLE AND EFFECTIVE WATERSHED MANAGEMENT - A HOLLISTIC APPROACH TO IMPROVE SOCIO-ECONOMIC STATUS OF RURAL COMMUNITY**

Gouranga Kar and Lipi Das \*

Sustainable development aims at maintaining an equilibrium between human needs and economic development within the parameters of environmental conservation through efficient use of natural resources to ensure trade off between desired production consumption levels within assimilate capacity of natural ecosystem. FAO defined sustainable agricultural and rural development to mean the management and conservation of the natural resource base and the orientation of the technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation. Such sustainable development (land and water resources) conserve land technically appropriate, economically viable and socially acceptable. Soil, water and vegetation are the most important natural resources for survival of the mankind. They provide food, firewood, fibre and other materials to satisfy the need of the people. As the pressure of human and bovine population is becoming threat to land and water resources for the nation, there will be greater need to proper management of natural resources on the sustained basis. However, we should not forget that even today we are largely depending upon rainfed agriculture for our cereals, pulses and oilseeds. If reasonable budget allocations are made for upliftment of farmers of rainfed agriculture on watershed basis, they will not only survive but the entire mankind also survives. In the recent years pressure on the land resources on our planet has increased tremendously. By the year 2010, the world's population will grow to almost 7 billions. At present it is growing at a rate of 90 million annually. Thus the amount of land available for food supply and other human needs will continue to decline in per capitaterms. In India, the agriculture is mainly rainfed, many regions are dry and drought prone, deforestation is going on at faster rate, the ground water is depleting quickly, problem of soil erosion and land degradation is very severe. The percent wise degraded land and vital statistics for land degradation due to water erosion are given in table 1 and 2, respectively.

---

\* Water Technology Centre for Eastern Region (ICAR) BHUBANESWAR-23

Under this situation the agricultural productivity needs to be enhanced to meet the food demand for ever increasing population and to improve the socioeconomic status of the farmers. In recent years sustainable management of natural resources on watershed basis has already been drawn attention of the national and global policy makers, scientists, other intellectuals and even by common people. The management may take place in the form of land use planning and intensive agriculture, construction of conversion work, water harvesting etc.

### **Watershed: Definition and concept**

Watershed is defined as a natural hydrological entity that covers a specific area expanse of land surface within whose boundaries the entire rainfall runoff ultimately passes through a specifically defined stream. So it is a unit of land on which all water that falls collects by gravity runs via a common outlet. Watershed, as a natural unit of ecosystem planning and development is widely used in most of the countries which requires generation and gathering of precise information on a number of parameters of both static and dynamic nature comprising of geology, geomorphology, hydrology, soils, land use/ land cover, soil erosion, climate etc. At any instant of time the watershed has a wide spectrum of characteristics like (a) Watershed topography which consists of mountains, hills, plains, gullies, valleys and so on, each is characterised by variable slope and area, from one location in the watershed to another location. (b) land mass of the watershed (land use, soil types and underlying geology) (c) meteorological factors (rain, evaporation, radiation, wind, temperature etc.).(e) vegetation (agriculture, forestry and agroforestry). The resources are integrated in such a way that use of one resource may influence others. As for example, the meteorological factors and land characteristics of watershed will have a pronounced effect on the type of vegetation that grows there and its distribution over the surface of watershed. The vegetation may vary from desert with minimal growth, grass, forest to dense bush vegetation associated with tropical rain forests. The vegetation will in turn affect the surface runoff, through the removal/storage of soil moisture. Topographical, meteorological, meteorological, geological and vegetation characteristics interact to affect the development of drainage network of the river. Topographical and geologic conditions determine the formation of lakes, water falls etc. So all these factors are interdependent and ultimately management planning of

these factors is determined with the proper consideration of ecological and socio-economic factors.

**Table 1**  
**The percent wise status of land degradation (Source: Anonymous, 2000)**

1.	Unaffected area	-37.4%
2.	Water erosion	-45.3%
3.	Wind erosion	-4.1%
4.	Chemical deterioration	-4.2%
5.	Physical deterioration	-3.5%
<hr/>		
	Total area affected	-57%
	Not fit for agriculture	-5.5%

**Table 2 :**  
**Vital statistics of resource degradation by water erosion**  
**(Source : Anonymous, 2000)**

---

(a) Annual average loss of nutrient	8.4 m tonne
(b) Average annual loss of production from ravine land	3mt
(c) Annual encroachment of table land by formation of ravines	8000 ha
(d) Annual damage due to shifting cultivation	1 mha
(e) Annual flood prone area	40 mha
(f) Average annual area affected by flood	3.7 ha
(g) Area affected in the worst year of flood	8mha
(h) Average annual cropped area affected by flood	3.7mha
(i) Man cropped area damage due to flood in a year	10mha

---

Some of the major constraints and problems which necessitates watershed management in India are given below.

- (a) Improper land use, excessive cropping, shifting cultivation and over grazing.
- (b) Land degradation due to wind and water erosion.
- (c) Water logging and lack of proper drainage.
- (d) Decline in soil fertility and soil depth.
- (e) Erratic uncertain and uneven distribution of rainfall.
- (f) Considerable area under waste land.
- (g) Shortage of fuel and fodder.
- (h) Environmental degradation due to excessive use of manure's, pesticides, fertilizers etc.
- (i) Deforestation and denudation of forest land and natural tree vegetation.
- (j) Cultivation of marginal and sub marginal lands due to over population and animal pressure.

- (k) Adoption of improper cropping systems and practice of traditional varieties and management practices.

So watershed management is not an anti-runoff approach but also a comprehensive integrated approach of the land and water resource management considering the ecological factors and socio-economic status of the locality. The watershed management approach is preventive, progressive, corrective, curative and preservative whose chief objectives are (a) conserving soil and water (b) checking deforestation (c) rain-water harvesting and recharging (d) planning of sustainable land use system.

### **Watershed management - a hollistic approach**

Watershed management in its broadest sense, refers to the prudent use of its land water resources. It requires generation and gathering of precise information on a number of parameters of both static and dynamic in nature comprising of geology geomorphology, hydrology soil, land use/land cover, soil erosion, climate etc. Watershed management is a very broad field that includes a multitude of subject in the biophysical domain and in the socio- economic domain. Management of watershed may involve proper land use planning, construction of rainwater on the streams, irrigation project, soil conservation, forest management and afforestation. In the rainfed farming area the watershed management must strive to conserve all the precipitation which it receives in order raise its productivity. Watershed management approach invites integrated inputs of various disciplines for the development of different minor watersheds of sub-order streams in accordance with the characters. The hollistic approach to be followed for watershed management are:

#### **(A) Formulation of objectives :**

- (a) conserving soil and water
- (b) Runoff recycling, water harvesting and recharging
- (c) Land capability classification
- (d) Improving water holding capacity of soil
- (e) Afforestation and intensive agriculture
- (f) Improvement of socio - economic status of locality

**(B) Collection of basic information of watershed.**

- (a) Natural/physical resources .....Soil, Drainage, Geology, Geomorphology  
Landaus/ land cover, Rainfall/ Climate Slope,  
aspect, altitude
- (b) Contemporary technology .....Agriculture, Water management, Mineral exploita  
tion Soil and water conservation, Exploitation of  
ground water
- (c) Socio-economic and demographic data....Number of house hold, population(male & female  
over and below 14years) Livingg conditions  
(good,fair,poor),Ownership (farm owner, ten ant,  
cooperating farming), Foddersource (forest, farm  
forest, grass lands), Livestock number(draft cattle,  
water buffalo, diarycattle,pigs,chickens and others).  
Watersupplu(sanitarypipes,village wells,river,  
individual wells),Village ware house capacity, Home  
gardens,number and sizes (vegetables,fruits,  
fuel wood), Village store (no.)(co-operative and  
individual),Organisations (farmimprovement,village  
club,credit Union etc.), Indebtedness  
(to government,moneylenders etc.)

**(C) Community participation for resource management decisions &development of site specific action plan for sustainable land and water resources development of watershed.**

Keeping in view the potentials and limitations of existing land and water resources, site specific action plan for alternate land and water resources should be developed, which will be economically viable and soicially acceptable and ecologically sound.. For efective and efficient execution of the programme, the planning should be based on bottom-up aproach and provision of empowerment to peopleto take decisions at local levels should be made, To imrove the living standars of rainfed farmers through different programmes like Integarted Watershed

Development Programme(IWDP),Drought Prone Ares Programme (DPAP) were

launched and implemented by both Government Organizations and NGO's. but still there is a gap between technology generation and dissemination. On the basis of suitability of soil, topography, hydrogeo-morphological features

### **Land resources development :**

Keeping the existing land use/land cover as a reference, on the basis of favourable natural resources the following land resources may be developed.

- (i) Agroforestry (ii) Horticulture (iii) Silviculture
- (iv) Agro-horticulture (v) Fodder & fuel plantation
- (vi) Double cropping inter cropping for intensive agriculture
- (vii) Energy plantations with or without land reclamation
- (viii) Afforestation (ix) Gap filling
- (x) Growing of salt resistant or drought tolerant crops

### **Water resources development and soil & water conservation measures:**

#### **Agronomic measures:**

Agronomic methods of soil and water conservation includes those practices which help to intercept raindrops and reduce the splash effect, help to retard and reduce runoff. Some of the agronomic measures which can be adopted for soil & Water conservation are

- (i) Contour farming
- (ii) Strip cropping: (a) Contour strip cropping (b) Field strip cropping (c) Wind strip cropping (d) Permanent/Temporary buffer strip cropping
- (iii) Mixed farming (iv) Crop rotation/Inter-cropping (v) Conservation tillage
- (vi) Mulch tillage

#### **Mechanical /Engineering Measures:**

- (a) Contour bunding
- (b) Graded bunding
- (c) Terracing
- (g) Water harvesting:

The main aim of water harvesting is to make crop production economically feasible in regions where rainfall is normally insufficient for cropping, even with the best water conservation measures or where there is uneven distribution of rainfall.