Read this article to learn about the definition, causes, effects, detection, solution and extent of waterlogging.

Definition:

When the conditions are so created that the crop root-zone gets deprived of proper aeration due to the presence of excessive moisture or water content, the tract is said to be waterlogged. To create such conditions it is not always necessary that under groundwater table should enter the crop root-zone. Sometimes even if water table is below the root-zone depth the capillary water zone may extend in the root-zone depth and makes the air circulation impossible by filling the pores in the soil.

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The waterlogging may be defined as rendering the soil unproductive and infertile due to excessive moisture and creation of anaerobic conditions. The phenomenon of waterlogging can be best understood with the help of a hydrologic equation, which states that

Inflow = Outflow -I- Storage

Here inflow represents that amount of water which enters the subsoil in various processes. It includes seepage from the canals, infiltration of rainwater, percolation from irrigated fields and subsoil flow. Thus although it is loss or us, it represents the amount of water flowing into the soil.

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The term outflow represents mainly evaporation from soil, transpiration from plants and underground drainage of the tract. The term storage represents the change in the groundwater reservoir.

Causes of Waterlogging:

After studying the phenomenon of waterlogging in the light of hydrologic equation main factors which help in raising the water-table may be recognised correctly.

They are:

i. Inadequate drainage of over-land run-off increases the rate of percolation and in turn helps in raising the water table.

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ii. The water from rivers may infiltrate into the soil.

iii. Seepage of water from earthen canals also adds significant quantity of water to the underground reservoir continuously.

iv. Sometimes subsoil does not permit free flow of subsoil water which may accentuate the process of raising

the water table.

v. Irrigation water is used to flood the fields. If it is used in excess it may help appreciably in raising the water table. Good drainage facility is very essential.

Effects of Waterlogging:

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The waterlogging affects the land in various ways. The various after effects are the following:

1. Creation of Anaerobic Condition in the Crop Root-Zone:

When the aeration of the soil is satisfactory bacteriological activities produce the required nitrates from the nitrogenous compounds present in the soil. It helps the crop growth. Excessive moisture content creates anaerobic condition in the soil. The plant roots do not get the required nourishing food or nutrients. As a result crop growth is badly affected.

2. Growth of Water Loving Wild Plants:

When the soil is waterlogged water loving wild plant life grows abundantly. The growth of wild plants totally prevent the growth of useful crops.

3. Impossibility of Tillage Operations:

Waterlogged fields cannot be tilled properly. The reason is that the soil contains excessive moisture content and it does not give proper tilth.

4. Accumulation of Harmful Salts:

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The upward water movement brings the toxic salts in the crop root-zone. Excess accumulation of these salts may turn the soil alkaline. It may hamper the crop growth.

5. Lowering of Soil Temperature:

The presence of excessive moisture content lowers the temperature of the soil. In low temperature the bacteriological activities are retarded which affects the crop growth badly.

6. Reduction in Time of Maturity:

Untimely maturity of the crops is the characteristic of waterlogged lands. Due to this shortening of crop period

the crop yield is reduced considerably.

Detection of Waterlogging:

From the subject matter discussed above it is clear that the waterlogging is indicated when the ground water reservoir goes on building up continuously. When the storage starts building up in the initial stages the crop growth is actually increased because more water is made available for the crop growth. But after some time the waters table rises very high and the land gets waterlogged. Finally the land is rendered unproductive and infertile.

The problem of waterlogging develops in its full form slowly. Therefore its early detection is possible by keeping a close watch over the yields and also on the variations in the groundwater level. A comparative reduction in crop yields in spite of irrigation and fertilisation and early maturity of crops indicate the symptoms of waterlogging. Also when harmful salts start appearing on the fields as white incrustation or deposit it indicates that waterlogging is likely to follow. In worst cases the water-table rises so high and close to the ground surface that the fields turn into swamps and marshes.

The best way of keeping watch over the problem of waterlogging is by observing variations in the groundwater level. It can be done by measuring the depth of water levels at regular interval in the wells dug in the area. Continuous high water levels indicate that the groundwater storage is building up which may create waterlogging in the area.

Solution to the Problem of Waterlogging:

The problem of waterlogging may be attacked on two fronts. First is preventive measures, which keep the land free from waterlogging. Secondly curative measures may be adopted to reclaim the waterlogged area. But in principle both measures aim at reducing the inflow and augmenting the outflow from the underground reservoir.

Preventive Measures:

Preventive measures include the following:

(a) Controlling the loss of water due to seepage from the canals:

The seepage loss may be reduced by adopting various measures for example

i. By lowering the FSL of the canal:

Loss may be due to percolation or absorption but when FSL is lowered the loss is reduced to sufficient extent. It is course essential to see that while lowering the FSL command is not sacrificed.

ii. By lining the canal section:

When the canal section is made fairly watertight by providing lining the seepage loss is reduced to quite a good extent.

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iii. By introducing intercepting drains:

They are generally constructed parallel to the canal. They give exceptionally good results for the reach where the canal runs in high embankments.

(b) Preventing the loss of water due to percolation from field channels and fields:

The percolation loss can be removed by using water more economically. It may also be affected by keeping intensity of irrigation low. Then only small portion of the irrigable tract is flooded and consequently the percolation loss takes place only on the limited area. It keeps the water-table sufficiently low.

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(c) Augmentation of outflow and prevention of inflow:

It may be accomplished by introducing artificial open and underground drainage grid. It may also be achieved by improving the flow conditions of existing natural drainages.

(d) Quick disposal of rainwater:

Quick removal of rainwater by surface or open drains is a very effective method of preventing the rise in water table and consequent waterlogging of the tract. It is needless to state that the rainwater removed is net reduction in inflow.

Curative Measures:

Curative measures include the following:

(a) Installation of lift irrigation systems:

When a lift irrigation project in the form of a tube well irrigation system is introduced in the waterlogged area the water table gets lowered sufficiently. It is found to be very successful method of reclaiming waterlogged land. Thus a combination of a canal system and a supplementary tube well irrigation system may be considered to be most successful and efficient irrigation scheme.

Of course it is true that it will create some complications while assessing the charges for irrigation water. (The canal water being cheaper than tube well water). Implementation of drainage schemes: The waterlogged area may be reclaimed by introducing overland and underground drainage schemes.

(b) Implementation od Drainage Schemes:

The waterlogged area may be reclaimed by introducing overland and underground drainage schemes.

Extent or Waterlogged Area:

In our country water-logging is a problem of great concern. It is estimated that total area of waterlogged land is 86.92 lakh hectares. It includes area in irrigation commands as well as other area outside the command.

While the areas in the irrigation command get waterlogged due to rise in water table as a direct consequence of inadequate drainage, other areas get waterlogged due to inundation, as consequence of flooding for long durations. The States mainly affected and the extent of area rendered infertile and unproductive are given in Table 11.1.

Extent of Waterlogged Area

About 48 lakh ha are estimated to be affected by salinity and 25 lakh ha by alkalinity. Saline soils include 10 lakh ha in arid and semi-arid regions of Rajasthan and Gujarat and 14 lakh ha in black cotton soils. The alkali problem is mainly in Punjab, Haryana and Uttar Pradesh.

Steps are being taken to reclaim the waterlogged land in the country. The steps taken to reclaim such areas include implementation of drainage schemes, provision of deep drains, excavation of new channels and improvement of existing ones, construction of sluices with marginal embankment and installation of tube wells.

The spread of conjunctive use of groundwater with that of surface water especially in Punjab, Haryana and parts of Uttar Pradesh has substantially lowered the groundwater table and helped in containing water-logging/salinity.

Summarising the most effective and efficient anti-water-logging measures are:

i. Lining of channels (main canal, branches and field channels).

ii. Provision of surface drains for drainage of rainwater; and

iii. Implementation of tube well projects both extensive and local.