

Watershed Management
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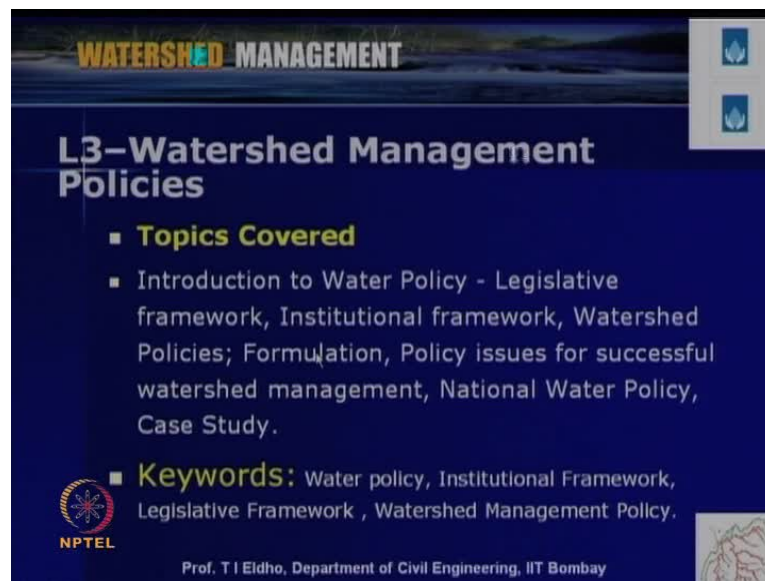
Module No. # 01

Lecture No. # 03

Watershed Management Policies

Welcome to the video course on Watershed Management in this module 1 on introduction and basic concepts.

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In today's lecture number 3, we will discuss about the watershed management policies. Some of the important topics covered here includes, introduction to water policy-legislative framework, institutional framework, watershed policies; formulation, policy issues for successful watershed management, national water policy and case study.

Some of the important key words related to this lecture are water policy, institutional framework, legislative framework and watershed management policy. While dealing with any resources like water or land, it is always better to have a well-defined policy. So, before going to the various aspect of watershed policy, let us have a look in to the

various policies related to water issues persisting in a country. What are the issues, which has to be there as far as a water policy is concerned?

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WATERSHED MANAGEMENT

Water Policy

- **Water policy** - set of guidelines and directives to the State for harnessing water resources - to cater the sectoral (agriculture, industrial and domestic) - need in equitable way that leads to sustainable development.
- **A policy statement defines-**
 - Ownership and related right with regard to its use
 - Incentive and penalty awards towards conservation and deterioration of water resources
 - Water allocation priorities to sectors
 - Water conservation
 - Institutional structure for executing planning and implementation

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Here are some of the important aspects of water policies and they are listed as water policy - it is a set of guidelines and directives to the state for harnessing water resources- to cater the various sectorial needs like agriculture sector, industrial sector and domestic sector. These need in equitable way that leads to the sustainable development.

As we have already discussed in the case of watershed management, we are looking for the sustainable development issues. So, water resource is a resource so that way the water policy should give sufficient information and sufficient guidelines as far as the various issues of sustainable developments are concerned. So, a policy is actually the water policy. It is a statement that defines ownership and related rights with regard to its use. It has incentive and penalty awards towards conservation and deterioration of water resources. The policy statement should include water allocation priorities to various sectors.

As we discussed, important sectors are agricultural, the industrial and domestic sectors. The policy statement should mention about water conservation. The policy statement should mention about the institutional structure for executing the planning, implementation and maintenance of the system, so that way the water policy should be

well defined. It should give the various aspects and various regulations, which are prevailing or which are supposed to be implemented as far as that resource is concerned.

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The slide is titled "WATERSHED MANAGEMENT" at the top. Below it, the main heading is "Components of Water Policy". There are two main bullet points:

- **Legislative framework**
 - Legal framework that defines the rights to exploit/use of water resources and provisions of award of incentives and penalties
- **Institutional framework**
 - Administrative system responsible for assessment and management of water resources

At the bottom left, there is a small inset image of a gavel and a scroll with the text "NPTEL". At the bottom right, it says "Prof. T I Eldho, Department of Civil Engineering, IIT Bombay".

What are the various components of water policy? In these slides, the components are listed. So, mainly water policy is concerned. Two components are there, first one is the legislative framework and second one is the institutional framework. The legislative framework gives the legal framework that defines the rights to exploit or use of water resources and provisions of award of incentives and penalties. So, this is said legislative framework. It is the legal aspects and has the rules and regulations for the policy.

Either the water policy or watershed policy or whichever policies we are considering, legislative framework gives the various rules and regulations and how to implement that rules and regulations. So, all these aspects are given as far as the legislative framework is concerned. The second framework is the institutional framework. Institutional framework gives the details of administrative system is responsible for assessments and management of water resources. As far as water policy is concerned, institutional framework shows the administrative system and administrate various aspects of the water resource on national level state level or block level or up to the panchayat level. We will discuss the important aspects as far as legislative and the administrative or the institutional framework is concerned.

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WATERSHED MANAGEMENT

Legislative Framework

- Water in Indian constitution
 - "Water" in entry 56 of union list and entry 17 of state list.
 - Article 246 and Art. 262, empowers parliament to make law regarding development and management of inter-state rivers.
 - " Art 262, specifies that parliament may by law provide that neither the supreme court or any other court shall exercise jurisdiction with respect of inter-state river disputes . Interpretation- arbitration

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Here, various issues related to legislative framework is discussed in this slide. As far as India is concerned, water in Indian constitution - water is in entry in 56 of union list and entry 17 of state list. Articles 246 and article 262 mentions about the water issues and empowers parliament to make laws regarding developments and management of interstate rivers. As such, India is concerned, water is mainly a state issues. The central government or government of India has adviser rules, but parliament can enact various rules and regulations, so that the various states have to follow.

As for this article 262 is concerned, this article specifies that parliament may by law provide that neither the Supreme Court nor any other court shall exercise jurisdiction with respect to interstate river disputes. So, you can see that in India, there are number of states and larger number of rivers are passing through various states. Of course, various disputes will be there between states as far as the water sharing issues are concerned for the particular river is concerned. So, as per article 262, instead of a judicial review of this; this article mentions about the arbitration or arbitrate rules as far as the interstate issues are concerned. So, the interpretation for this article 262 is the supreme court or other judicial agencies can appoint some arbitrate to deal with this interstate rules. You can these in the website of ministry of water resource in the website as mentioned here.

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WATERSHED MANAGEMENT

Water Legislations in India

- Surface water and groundwater is not defined separately "water" in constitution mostly defined as surface water (Iyer R, 2003)

Component of water regulation	Applicable regulatory framework
Ownership of Water	Government of India Act: The Easement Act 1882- private right to groundwater since it is viewed as an attachment
Withdrawal of water	State subject ; few states has enacted and implemented water resource legislation
Usage of water	Government of India Act: Water (Prevention and Control of Pollution) Cess Act, 1977, 1990 and 2003 and rules thereof for providing for the collection of cess on water consumed on bulk
Wastewater Disposal	Government of India Act : Water (Prevention and Control of Pollution)Act , 1974 and 1998 , and rules thereof which provide norms for wastewater disposal and prevention and control of water pollution.

Now, we will discuss various water legislations as for as India is concerned. In India, as far as water legislation is concerned, the surface water and ground water are not defined separately. It is mentioned as water only, so various components of water regulations are listed and then its applicable regulatory framework is also mentioned. As far as ownership of water is concerned, the government of India act as per 1882 rules, the ownership of the water is with the state government and of course, government of India advises all.

When withdrawal of water is concerned, it is a state subject, some of the states have enacted, implemented water resource legislation and usage of water is concerned. As per government of India act, prevention and control of pollution and various acts have been enacted. As far as the various government of India's serve agents are concerned, they are advisers and state government will be dealing with the water pollution issues are concerned.

Wastewater disposal - government of India act is implemented in 1974 and 1998. It states various regulations and state pollution control boards deal with the wastewater related issues, water management, water quality issues are also concerned. Mainly, state has a major say and then government of India has got an adviser roles and its agencies can give advises and important laws can be enacted by the parliament.

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WATERSHED MANAGEMENT

Water Legislations in India...

- Water (Prevention and Control of Pollution) Act 1974 (A 1978 & 1988)
 - Dealing with setting up Institution related to administration of water (Central Pollution control Board and state PCB's)
 - It undertake functions related to prevention and control and maintaining and restoring related to wholesomeness of water
 - The institution provide consent to operate and consent to establish to industries based on applicability

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Some of the important water legislations in India are listed here. Some of the legislations related to prevention and control of pollution act 1974, which is again amended in 1978 and 1998. So, these legislations deals with setting up of institution related to administration of water like central pollution control board and state pollution control board. It undertakes functions related to prevention and control, maintaining and restoring related to wholesomeness of water. So, water is considered as a whole issue.

It is not only quantity of water; quality of water is also a major issue. So, various legislations for water sharing or water resources utilization and quality of water is to be maintained or number of legislations are available in India. The institution provides consent to operate and consent to establish to industries based on applicability. So, this is also a state issue, but government of India enacts certain laws and regulations, so that the states can follow as appropriates as far as the various issues are concerned.

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WATERSHED MANAGEMENT

Water Legislations in India...

- Environment and Protection Act, 1986
 - It lays down the procedure for settings of standards emission and discharge of pollution
 - based on BIS standards such as IS : 3025 (for sampling), IS: 2373 (for flow measurement), BIS: 10500 (drinking water specification), contaminant wise related guidelines for wastewater issued by respective PCB's

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Environmental and protection act of 1986 gives various regulations for the environmental issues. So, this protection act lays down the procedure for setting up of standards emissions and discharge of pollutions. Accordingly, the bureau of Indian standards have come up with various Indian standards, such as 3025 for sampling, 2373 for flow measurements, 10500 for drinking water specifications, contaminant wise related guidelines for wastewater etc. So, to deal with all these issues, central pollution control board is there and various state pollution control boards are also there to see that these rules and regulations are implemented appropriately for various issues.

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The slide features a dark blue background with a landscape image at the top. The title 'WATERSHED MANAGEMENT' is in orange and white. Below it, 'Water Legislations in India...' is in white. A bullet point '■ Model Groundwater Bill 1970' is followed by two sub-points: '- Contains the broad framework of groundwater regulation of the country' and '- The bill provides the union territory and state government to establish ground water authority to notify areas of control and regulate the groundwater development and management'. Below this, text states 'Under the bill CGWA categorizes country as "safe", "critical" and "over-exploited"'. The slide includes an NPTEL logo, a map of India, and the IIT Bombay logo. The footer reads 'Prof. T I Eldho, Department of Civil Engineering, IIT Bombay'.

As far as water is concerned, another important bill is - a model ground water bill of 1970. This bill contains the broad framework of groundwater regulation of the country. So, due to over drought to the ground water, ground water levels are going down in places and also ground water pollution is a major issue. So, this 1970 bill provides the states and union territories to establish ground water authority to notify areas of control and regulate the ground water development and managements.

Accordingly, government of India has formed central ground water authority. So, according to their norms, they have categorized the various zones as safe drinking water zones or over exploited zone or critical polluted zones. So, like that central ground water authority has various norms, as far as the ground water is concerned. That is about the ground water build of 1970. This is about the legislative framework for the water policies are concerned. Of course, when we deal with a watershed management, water policies are very important. According to these water policies, we will be dealing the water resources management in a particular watershed and that is why these water policies are also important as far as the watershed management issues are concerned. As far as water policy is concerned, why we discussed about some legislation?

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WATERSHED MANAGEMENT

Water Institutions: Administrative structure

- Ministry of Water Resources - nodal agency for planning , development & management of water resources
- Departments-
 - Central Water commission – for surface water related issues
 - Central Ground Water Board – for groundwater
 - National Water Development Agency- to provide technical support

Water and Land Management Institutes and Agricultural Universities – research at state level

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The slide features a blue background with a landscape image at the top. It includes logos for NPTEL and the Government of India at the bottom.

Now, the various administrative structures - as far as government of India and state governments are concerned and some of the major institutions over the administrative structure are concerned, government of India has a ministry of water resource. Many state governments also have this ministry of water resource. So, the government of India, ministry of water resource are the nodal agency for planning development and management of the water resource of the country.

As I mentioned earlier, the state governments have a major say, as far as the water resource is concerned, but government of India has an adviser role and likewise, the ministry and then its agencies have a adviser role. They can advise the state government to do the development as far as developmental issues are concerned or as far as the implementation issues are concerned or sustainable development or sustainable water management are concerned, they have the adviser role.

Under ministry of water resources, various departments are there like a central water commission for surface water related issues, central ground water board is there for ground water related issues. National water development agency is there to provide technical support for ministry of water resource and various state governments are concerned. They develop detail project report and then come up with various issues. They come up with models and support system for the government of India and its project implementation and for state government. Various institutions like water and land

management institutes in various states, various agriculture universities, various water related departments in states and union territories are there for research and developmental issues for water related issues. These are the details of administrative structure for government of India and some other ministries. They are also dealing with some of the water related issues.

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Other Ministries – In India		
Ministry of Rural Development	Department of Land Resources	Desert Development Programme Drought Prone Area Programme Integrated Wasteland Development Programme
	Department of Drinking Water Supply	Accelerated Rural Water Supply Programme
Ministry of Agriculture and Cooperation	Department of Rural Development	PM Rural Drinking Water Prog. National Watershed Development Projects for Rainfed Areas
		Regionwise Watershed Development Projects
		Integrated Watershed Development Projects
Ministry of Environment and Forest	Central Pollution Control Board	Water Quality Programmes
	National River Conservation Board	National Eco-Development Programmes

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The ministries included are listed here: ministry of rural development, so this ministry deals with the land and then rural area development. Some of the project or some of the issues, which ministry of rural development will be dealing are desert development programme, drought prone area programme, integrated wasteland development programme.

Other important ministries are ministry of agriculture and cooperation. They deal with the various agriculture water management issues, drinking water programme, national watershed development programme of government of India. Various watershed related issues are dealt by ministry of agriculture for government of India and similarly for various state governments. So, the various watershed related policies and projects are under the ministry of agriculture like region wise watershed development projects, integrated watershed development projects etc are dealt by ministry of agriculture.

Another important ministry is ministry of environment and forest. So, ministry of environment forest deals with the pollution issues of water, air and related issues. So, under ministry of environment and forest, there is central pollution control board, national river conservation board. They deal with the various water quality issues and it has lake development, eco development programme etc. So, these are the administrative structures for government of India and then various state governments are concerned; a typical case as far as India is concerned.

What for you are discussing about the water policies? As I mentioned, when we discussed about the watershed management issues or watershed policies, water policies are also very important, since most of the issues related to water policies are also applicable for watershed management policy.

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WATERSHED MANAGEMENT

Watershed Policy

- To **manage & protect watershed** fully and effectively, a clear **policy** is required - emphasize *inter alia* a coordinated & integrated approach, local participation, manpower & resource building, land use planning, among others.
- **Main objective of watershed management:** promote integrated protection, conservation & development of land & water resources in watersheds for sustainable use and for the benefit of the nation as a whole.
- **Watershed Policy:** what regulates both public and private activities within our watersheds, primarily through use of codes & ordinances, through the establishment of minimum or maximum standards, and the setting of budgets.

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Now, we compare with watershed policy and then discuss various issues in watershed policies. Watershed policy is formulated to manage and protect watershed fully and effectively. A clear policy is always required to emphasize inter alia, so that the various interaction between various sectors have a coordinated and integrated approach. Local participation is possible, manpower and resource management are possible, appropriate land use planning are possible, so like that a specific policy as a watershed policy is always essential to deal with the watershed management effectively.

The main objective of watershed management is to promote integrated protection conservation and development of land and water resource in a watershed for sustainable use and for the benefit of the nation as a whole. That is the main objective of any watershed management programme. So, the watershed policy, which we can formulate helps to make appropriate plans and a managerial plan for the considered watershed. So, the watershed policy, the document gives the regulations; both a public and private activities within our watersheds. It is primarily through use of codes, ordinances and through the establishment of minimum or maximum standards and then setting of budgets.

The watershed policy is either under the ministry of agriculture or ministry of water resource. When the watershed policies are formulated and it is further modified as per the various needs, so that policy paper shows policy and gives the details for setting of budgets. What kind of activities should be put? For example, when we consider various 5 year plans; for example, twelfth 5 year plan, what are our targets for various achievements for next 5 years, related to watershed? What are things to be implemented? What kind of support should be given to various states and other agencies from the government of India? So, all these details will be putting the watershed policies.

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WATERSHED MANAGEMENT

Strategies for Implementation of the Watershed Policy

- Develop a National Watershed Programme
- Establish an Inter-Ministerial Watershed Management Committee
- Strengthen human and financial resources required to co-ordinate, implement and monitor work in the watersheds
- Rank each watershed and establish priorities for interventions.
- Secure budgetary support for implementation of the Policy

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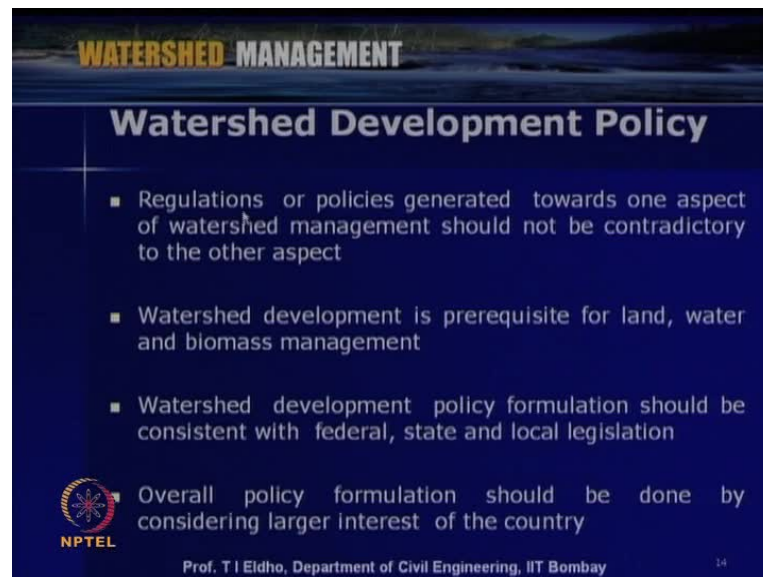
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As far as various strategies for implementation of the watershed policies are concerned, various issues are listed here. A watershed policy gives the overall picture of the

developmental issues for the national watershed programme. It establishes an inter-ministerial watershed management committee. As I mentioned, various ministries are coming to picture for the watershed management implementation or the policy development are concerned. So, the various ministries or various agencies should come together to make an appropriate watershed policy document. It should strengthen human and financial resources that are required to coordinate, implement and monitor work in the various watershed related projects.

The watershed policy rank - each watershed establishes priorities for interventions. So, we have already seen various watershed related issues and their problems. When we look for a holistic way of watershed management practice or watershed management plans, we should rank them based on the priorities. The watershed policy will give the ranking, according to the priorities. The watershed policy secures budgetary support for implementation of the policy. Once a policy document is made, the budget will be allocated and then the implementation issues will also be discussed. Accordingly, we can develop a watershed policy, so that gives the various framework for watershed management plans.

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WATERSHED MANAGEMENT

Watershed Development Policy

- Regulations or policies generated towards one aspect of watershed management should not be contradictory to the other aspect
- Watershed development is prerequisite for land, water and biomass management
- Watershed development policy formulation should be consistent with federal, state and local legislation

Overall policy formulation should be done by considering larger interest of the country

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The watershed development policy issues are listed further. The regulations or policies generated towards one aspect of watershed management should not be contradictory to the other aspect. As I mentioned that various ministries, various agencies are dealing

with water related issues or watershed related issues. So, the regulations of policies generated by one agency or one ministry should not be contradictory to the other agency, so we should be careful.

Watershed development is prerequisite for land, water and biomass management. So, when we develop a watershed development policy, we have to see that the watershed development is the prerequisite for land, water and biomass management. Watershed development policy formulation should be consistent with federal state and local legislation. So, the federal government or the government of India will be having its norms and policy. When the watershed development policies are formulated, we have to see the various needs, various geographical conditions, various existing policies in local states and regional level, so that there will not be any conflicts and some cooperation will be possible.

Overall policy formulation should be done by considering a larger interest of the country, even though various issues will be there on regional level or state level. Whenever a final policy formulation is done, the main emphasize should be on overall policy formulation and should be for the larger interest of the country, so that we should be careful when the appropriate watershed policies are formulated.

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WATERSHED MANAGEMENT

Characteristics of Watershed Policies

- Policies should stand as ready guides to answering many questions that may arise in the implementation of watershed
- Generally, watershed policies are formulated at the government level
- At Government level - watershed policy

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Decisions and actions (significant importance)

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Widest ramification

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longest time perspective

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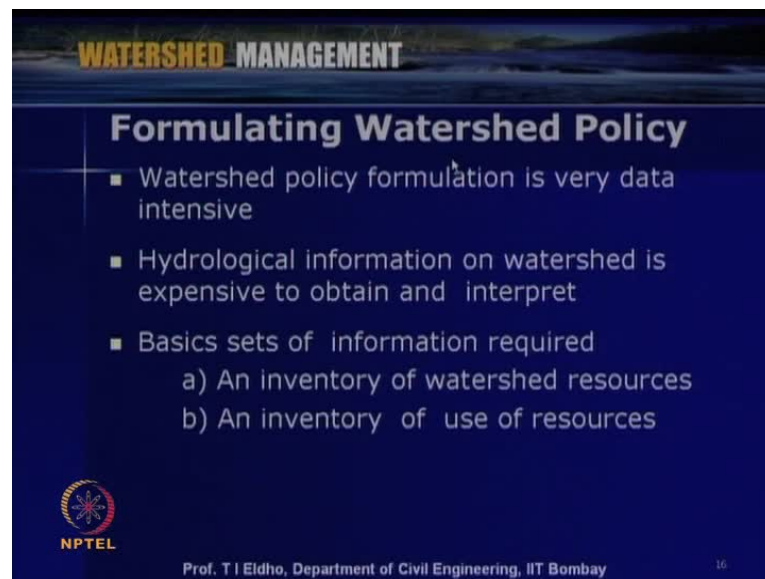
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Let us see some of the important characteristics of watershed policies. Policies should stand as ready guides to answering many questions that may arise in the implementation of watershed management plans. So, when we are developing watershed management plan and then going for implementation, the policy document should clearly tell the various questions and various issues for the implementation agencies.

Generally, watershed policies are formulated at the government level, by considering the various issues and by discussing with various agencies including non-government organization; NGO's and local people etc. At government level, the watershed policies will be following the decision and actions. We will be checking the importance of each decision. If one city is implemented, what will be happening? What will be the ramifications in various policy issues? Then the time frame, whenever this policy will be implemented, what will be happening for the that particular policy? What will be its ramification? We have to discuss that also, whenever we formulate a watershed policy and we must discuss the various issues concerned to that particular watershed policy.

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WATERSHED MANAGEMENT

Formulating Watershed Policy

- Watershed policy formulation is very data intensive
- Hydrological information on watershed is expensive to obtain and interpret
- Basics sets of information required
 - a) An inventory of watershed resources
 - b) An inventory of use of resources

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Now, the various issues, when we formulate watershed policies are discussed here. Watershed policy formulation is very data intensive. As I mentioned, when we prepare watershed management plans, various issues like the particular watershed characteristics, various needs of the society or various needs of the particular area arises. The climatic

issues or hydrological issues; when we are formulating particular watershed policy, we have to see that all these issues are addressed properly.

From one location to another location, various characteristic or various issues will be varying, but to come up with a watershed policy, we should or we can classify the various issues according to the needs and according to its characteristics. We can collect the appropriate data, analyze it and go for the formulation of the watershed policy. So, we have to get the data like hydrological information of watershed. That is very expensive to obtain and interpret. Some of the basic sets of data like inventory of watershed resources, an inventory of use of resources, socioeconomics of the people, so like that we have to deal with various issues, when we formulate the watershed policy.

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WATERSHED MANAGEMENT

Collection of Information

Following aspects should be considered for collection of information

- Right of access to information: It should be readily available
- Information requirements:
 - Gathering and processing of information is a huge task.
 - Requirements should be kept to the minimum.
 - Should be gathered cost effectively

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As far as various data is concerned and for the collection of information, we can follow various aspects listed here. Right of access to information: This should be readily available. As we discussed, most of these implementation aspects or the various issues are stated by its subject. So, the state government can make policies or formulate the objectives and collect the appropriate data.

Various information requirements, such as the technical details or the land details or the water related details. This need large amount of time and it is a huge task. We have to see that the watershed characteristics or watershed plans will be varying depending upon

the area. So, we have to see that the data requirement should be minimum. We have to collect the data in an optimal way; so that we can go for the best policy documentation for the particular watershed management issues.

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WATERSHED MANAGEMENT

Policy issues for successful watershed management

- Understanding and quantifying the biomass types and interactions both in space and time.
- There should be proper linkage between social, political & technical system at appropriate levels.
- Agro-ecological approach should be considered for planning of watershed.
- Priority should be given to water resources development in watershed.
- Requirements of poor people & influences on the watershed - considered in policy formulation.

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Let us discuss about the important policy issues for the development of a successful watershed management policy. Some of the important policy issues are listed here, like understanding and quantifying the biomass types and interactions in space and time. As you can see that the various resources like water, land use etc will be varying with respect to space and time. So, we have to understand and quantify this biomass types, then there should be proper linkage between social, political and technical system at appropriate levels. That is very important for the successful development of policy.

Agro-ecological approach should be considered for planning of watershed. Most of the time, the agricultural practices or the ecological aspects are very important. We have to consider those issues and then the priority should be given to water resource development in watershed. As we discussed, water is one of the important resource for domestic, industrial or agricultural practice. So, the priority should be to given to water resource development in the area, then requirement of the poor people influences on the watershed. All these should come in a policy formulation, so that there will be appropriate socioeconomic aspects will be incorporated within the watershed policy.

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WATERSHED MANAGEMENT

Policy issues for successful watershed management...

- Need to establish and manage a national database system for watershed
- Watershed models should be properly formulated, verified and confirmed with field observations
- Agriculture is highly dependent on soils and climate
- Eg. Based on 50 years of climate data and an up-to-date soil database, India divided into 20 agro-ecological zones (AEZs)
- Each AEZ is as uniform as possible in terms of physiography, climate, length of growing period and soil type for macro level land-use planning and effective transfer of technology

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Some more issues are listed here, like need to establish and manage a national database system for the watershed. So, when we develop the policy issues, we have to see these issues. Watershed models should be properly formulated, verified and confirmed with field observations. As I mentioned, when these policies are formulated, we have to see that what is really happening within the field or within the various watershed. We have to see and confirm with respect to field observations, whether the policies, which we are formulating are viable and whether it can be implemented and can be sustained.

Most of the watershed policies are for agriculture. We can see that it is one of the important sector. So, this agriculture is highly dependent on soils and climate. Most of the areas in India depend upon rain fed agricultural zone. The climate conditions are very important, for example - based on 50 years of climate data and up to date soil database, India is divided into twenty agro-ecological zones that is AEZ. We can classify them depending upon the soil related data, climate condition and we can have agro-ecological zones. When formulating the watershed policy for each zone, we can have a different type of policies depending upon the ecological condition, depending upon the climatic conditions, depending upon soil nature etc.

Each agro-ecological zone can be considered as uniform zone and then it is possible in terms of physiography, climates, length of growing period and soil type for macro level land use planning and effective transfer technology. So, these kinds of agro-ecological

zoning is very good. The ministry of water resource has done this agro-ecological zoning for India. Accordingly, 20 zones have various issues or we say according to the various characteristics, zoning is done. So, each zone can have separate watershed policies and accordingly, we can formulate the policy.

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WATERSHED MANAGEMENT

Policy issues for successful watershed management...

- Collaboration of all organizations can expand the experiences in an efficient manner.
EX: Ministry of agriculture, Ministry of Water Resources etc.
- ⊕ There should be proper institutional setup with people's initiative and involvement
- Continuous monitoring of the physical progress of the watershed projects
- Use of Remote sensing techniques and GIS should be promoted for assessing the capability of the land inventory

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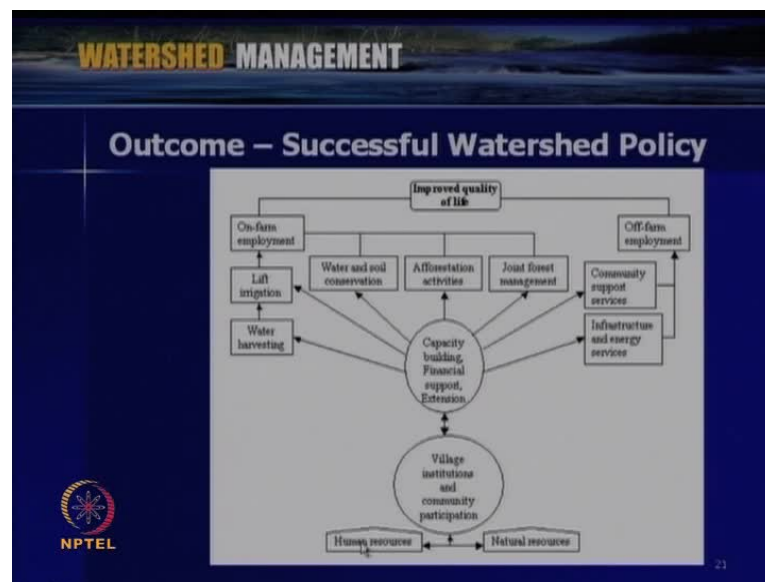
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We have to see the collaboration of various organizations for watershed policy is concerned. As we have seen, various ministries interact to formulate successful policies. For example, in India, ministry of agriculture and ministry of water resource deal with watershed development policies. So, they have to collaborate. The ministries, various agencies have to collaborate, so that appropriate policies are developed. There should be proper institutional set up with people's initiative and involvement.

In the earlier lectures, we have seen for the successful implementation of any watershed development plans, people participation is very important. Stakeholder should have a good say, starting from the development plans to implementation and to its maintenance. So, people as initiate is very important and people's involvement is very important, so that way proper institutional framework should be setup, when we develop a watershed policy. Continuous monitoring of the physical progress of the watershed projects should be done as a policy formulation.

Nowadays, various modern techniques like remote sensing can be effectively used and geography information system can be effectively used. So, all these modern techniques or modern technical tools give the capability for successful policy formulation. For example, remote sensing data for India at various seasons gives land use planning and the kind of things that were going in the past and accordingly, various policy formulations will be possible. The geography information systems give lot of flexibility for the watershed based planning and management. So, we can have a better policy and it can be developed, say for watershed policies.

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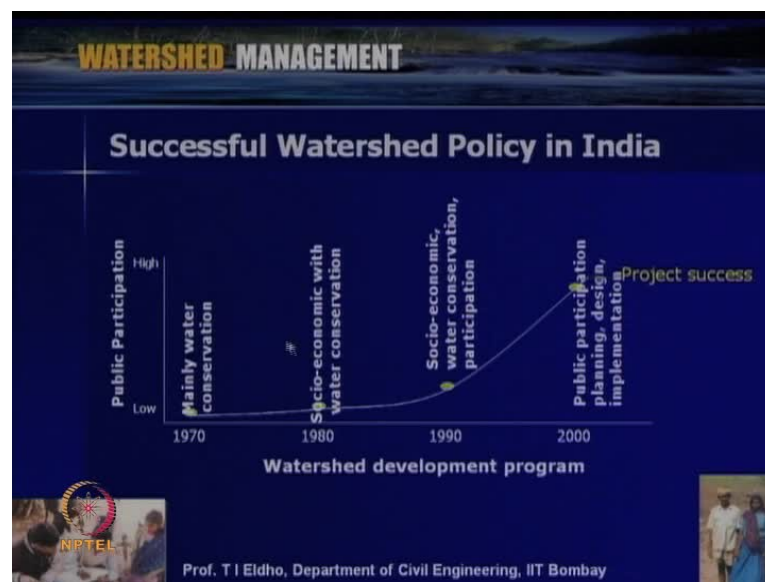


So far we have seen the various issues in various characteristics, how we can develop a successful watershed policy. What will be the outcome of a successful watershed policy? As we have discussed earlier, any successful watershed policy gives overall development and overall upliftment of the society or upliftment of the people. The various issues for watershed scale is concerne, you can see that the various issues for a successful outcome of a watershed policy is mentioned here in a block diagram.

Here, you can see that the natural resource and human resource are effectively utilizing on a watershed scale. So, various village institutions and community participations will take place and accordingly, the policy formulation is done. We should have various norms for capacity building, financial support and its extensions. For example, water harvesting, lift irrigation, water and soil conservation, forestation activities, joint forest

management community support systems, infrastructure and energy services, like that we have various sectors. We should have appropriate policies in the successful watershed policy and finally all these good policies will lead to better employment, better development. The outcome will be improved quality of life as far as the people of particular area is concerned. So, a successful watershed policy gives overall development, overall improvement in the socioeconomics of the people and sustainable development in watershed or the flora and fauna of the particular area. So, this block diagram shows what will be the outcome for a successful watershed policies are concerned.

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In India, government of India and various state governments are implementing various watershed policies or watershed plans for the last 40 to 50 years. If you look at the various policies, development or various watershed development plans formulated by government of India and other state governments from 1970 onwards, we can see that how the variation is taking place, how the trend is changing. In 1970s, the main emphasis was on the water conservation like development of larger dam, reservoirs and soil erosion issues or water management issues. The policy was formulated in such a way that the government will be implementing various projects and either the central government or state governments will be formulating the projects and its agencies will be implementing it.

There were no say by the people or the people were not participating effectively in none of these projects. So, that way, the watershed development policies were in 1970s till 80s and the success rate was not so good. Many of these projects implemented by various agencies could not sustain due to the lack of people participations, people understanding or people will to participate in the project, so that the maintenance and the further keeping up of the project where possible.

By understanding these mistakes, various agencies, government of Indian, state government has changed their policies. In 1980s, the importance in watershed development was on socio-economic aspects with water conservation. Various watershed development projects were implemented throughout the country, through the state governments. So, the emphasis was on the water conservation and as well as socioeconomic development of the people. So, there again, the stakeholders of the people were not coming to picture. They did not actively participate in this project.

In 1990s, there was a trend change, not only in the socio-economic aspects, but in water conservation and their implementation is concerned. People's participation or the stakeholder's participation was considered in 1990s. You can see the success rate was increasing in many of these projects. Finally, there were various successful projects like Ralegan siddhi in Maharashtra or Jabo watershed in Madhya Pradesh. There were a shift in the policy formulations or watershed policy formulation as far as the government of India or state government agencies are concerned.

So now the latest of 20s, there have public involvement or public participation from the planning stage to design stage and then also in implementation stage. You can see that many of the recent projects are implemented by various agencies. Once the projects are evaluated, you can see that many of these projects are successful. Mainly, you can see that the reason is that people's participation and people were actively involved from the planning stage to the implementation, design and its maintenance.

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WATERSHED MANAGEMENT

National water policy in India- Needs

- Availability of water is highly uneven in both space and time
- Precipitation is confined to only few months in a year
- Rainfall Varies spatially – eg. In India: from 100 mm in the western parts of Rajasthan to over 10000 mm at Cherrapunji in Meghalaya
- On an average, floods affect around 7.5 milli. Hectare/ year
- Planning and Implementation of water resources projects involve a number of socio-economic aspects and issues
- Eg: environmental sustainability, rehabilitation of project-affected people and livestock
- Common approaches and guidelines are necessary on these matters
- Gross Irrigation potential is estimated to have increased from 19.5 million about 95 million hectare by the end of the Year 1999-2000.
- Some other factors like degradation of water quality

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Now, within this perspective, here again, we will come back to the water policies. As far as India is concerned, some of the needs of national water policy are listed here: availability of water is highly uneven in both space and time. In India, water is mainly obtained through monsoon rainfall, starting from June to September or October. So, the precipitation is confined to only few months in a year and rainfall varies spatially, for example, in western parts of Rajasthan, rainfall is about 100 mm, but this goes to 10000 mm in some parts of Meghalaya region. On an average, there are number of problems like flood. So, flood affects around 7.5 million hectares per year as for as India is concerned. Planning and implementation of water resource projects involve a number socio-economic aspects and issues.

The need is for environmental sustainability issues, rehabilitation of project affected people and livestock. Whenever huge projects are coming up, environmental issues, rehabilitation of the people are the major issues that has to be considered. Common approaches and guidelines are necessary on these matters. Gross irrigation potential is estimated to have increased from 19.5 million to 95 million hectares by the year 1999 or 2000.

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The slide features a dark blue background with a landscape image at the top. The title 'WATERSHED MANAGEMENT' is in yellow and white. Below it, 'National Water Policy in India' is in white. A bulleted list follows, and the NPTEL logo is in the bottom left. Footer text and a small number '24' are at the bottom.

WATERSHED MANAGEMENT

National Water Policy in India

- First adopted in 1987 and formulated in 2002
- It advocates water resources of the country should be brought within the category of utilizable resources to the maximum possible extent
- Salient features
 - Policy promotes use of non-conventional methods such as traditional water & rooftop rainwater harvesting
 - Water transfer to water scarce region
 - People's participation
 - Public Private Partnership
 - Water Resources planning at hydrologic unit not on political unit

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Whenever a national water policy is formulated, we have to see the water quality issues and accordingly, national water policy has been formulated in India. This policy has been first adopted in 1987 and it is formulated in 2002. So, this national water policy advocates that water resource of the country should be brought within the category of utilizable resource to the maximum possible extent. Various sector needs, like agriculture sector, industrial sector or domestic sector needs are considered to the maximum possible extent. Thus, these are some of the important aspects as for the national water policy.

Some of the salient features are listed here: national water policy promotes use of non-conventional methods, such as traditional water harvesting, rooftop rainwater harvesting etc. So, this water harvesting is mainly possible and will be done on a watershed scale and water is transferred to water scales region. In this water policy, they transfer, like inter basing transfer from one basin to another basin, so that was formulated in the national water policy in 2002.

People's participation has been given very much importance as far as the water policy is concerned and public private partnership, like ppp was also given emphasize in this water policy of 2002. Water resource planning is at hydrological unit and not on political unit, like village level or the block level or district level. As we discussed, it should be scientific level, like a watershed scale or a hydrological unit should be considered, so

that was one of the important aspects of this national water policy, which was formulated in 2002.

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WATERSHED MANAGEMENT

National Water Policy in India..

- Directed state to devise its own water policy – in practice very few state has prepared it so far
- Allocation priority (national level, may differ at state level)
 1. Drinking Water
 2. Irrigation Hydropower
 3. Ecology
 4. Agro-industries
 5. Non-agricultural industries
 6. Navigation

Same for all state, except Maharashtra where water for industrial use is top priority than irrigation

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This national water policy directs the states to devise its own water policy in practice. As we discussed, various states have develop these policies. In the national water policy, the allocation priorities were listed in national level and mainly, water should be the first priority. As far as national level is concerned, first priority should be for drinking water, then irrigation hydropower, ecology, agro industries, non-agriculture industries, navigations etc.

These are some of the priorities listed in the national water policy, but for the needs of the various states, this can vary. For example, most of the states follow this allocation priority, but some states like Maharashtra, their main priorities like industrial use, then other uses. So, this way the priorities may change from one state to another state.

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WATERSHED MANAGEMENT

National Water Policy in India..

- It emphasizes on-
 1. Need for efficient pricing system and transparent subsidy structure for disadvantaged and poor
 2. Transfer the water management to user groups and local bodies
 3. Private sector participation in water sector
 4. Undertaking phased programme for improvement of water quality based on 'polluter pay principle'
 5. Need based economic activities on the water zoning of the country
 6. Prioritizing the need of drought prone areas

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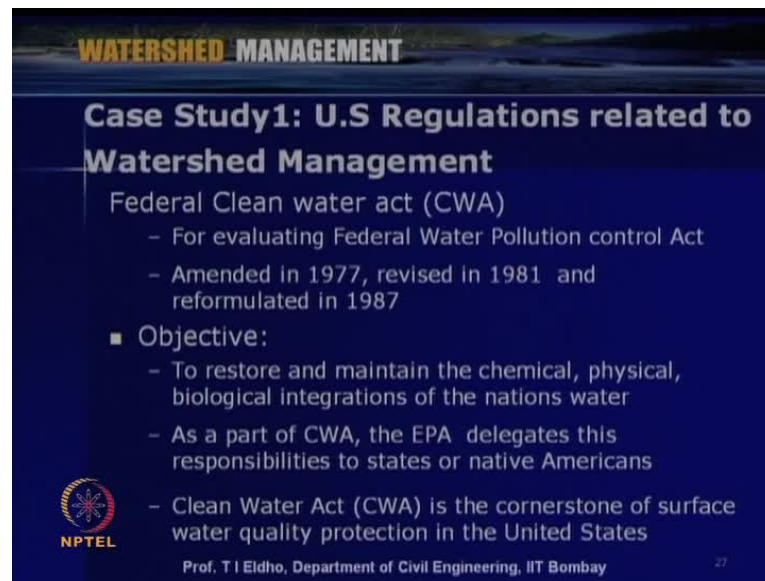
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As I mentioned in the national water policy in India, policy emphasizes on need for efficient pricing system and transparent subsidy structure for the disadvantage and poor. That is also listed in the national water policy. Transfer the water management to user groups and local bodies. Nowadays, the user groups promoted in various sectors like agriculture water use or industrial water use. So, accordingly the transfer of the water management can be done to the user group.

Private sector participation in water sector, so that is also emphasized in this national water policy. Undertaking phased programme for improvement of water quality based on polluter pay principle. In India, water pollution is a major issue and so national water policy polluter pay principle has been formulated. The need based economic activities on water zoning has been formulated in the national water policy, then prioritizing the need for drought prone areas. As per the climatic conditions, drought prone areas were categorized and the priority should be given for the drought prone areas.

These are some of the salient features of the national water policies of government of India. The water policies or watershed policy depends upon the various needs and various issues and we can develop the particular water policy or watershed policy. So, the water policy gives the guidelines for the watershed development plans or watershed development policies.

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WATERSHED MANAGEMENT


Case Study1: U.S Regulations related to Watershed Management

Federal Clean water act (CWA)

- For evaluating Federal Water Pollution control Act
- Amended in 1977, revised in 1981 and reformulated in 1987

■ Objective:

- To restore and maintain the chemical, physical, biological integrations of the nations water
- As a part of CWA, the EPA delegates this responsibilities to states or native Americans
- Clean Water Act (CWA) is the cornerstone of surface water quality protection in the United States

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Before I cross this lecture, let us have a brief look into two case studies. First case study is some of the regulations and policies of watershed management in U S A is concerned. In U S A, the water regulations are concerned, the emphasis is on clean water act of federal government. For evaluating, federal water pollution control act was amended in 1977 and further revised in various years like in 1981 to 87.

The objective is to restore and maintain the chemical, physical and biological integration of the nation's water. As far as the U S A water regulation act is concerned, so as a part of clean water act, the environmental protection agency delegates these responsibilities to states. The clean water act is the cornerstone of surface water quality protection in United States. So, this clean water act will be followed by various states.

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WATERSHED MANAGEMENT

Salient features of regulation

- Involvement of stakeholder groups in the development and implementation of strategies
- For achieving and maintaining state water quality is another hallmark of this approach
- Under the CWA, EPA has implemented pollution control programs such as setting wastewater standards for industry
- Water quality standards for all contaminants in surface waters
- NPDES - Controls water pollution by regulating point sources that discharge pollutants into waters.

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Some of the salient features of this regulation include involvement of stakeholder groups in the development and implementation of the strategies. For achieving and maintaining state water quality is another hallmark of this approach for clean water act. Under the CWA environmental protection, agency has implemented pollution control programmes, such as setting of wastewater standards for industry and then local domestic sewage plans etc.

Water quality standards for all contaminants include in surface water or ground water are listed. The national pollutant discharge elimination system has been implemented under this clean water act. So, this NPDES controls water pollution by regulating point sources discharge pollutants into the waters.


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WATERSHED MANAGEMENT

CWA Time Line and Amendments

1972

- Goal - prohibit the discharge of any pollutant to waters of the USA from a point source unless the discharge is authorized by a NPDES permit
- NPDES: National Pollutant Discharge Elimination System
- NPDES - track point sources, such as industrial waste water and municipal sewerage and to minimize the discharge of pollutants
- Process was extremely successful in manage the pollution from point sources

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Various timelines and amendments are listed for various years. In 1972, the goal was to prohibit the discharge of any pollutant to the waters of... at various allocations. National pollutant discharge elimination system has been developed and the process was extremely successful in various areas. These implementations and maintenance were looked after by the environmental protection agency, USEPA.

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WATERSHED MANAGEMENT

Time line contd.....

1987


- Section deals with non point source pollutions
- Goals of the NPDES program are achieved through the use of BMP (Best Management Practices)
- To improve the quality of storm water out flow

1992

- EPA published a notice requesting information and public comments for preparing regulations under CWA point source pollution section

1995

- EPA proclaimed formally a final rule, refused to the regulations in 1987 amendments to apply for an NPDES permit by August 7, 2001

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In various timelines like in 1987, the modification or amendments were done for non-point source of pollutions. In 1992, environmental protection agency published a notice


requesting information and public comments for preparing regulations under clean water act. In 1995, EPA proclaimed a final rule, so under this NPDES, various amendments were done.

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WATERSHED MANAGEMENT

Time line contd.....

- 1996**
 - ⊙ EPA's National Water Quality inventory showed that 40% of surveyed U.S water bodies did not meet national water quality standards
- 1998**
 - ⊙ EPA national water quality inventory report showed that nonpoint source pollution, which includes urban storm water runoff is considered as the leading cause
- 1999**
 - ⊙ Goals was set of establishing total maximum daily loads (TMLDS)
 - ⊙ TMDL specifies the amount of each particular pollutant that may be present in a water body

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Further, the implementations were made strict. In 1996, national water quality inventory were implemented. In 1998, EPA national water quality inventory reports were formulated. In 1999, the goal was set of establishing total maximum daily loads. As far as TMDL is concerned, it specifies the amount of each particular pollutant that may be present in water body.

The clean water act proposed in USA and it is implemented by USEPA. It has been very successful in preventing the water pollution at various locations and the water policy or water pollution prevention policy has been implemented by various states effectively. Now, you can see that whenever the evaluations were done, you can see that these policies were very successful in the last few years.


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WATERSHED MANAGEMENT

Case Study 2: River interlinking project of India (proposed)

- **Rationale:** large spatial & temporal distribution of rainfall patterns causing drought and flood like condition in India. This give birth to policy concept of river-interlinking project, connecting water surplus area with water scarce area.

Suggested Reading :
<http://www.ecoworld.com/waters/indias-water-future.html>



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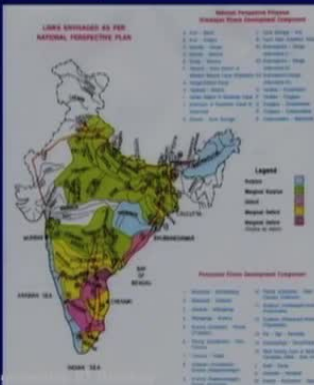
As a second case is about river interlinking project of government of India, which has been proposed in 2000 to 2004. The rationale was large spatial and temporal distribution of rainfall patterns causing drought and floods like condition in India. So, this gives birth to policy concept of river interlinking project. So that means connecting the surplus water areas to other scarce areas through interlinking of various river basins. So, various river basins are listed here.

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WATERSHED MANAGEMENT

Case Study 2: River interlinking project of India (proposed)...

- **Policy Impact:**
 - (anticipated) enhance food grain production by 500 million tonnes to meet ever increasing population demand by 2025. provide 35 million ha. of additional potential arable land and 34000 MW of electricity.
 - Involve huge expenditure , causing burden on taxpayers. Require huge energy to lift water.
 - Anticipated displacement of people and environmental damages



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This proposal is still under proposed stage. National water development agencies are preparing various DPR's - Development Project Reports. So, the policy impact some of the links are mentioned here. So, there is a peninsula link and there is a northern link connecting the various major river basins to the northern rivers to the southern peninsula region.

You can see that such a policy has lot of impacts for various issues. Actually, the positive impacts like this may enhance food grain production, water availability. Of course, lot of problems would be like environmental issues, displacement issues of the people, sustainability issues. Some of the positive impact and negative impacts and all these details have been studied by national water development agency for the last few years.

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WATERSHED MANAGEMENT

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- Raj Vir Singh (2000), Watershed Planning and Management, Yash Publishing House
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Recently, two more links like in a link the implementation process are going on, but on remaining links, studies are going on. These are some of the relevant references as far as today's lecture is concerned on watershed development policies.

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WATERSHED MANAGEMENT

Tutorials - Questions!?.

- Discuss the needs of water policy and components of an effective water policy.
- Describe the outcome of a successful watershed management policy.
- Discuss the National Water policy in India.

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We have already seen these details in the lecture. Describe the outcome of a successful watershed management policy. We have already seen the development of successful policy details. We have already seen the national water policy in India and we have seen various steps or various issues for government of India as far as national water policy is concerned.

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WATERSHED MANAGEMENT

Self Evaluation - Questions!.

- What are the important policy issues for successful watershed management?.
- Discuss water related Institutions, its roles & Administrative Structure in India.

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Some of the two self-evaluation questions are listed here. What are the important policy issues for successful watershed management? Second question is discuss water related

institutions, its roles administrative structures in India. So, these issues are also discussed in today's lecture.

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WATERSHED MANAGEMENT

Assignment- Questions?.

- Illustrate various water Legislations in India and its impacts.
- How to formulate an effective watershed policy?.
- Discuss about the necessity of an effective watershed policy for better watershed management practices.

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Few assignment questions like illustrate various water legislations in India and its impacts. How to formulate an effective watershed policy? Discuss about the necessity of an effective watershed policy for better watershed management practices. So, these issues can also be made as an assignment. Questions are listed here, but many of these issues have been discussed in today's lecture.

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WATERSHED MANAGEMENT

Unsolved Problem!.

- Develop a case study of watershed policy of a country by considering: Physical setting, watershed conditions and problems, History of watershed management, International trends, legislative framework, Institutional framework, challenges, strategies for policy implementation, financial aspects, implementation issues etc.

Hint: Check Watershed Policy of Jamaica:
<http://www.nrca.org/policies/DRAFT%20WATERSHED%20POLICY.pdf>

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As an unsolved problem, one may develop it as a case study of watershed policy of a country by considering: physical setting, watershed conditions and various problems, history of watershed management, international trends, legislative framework, institutional framework, challenges, strategies for policy implementation, financial aspects, implementation issues etc. Various case studies are available in the internet, for example, you can see a case study for Jamaica in this website. So, you can develop a case study by considering various issues.

Today, we have discussed the watershed development policy and then its formulation. Water policies is also an important issue, so various aspects of water policies are also discussed in today's lecture. With this, the first module on introduction and on watershed concepts and three lectures are over. So, you can see the various questions as listed in the self-evaluation tutorial assignments and then unsolved problems for the three lectures, you would have seen in the video. Now, we will be going to module 2 in the next lecture. Thank you very much.