UNIT –1

CROP WATER REQUIREMENT

PART-A

1) Define irrigation? (**AU MJ 2008)**

Irrigation is defined as the science of artificial application of water to the land in accordance with the crop requirements.

2) What are the necessity of irrigation? (**AU MJ 2008)**

- Inadequate Rainfall
- Increasing Yield Of Crops
- Growing Perennial Crops
- Uneven Distribution of Rainfall.

3) What are the advantages of irrigation? (**AU ND 2008)**

- Increase In Food Production
- Optimum Benefits
- General Prosperity
- Afforestation.

4) What are the disadvantages of irrigation? (**AU ND 2008)**

- Over Irrigation May Lead To Water Logging
- It May Reduce Crop yield
- It Is Expensive And Complex.

5) What are the types of irrigation? (**AU MJ 2009)**

- Surface Irrigation
- Sub-Surface Irrigation.

6) What are the techniques of water distribution in the farms? (**AU MJ 2009)**

- Free Flooding
- Border Flooding
- Check Flooding
- Basin Flooding, Furrow Irrigation Method, Drip Irrigation Method.

7) What are the types of sprinkler system? (**AU ND 2009)**

- Permanent System
- Semi-Permanent System
- Portable System

8) What are the advantages of sprinkler irrigation? (**AU ND 2009)**

- Land Levelling Is Not Required
- Fertilisers Can Be Uniformly Applied

- It Is Less Labour Oriented

9) What are the limitations of sprinkler irrigation? (**AU MJ 2009)**

- Initial Cost Of The System Is Very High
- It Requires Larger Electrical Power
- High Wind May Distort Sprinkler Pattern

10) What is arid region? (**AU ND 2010)**

The area where irrigation is must for agriculture is called arid region

11) What is semi-arid region? (**AU ND 2010)**

The area in which inferior crops can be grown without irrigation

12) What is crop period? (**AU MJ 2010)**

The time period that elapses from the instant of its sowing to the instant of its harvesting is called crop period.

13) What is base period? (**AU MJ 2010)**

The time between the first watering of a crop at the time of its sowing to its last watering before harvesting is called the base period

14) What is rotation period? (**AU ND 2011)**

The time interval between two such consecutive watering is called frequency irrigation.

15) Define duty of water? (**AU ND 2011)**

It is the relationship between the volume of water and the area of crops it matures is called duty of water.

16) Define delta of a crop? (**AU MJ 2012)**

Each crop requires a certain amount of water after a certain fixed interval of time, through its period of growth is called delta of a crop

17) What are the factors on which duty depends? (**AU MJ 2012)**

- Type Of Crop
- Climate And Seasons
- Useful Rainfall
- Type Of Soil
- Efficiency Of Cultivation Method

18) What are kharif crops? (**AU MJ 2012)**

The kharif crops are rice,bajra,jawar,maize,cotton,tobacco, groundnut,etc.

19) Define irrigation efficiency? (**AU ND 2012)**

It is the efficiency of water output to the water input and is usually expressed as percentage.

20) What is called effective rainfall? (**AU ND 2012)**

Precipitation falling during the growing period of a crop that is available to meet the evapo-transpiration needs of the crop, is called effective rainfall.

PART B

1 Explain the term duty and delta and derive their relationship? (**AU MJ 2008, MJ 2009,** ND **2009)**

Delta of a crop and Duty of water and their relation

Delta:

Some quantity of water is required for any crop to come to its maturity. The total quantity of water required for any crop during its base period(B) for its full fledged nourishment when expressed in depth of water(i.e. in 'cm' or in 'inches') is called its Delta. The total quantity of water(i.e. volume of water) is divided by the total irrigated area to obtain Delta of crop of the irrigated area.

We have talked about base period(B), it is the time period between the first watering of the crop during its sowing to last watering before its harvesting. It is generally expressed in 'days'.

The another related term is Crop period. For practical purpose Base period and Crop period are taken as same but they have a little difference. Crop period is the time period between sowing of a crop to its harvesting. In this manner, Crop period is slightly greater than the Base period.

Duty:

Duty of a water simply expresses the number of hectare of land that can be irrigated for the full growth of the given crop by supplying 1 cumec water continuously during the entire base period of that crop. It is generally represented by 'D'. Its unit is hectare/cumec. For example, if water flowing at the rate of 1 cumec, runs continuously for B days of the crop matures 100 hectares then Duty of that crop is 100 hectare/cumec to the base of B days.

Duty varies from point to point. It increases as one moves to downstream from the head of main canal to the head of branches. It is due to the transmission losses in the channels.

Relation between Delta and Duty:

Let a crop of Base period B for which 1 cumec water is supplied continuously for its full growth.

Then the total volume of water supplied during B days for that Crop = (1*B*24*60*60) cubic meter.

By the definition of duty, it is clear that it matures D hectares of land.

Then the total depth of water supplied during base period B = (1*B*24*60*60)/(D*10000)

=8.64B/D meters

We know total depth of water supplied during base period of a crop is Delta.

Then, Delta= 8.64B/D meter

2. Discuss the need for the irrigation projects in the Indian context? (AU ND 2008)

Main importances of irrigation supplies are discussed below.

- Agriculture is often greatly hampered due to irregular, insufficient or uncertain rain. Proper irrigation systems can secure uninterrupted agriculture.
- The productivity of irrigated land is more than the un-irrigated land. Crop yields everywhere in the developing world are consistently higher in irrigated areas than in rainfed areas[1].
- Seeds cannot grow in dry soil as moisture is necessary for the germination of seeds. With the help of irrigation supply, the required moisture content of soil for the growth of seed can be ensured.
- Multiple cropping in a year is possible through irrigation. This will enhance production & productivity. In many areas of India, two or three crops in a year are cultivated with irrigation facilities.
- Through the irrigation, it is possible to supply the required amount of hydrogen & oxygen, which is important for the proper development of plant root.
- A plant can absorb mineral nutrients from the irrigated soil. Thus irrigation is essential for the general growth of the plant.
- Bringing more land under cultivation is possible through irrigation.
- Insufficient rain may also cause drought & famines. Irrigation can play a protective role during the period of drought & famines.
- Irrigation contributes to the economic growth and poverty reduction[2]. As income and employment are closely related to output and irrigation increases production, substantial increase in income is achieved in the countryside.

3 List out the various type of irrigation efficiencies and discuss any four? (AU MJ 2010, ND 2012)

Definition

The ratio of the amount of water available (output) to the amount of water supplied (input) is known as Irrigation Efficiency. It is expressed in percentage.

Types of Irrigation Efficiency

The following are the various types of irrigation efficiencies:

(a) Water Conveyance Efficiency (η_c):

It is the ratio of the amount of water applied, to the land to the amount of water supplied from the reservoir. It is obtained by the expression,

$\eta_c = W_lW_r \times 100$ Where, η_c = Water conveyance efficiency W_l = Amount of water applied to land W_r = Amount of water supplied from reservoir

(b) Water Application Efficiency (ηa):

It is the ratio of the water stored in root zone of plants to the water applied to the land. It is obtained by the expression,

ηa = WzWl × 100 Where, ηa = Water application efficiency Wz = Amount of water stored in root zone Wl = Amount of water applied to land

(c) Water Use Efficiency (ηu):

It is the ratio of the amount of water used to the amount of water applied. It is obtained by the expression,

ηu = Wu Wl × 100 Where, ηu = Water use efficiency Wu = Amount of water used Wl = Amount of water applied to land

(d) Consumptive use Efficiency (ηcu):

It is the ration of the consumptive use of water to the amount of water depleted from the root zone. It is obtained by the expression, ηcu = Cu Wp × 100

4. What are the methods of improving duty? (AU MJ 2011,ND2012)

(1) Proper Ploughing:

Ploughing should be done properly and deeply so that the moisture retaining capacity of soil is increased.

(2) Methods of supplying water:

The method of supplying water to the agriculture land should be decided according to the field and soil conditions. For example,

- Furrow method For crops sown ion rows
- Contour method For hilly areas
- Basin For orchards
- Flooding For plain lands

(3) Canal Lining:

It is provided to reduce percolation loss and evaporation loss due to high velocity.

(4) Minimum idle length of irrigation Canals:

The canal should be nearest to the command area so that idle length of the canal is minimum and hence reduced transmission losses.

(5) Quality of water:

Good quality of water should be used for irrigation. Pollution en route the canal should be avoided.

(6) Crop rotation:

The principle of crop rotation should be adopted to increase the moisture retaining capacity and fertility of the soil.

(7) Method of Assessment of water:

Particularly, the volumetric assessment would encourage the farmer to use the water carefully.

(8) Implementation of Tax:

The water tax should be imposed on the basis of volume of water consumption

5 Discuss in detail the planning and the development of irrigation project in the Indian context? (AU ND 2010)

Water is very important for survival of all forms of life- plant as well as animal. India, by virtue of its peculiar placement in the foothills of the Himalayas and the Deccan Plateau running through it, has vast water resources which have been very meagrely tapped. Conventional and recognised means of irrigation are tanks, wells and canals.

Wells: Well irrigation is an important type of irrigation in India. Wells are particularly suitable for small farms. The important well-irrigated States are Uttar Pradesh, Punjab, Tamil Nadu and Maharashtra. In these States water-table is high, soil is soft and, therefore, wells are easily sunk.

Tubewells are an important development in India. They are worked by electricity or diesel oil and thus, they relieve our cattle of much of the strain. They are being quickly developed in Uttar Pradesh, Bihar, Haryana and Punjab. This is because these have ample sub-soil water.

Wells and tubewells account for about 48 percent of the total irrigation in India.

Tanks: Tanks are also an important and ancient source of irrigation. They are of considerable importance in central and southern India, specially in Andhra Pradesh and Tamil Nadu. About 8 percent of the total irrigated area is irrigated by tanks.

Canals: Canals are the most important means of irrigation in the country. Some canals were constructed by the early Hindu and Mohammedan kings. Most of the canals, however, are the product of the British rule. At present, canals irrigate about 39 percent of total irrigated area of India. Most of the canals of the country are found in Uttar Pradesh and Punjab. Storage canals have been constructed in Deccan and Madhya Pradesh.

Major , Medium and Minor Irrigation Projects: The methods of irrigation used in India can be broadly classified into major, medium and minor irrigation schemes. Irrigation projects having Culturable Command Area (CCA) of more than 10,000 hectares each are classified as major projects. Those having a CCA between 2,000 hectares and 10,000 hectares fall under the category of medium irrigation projects. And the projects which have a CCA of less than 2,000 hectares are classified as minor irrigation schemes. For the purpose of analysis the major and the medium irrigation projects are generally grouped together. These projects comprise a network of dams, bunds, canals and other such schemes. Such projects require substantial financial outlay and are, therefore, constructed by the government or any other agency which may draw financial assistance form the government and financial institutions.

The minor irrigation projects, on the other hand, comprise all ground water development schemes such as dug wells, private shallow tubewells, deep public tubewells, and boring and deepening of dugewells, and small surface water development works such as storage tanks, lift irrigation projects, etc. Minor irrigation projects or the groundwater development schemes are essentially people's programmes implemented primarily through individual and cooperative efforts with finances obtained mainly through institutional sources.

IRRIGATION DEVELOPMENT

Creation for irrigation potential of 10 million hectares was targeted under Bharat Nirman during 2005-06 to 2008-09. The target was proposed to be met through completion of on-going major and medium irrigation projects, and extension, renovation and modernization of existing projects. As per information provided by State Governments, the total irrigation potential created during the period is 7.31 million hectares against the target of 10 million hectares.

SOME IRRIGATION AND MULTIPURPOSE PROJECTS

Bargi Project (Madhya Pradesh): It is a multipurpose project consisting of a masonry dam across Bargiriver in the Jabalpur district and a left bank canal.

Beas Project (Joint venture of Haryana, Punjab and Rajasthan): It consists of Beas-Sutlej Link and Beas Dam at Pong.

Bhadra Project (Karnataka): A multipurpose project across the river Bhadra.

Bhakra Nangal Project (Joint project of Haryana, Punjab, and Rajasthan): India's biggest, multipurpose river valley project comprises a straight gravity dam across the Sutlej river at Bhakra, the Nangal dam, the Nangal hydel channel, two power houses at Bhakra dam and two power stations at Ganguwal and Kotla.

Bhima Project (Maharashtra): Comprises two dams, one on the Pawanariver near Phagne in Pune district and the other across the Krishna river near Ujjaini in Sholapur district.

Chambal Project (Joint project of Madhya Pradesh and Rajasthan): The project comprises Gandhi Sagar dam, Rana PratapSagar dam and jawaharSagar dam.

Damodar Valley Project (West Bengal and Bihar): A multipurpose project for the unified development of irrigation, flood control and power generation in West Bengal and Bihar. It comprises multipurpose dams at Konar, Tilaiya, Maithon and Pancher; hydel power stations at Tilaiya, Konar, Maithon and Panchet; barrage at Durgapur; and thermal power houses at Bokaro, Chandrapura and Durgapur. The project is administrated by the Damodar Valley Corporation.

Dulhasti Power Project (Jammu & Kashmir): It is a 390 MW power project in Kishtwar region of Jammu & Kashmir on Chenab river. Work for this project started in 1981. The foundation stone was laid on April 15, 1983 by the then Prime Minister, Indira Gandhi. Work on this project was suspended due to threats of kidnapping and killings by Kashmiri militants resulting in long delay in completion of project.

Farakka Project (West Bengal): The project was taken up for the preservation and maintenance of Calcutta port and for improving the navigability of the Hoogly. It comprises a barrage at Jangipur across the Bhagirathi and a feeder channel taking off from the Ganga at Farakka and tailing into the Bhagirathi below the Jangipur barrage.

Gandak Project (Joint project of Bihar and Uttar Pradesh): Nepal also derives irrigation and power benefits form this project.

Ghataprabha Project (Karnataka): A project across Ghataprabha in Belgaum and Bijapur districts.

Hirakund (Odisha): World's longest dam, is located on the Mahanadi river.

Jayakwadi Project (Maharashtra): A masonry spillway across the river Godavari.

Kahalgaon Project (Bihar): The 840-MW Kahalgaon Super Thermal Power Project, a joint venture between National Thermal Power Corporation and the Russian State Enterprise Foreign Economic Association, was on August 12,1996 commissioned and put into commercial operation.

Kakrapara Project (Gujarat): On the Tapti river near Kakrapara, in Surat district.

Kangsabati Project (West Bengal): The project, put in operation in 1965, is located on the Kangsabati and Kumari rivers.

Karjan Project (Gujarat): A masonry dam across Karjan river near Jitgarh village in Nandoo Taluka of Bharuch district.

Kosi Project (Bihar): A multipurpose project, which serves Bihar and Nepal.

Koyna Project (Maharashtra): It is built on a tributary of river Krishna with a capacity of 880 MW. It feeds power to Mumbai-Pune industrial belt.

Krishna Project (Maharashtra): Dhom dam near Dhom village on Krishna and Kanhar dam near Kanhar village on Varna river in Satna district.

Kukadi Project (Maharashtra): Five independent storage dams, i.e. Yodgaon, Manikdohi, Dimbha, Wadaj and Pimpalgaon Jog. The canal system comprises (i) Kukadi left bank Canal, (ii) Dimbha left bank canal, (iii) Dimbha right bank canal, (iv) Meena feeder and (v) Meena branch.

Kundoh Project (Tamil Nadu): It is in Tamil Nadu whose initial capacity of 425 MW has since been expanded to 535 MW.

Let Bank Ghaghra Canal (Uttar Pradesh): A link channel taking off from the left bank of Ghaghra river of Girja barrage across Sarju.

Madhya Ganaga Canal (Uttar Pradesh): A barrage across Ganga in Bijnore district.

Mahanadi Delta Scheme (Odisha): The irrigation scheme will utilize releases from the Hirakud reservoir.

Mahanadi Reservoir Project (Madhya Pradesh): It has three phases: (1) RavishankarSagar Project and feeder canal system for supply of water of Bhilai Steel Plant and Sandur dam across Sandur village. (2) Extension of Mahanadi feeder canal. (3) Pairi dam.

Mahi Project (Gujarat): A two –phase project, one across the Mahi river near Wanakbori village and the other across Mahi river near Kadana.

Malaprabha Project (Karnataka): A dam across the Malaprabha in Belgaum district.

Mayurakshi Project (West Bengal): An irrigation and hydro-electric project comprise the Canada dam.

MinimatoBangoHasdeo Project (Madhya Pradesh): This project is locted at HasdeoBangoriver in Korba district and envisages construction of a masonry dam. A hydel power plant of 120 MW capacity has been commissioned on the Bango dam.

Nagarjunasagar (Andhra Pradesh): On the Krishna river near Nandikona village (about 44 km from Hyderabad).

Panam Project (Gujarat): A gravity masonry dam across Panamriver near Keldezar village in Panchmahal district.

ParambikulamAliyar (Joint venture of Tamil Nadu and Kerala): The integrated harnessing of eight rivers, six in the Annamalai Hills and two in the plains.

Pochampad (Andhra Pradesh): Across Godavari river.

Pong Dam (Punjab): It is an important hydro-electric project located on Beas river.

Rajasthan Canal (Indira Gandhi Canal- Rajasthan): The Project uses water released from Pong dam and provides irrigation facilities to the north-western region of Rajasthan, i.e., a part of the Thar desert. It consists of Rajasthan feeder canal (with the first 167 km in Punjab and Haryana and the remaining 37 km in Rajasthan) and 445 km Rajasthan main canal entirely in Rajasthan.

Rajghat Dam Project (Madhya Pradesh): The Rajghat Dam and Rajghat Hydro Electric Projects are Inter-State projects of MP and UP. The Rajghat Dam is almost complete. All the three units of Rajghat Hydro-Electric Project had been synchronized during 1999 and power generation has been continuing ever since.

Ramganga (Uttarakhand): A dam across Ramganga, a tributary of the Ganga river located in Garhwal district. The project has, besides reducing the intensity of floods in central and western Uttar Pradesh, provided water for the Delhi water supply scheme.

RanjitSagar Dam (Thein Dam) (Punjab): A multi-purpose highest dam in the country, built on the Ravi river for the benefit of Punjab, Haryana and Jammu and Kashmir.

Rihand Project (Uttar Pradesh and Madhya Pradesh): It is the largest man-made lake in India on the borders of Uttar Pradesh and Madhya Pradesh with a capacity of 300 MW annually.

Sabarmati (Gujarat): A storage dam across Sabarmati river near Dhari Village in Mehsana district and wasna barrage near Ahmedabad.

Salal Project (Jammu & Kashmir): With the successful completion of the 2.5-km long tailrace tunnel, the 690-MW Salal (Stage I and II) project in Jammu and Kashmir became fully operational on August 6, 1996.

SardaSahayak (Uttar Pradesh): A barrage across the river Ghaghra, a link channel, a barrage across River Sarda and a feeder channel of two major aqueducts over rivers Gomti and Sai.

Sharavathi Project (Karnataka): It is located at the Jog Falls with a capacity of 891 MW. It primarily feeds Bengaluru industrial region and also Goa and Tamil Nadu.

Sone High Level Canal(Bihar): An extension on Sone Barrage project.

Tawa Project (Madhya Pradesh): A project across the Tawariver, a tributary of the Narmada in Hoshangabad district.

Tehri Dam Project (Uttarakhand): Earth and rock-fill dam on Bhagirathi river in Tehri district.

Tungabhadra Project (Joint Project of Andhra Pradesh and Karnataka): On the Tungabhadra River.

Ukai Project (Gujarat): A multipurpose project across Tapti river near Ukai village.

Upper Krishna Project (Karnataka): A project consisting of Narayanpur dam across the Krishna river and a dam at Almatti.

Upper Penganga Project (Maharashtra): Two reservoirs on Penganga river at Isapur in Yavatmal district and the other on Rayadhuriver at Sapli in Parbhani district.

Uri Power Project (Jammu & Kashmir): It is located on the river Jhelum in the Uri Tehsil of Baramulla district in Jammu & Kashmir. It is a 480-MW hydroelectric project which was dedicated to the nation of February 13, 1997

6 Explain the merits and demerits of irrigation in the present day. Also discuss theenvironmental consequences of major irrigation project? (AU ND2011)

Direct effects

An irrigation scheme draws water from groundwater, rivers, lakes or overland flow, and distributes it over an area. Hydrological, or direct, effects of doing this[1] include reduction in downstream river flow, increased evaporation in the irrigated area, increased level in the water table as groundwater recharge in the area is increased and flow increased in the irrigated area. Likewise, irrigation has immediate effects on the provision of moisture to the atmosphere, inducing atmospheric instabilities and increasing downwind rainfall,[2] or in other cases modifies the atmospheric circulation, delivering rain to different downwind areas.[3] Increases or decreases in irrigation are a key area of concern in precipitationshed studies, that examine how significant modifications to the delivery of evaporation to the atmosphere can alter downwind rainfall.[4]

Indirect Effects[edit]

Indirect effects are those that have consequences that take longer to develop and may also be longer-lasting. The indirect effects of irrigation include the following:

- Waterlogging
- Soil salination
- Ecological damage
- Socioeconomic impacts

The indirect effects of waterlogging and soil salination occur directly on the land being irrigated. The ecological and socioeconomic consequences take longer to happen but can be more far-reaching.

Some irrigation schemes use water wells for irrigation. As a result, the overall water level decreases. This may cause water mining, land/soil subsidence, and, along the coast, saltwater intrusion.

Irrigated land area worldwide occupies about 16% of the total agricultural area and the crop yield of irrigated land is roughly 40% of the total yield.[5] In other words, irrigated land produces 2.5 times more product than non-irrigated land. This article will discuss some of the environmental and socioeconomic impacts of irrigation.

Adverse impacts[edit]

Reduced river flow[edit]

The reduced downstream river flow may cause:

- reduced downstream flooding
- disappearance of ecologically and economically important wetlands or flood forests[6]
- reduced availability of industrial, municipal, household, and drinking water
- reduced shipping routes. Water withdrawal poses a serious threat to the Ganges. In India, barrages control all of the tributaries to the Ganges and divert roughly 60 percent of river flow to irrigation[6]
- reduced fishing opportunities. The Indus River in Pakistan faces scarcity due to over-extraction of water for agriculture. The Indus is inhabited by 25 amphibian species and 147 fish species of which 22 are found nowhere else in the world. It harbors the endangered Indus river dolphin, one of the world's rarest mammals. Fish populations, the main source of protein and overall life support systems for many communities, are also being threatened[6]
- reduced discharge into the sea, which may have various consequences like coastal erosion (e.g. in Ghana[7]) and salt water intrusion in delta's and estuaries (e.g. in Egypt, see Aswan dam). Current water withdrawal from the river Nile for irrigation is so high that, despite its size, in dry periods the river does not reach the sea.[6] The Aral Sea has suffered an "environmental catastrophe" due to the interception of river water for irrigation purposes.

Increased groundwater recharge, waterlogging, soil salinity[edit]

Looking over the shoulder of a Peruvian farmer in the Huarmey delta
at waterlogged and salinised irrigated land with a poor crop stand.
This illustrates an environmental impact of upstream irrigation developments causing an increased flow of groundwater to this lower-lying area, leading to adverse conditions.

Increased groundwater recharge stems from the unavoidable deep percolation losses occurring in the irrigation scheme. The lower the irrigation efficiency, the higher the losses. Although fairly high irrigation efficiencies of 70% or more (i.e. losses of 30% or less) can occur with sophisticated techniques like sprinkler irrigation and drip irrigation, or by well managed surface irrigation, in practice the losses are commonly in the order of 40% to 60%. This may cause the following issues:

- rising water tables
- increased storage of groundwater that may be used for irrigation, municipal, household and drinking water by pumping from wells
- waterlogging and drainage problems in villages, agricultural lands, and along roads - with mostly negative consequences. The increased level of the water table can lead to reduced agricultural production.
- shallow water tables - a sign that the aquifer is unable to cope with the groundwater recharge stemming from the deep percolation losses
- where water tables are shallow, the irrigation applications are reduced. As a result, the soil is no longer leached and soil salinity problems develop
- stagnant water tables at the soil surface are known to increase the incidence of water-borne diseases like malaria, filariasis, yellow fever, dengue, and schistosomiasis (Bilharzia) in many areas.[8] Health costs, appraisals of health impacts and mitigation measures are rarely part of irrigation projects, if at all.[9]
- to mitigate the adverse effects of shallow water tables and soil salinization, some form of watertable control, soil salinity control, drainage and drainage system is needed
- as drainage water moves through the soil profile it may dissolve nutrients (either fertilizer-based or naturally occurring) such as nitrates, leading to a buildup of those nutrients in the ground-water aquifer. High nitrate levels in drinking water can be harmful to humans, particularly infants under 6 months, where it is linked to "blue-baby syndrome" (see Methemoglobinemia).

Reduced downstream river water quality[edit]

Owing to drainage of surface and groundwater in the project area, which waters may be salinized and polluted by agricultural chemicals like biocides and fertilizers, the quality of the river water below the project area can deteriorate, which makes it less fit for industrial, municipal and household use. It may lead to reduced public health.
Polluted river water entering the sea may adversely affect the ecology along the sea shore (see Aswan dam).

The natural contribution of sediments can be eliminated by the detention of sediments behind the dams critical to surface water irrigation diversions. Sedimentation is an essential part of the ecosystem that requires the natural flux of the river flow. This natural cycle of sediment dispersion replenishes the nutrients in the soil, that will in turn, determine the livelihood of the plants and animals that rely on the sediments carried downstream. The benefits of heavy deposits of sedimentation can be seen in large rivers like the Nile River. The sediment from the delta has built up to form a giant aquifer during flood season, and retains water in the wetlands. The wetlands that are created and sustained due to built up sediment at the basin of the river is a habitat for numerous species of birds.[10] However, heavy sedimentation can reduce downstream river water quality and can exacerbate floods up stream. This has been known to happen in the Sanmenxia reservoir in China. The Sanmenxia reservoir is part of a larger man-made project of hydro-electric dams called the Three Gorge Project [11] In 1998, uncertain calculations and heavy sediment greatly affected the reservoir’s ability to properly fulfill its flood-control function [12] This also reduces the down stream river water quality. Shifting more towards mass irrigation installments in order to meet more socioeconomic demands is going against the natural balance of nature, and use water pragmatically- use it where it is found[13]

Affected downstream water users[edit]

Water becomes scarce for nomadic pastoralist in Baluchistan due to new irrigation developments

Downstream water users often have no legal water rights and may fall victim of the development of irrigation.

Pastoralists and nomadic tribes may find their land and water resources blocked by new irrigation developments without having a legal recourse.

Flood-recession cropping may be seriously affected by the upstream interception of river water for irrigation purposes.

- In Baluchistan, Pakistan, the development of new small-scale irrigation projects depleted the water resources of nomadic tribes traveling annually between Baluchistan and Gujarat or Rajasthan, India[14]
- After the closure of the Kainji dam, Nigeria, 50 to 70 per cent of the downstream area of flood-recession cropping was lost[15]

Lost land use opportunities

Irrigation projects may reduce the fishing opportunities of the original population and the grazing opportunities for cattle. The livestock pressure on the remaining lands may increase considerably, because the ousted traditional pastoralist tribes will have to find their subsistence and existence elsewhere, overgrazing may increase, followed by serious soil erosion and the loss of natural resources.[16]
The Manatali reservoir formed by the Manantali dam in Mali intersects the migration routes of nomadic pastoralists and destroyed 43000 ha of savannah, probably leading to overgrazing and erosion elsewhere. Further, the reservoir destroyed 120 km^2 of forest. The depletion of groundwater aquifers, which is caused by the suppression of the seasonal flood cycle, is damaging the forests downstream of the dam.[17][18]

Groundwater mining with wells, land subsidence

Flooding as a consequence of land subsidence

When more groundwater is pumped from wells than replenished, storage of water in the aquifer is being mined and the use of that water is no longer sustainable. As levels fail, it becomes more difficult to extract water and pumps will struggle to maintain the design flowrate and consume more may energy per unit of water.