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Pragyambu

cGanga
Centre for Ganga River Basin Management and Studies

The purpose of this quarterly digest brought out by the Centre for Ganga River Basin Management and Studies (cGanga) led by the Indian Institute of Technology Kanpur is to disseminate valuable traditional and scientific knowledge assimilated from national and international sources on various aspects of management of water and river restoration and conservation among concerned institutions and citizens.

Water and River Basin Management: A Cyclic Process

River Basin Management refers to the management of all natural and artificial structures and processes that are directly or indirectly connected to all water resources of the river basin. Apart from proper and sustainable use of water and water resources in normal times, the following points must be included in river basin management:

- Water security and water budget particularly in adverse circumstances.
- Conservation and development of aquatic and terrestrial flora and fauna in the entire basin area.
- Planning and management of issues like floods and droughts caused by rivers and waterbodies.
- Balanced use of water, land and forests to meet local and regional needs such as for food/agriculture, energy, transport and aquatic life.
- Formation of local River Basin Management Committees, and providing guidance to the Committees for works of river conservation under the leadership of eminent local representatives and with the cooperation of all stakeholders.

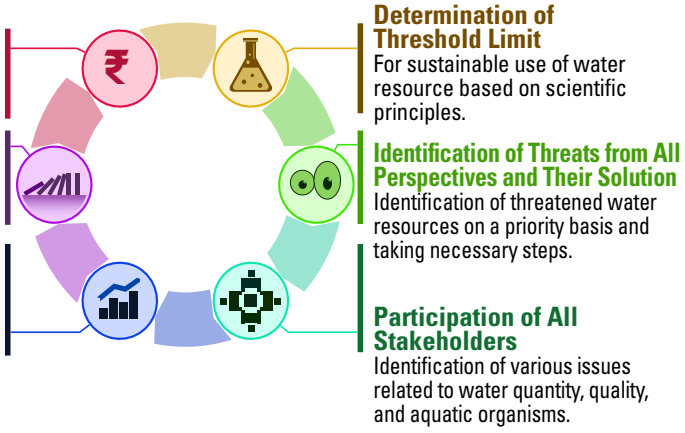

Figure 1: Water and river basin management - important task

Besides the above tasks, by seeking out solutions and setting targets to solve local problems on priority can make river basin management more effective. As shown in the above figure, all elements in the basin that have favourable or adverse effects on the river and related resources like water, land and forests should first be identified based on available information. On identifying all water, land and forest related-resources in the region, all concerned issues should be comprehensively and holistically analyzed and reviewed in consultation with concerned stakeholders. All problems and degrading/depleting resources should be identified and possible solutions should be found at the local level. With the help of subject and technical experts, conservation of nature should be studied with scientific rigour. It is also important to set limits for human use of the river and other resources of the area so that the continuous availability of tangible and intangible benefits of rivers can be ensured by keeping intact their innate qualities. For this, it is first of all necessary to prepare annual water budget for various uses with estimates of all natural and artificially incoming and outgoing water at the local geographical level. Based on this budget, the effects of other components in the river basin should be studied for their sustainable use.

Development and Impact on Water Sources

With the development and population growth of human societies, the exploitation and use of natural resources has also increased. In addition to excessive use of groundwater for production of essential food grains, water is also being abstracted from surface water sources, thereby creating an imbalance vis-à-vis dependence on natural rainfall inputs in a region. Besides, there have been changes in the quality, quantity, and locations of water availability due to many other artificial reasons, and the changes are becoming frequent. For sustainable development of human civilization, it is necessary to synchronize human development with the restoration and conservation of waterbodies in order to conserve vital resources like water.

River Conservation: Where to Start!

Even if human beings are concerned only about their own interest instead of bothering about the interests of rivers and aquatic life, it needs to be understood that, for rivers to be sustainable and useful, it is very important that the river basin is healthy. The saying 'the feet of a child are conditioned by its upbringing' seems accurate here, because the condition of any large river is determined by the conditions of the small rivers flowing into it. These small rivers not only form the big river but also inform the reality of the river basin. Therefore, it is necessary that the initiative of river conservation should be taken with conservation of these small rivers.

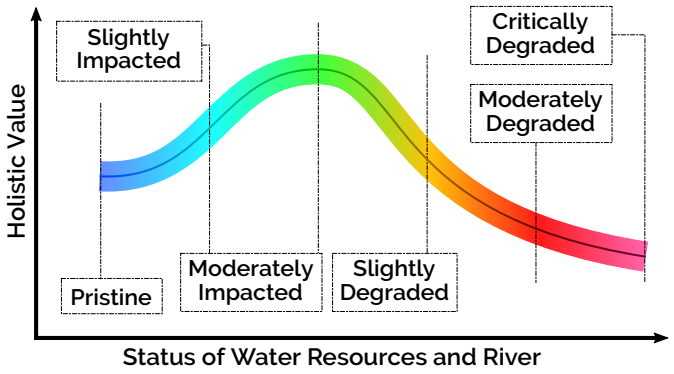

Figure 2: Change in holistic values of benefits from water bodies with their changing conditions

Arth Ganga, Resources Obtained from Rivers, and Human Impacts on Them

Arth-Ganga means the overall value of any river; these include tangible values – physical or economic (i.e. ecosystem goods such as water, sediment, nutrients, biodiversity, etc. and ecosystem services such as flood drainage, navigation, etc.) and intangible values (incalculable benefits such as aesthetic, mystical, spiritual and other timeless values), both of which must be suitably combined. The combined tangible and intangible values represent the overall value of any river which gives the true meaning of 'Arth-Ganga'. Out of the two types of river values, only tangible values can be calculated on human use or economic basis. Any healthy river, which has undergone only minor changes by human use, can have both tangible and intangible values. But if the river has degraded in any manner, then both these values will decrease. Thus intangible and tangible values are inter-related, and their maximum value cannot be achieved without river conservation.

River Restoration and Conservation

Rivers are not only a source of water and fertile silt, but over time they have also come to be used for energy generation, navigation, water sports for recreation and tourism, etc. In addition to all this, rivers provide essential goods and conditions needed by different types of ecosystems in the river basins. We now know that small rivers bring water and fertile soils to big rivers, it also needs to be understood that there are many aquatic animals that either come to a big river from small rivers or travel from big rivers to small rivers at some important times of their lives or during certain times of the year. Some species consider small rivers more important and safer for breeding and protection than large rivers at certain times. It is perhaps now even easier to understand why it is worthwhile and proper to begin river conservation efforts with primary units namely, the small rivers. With increasing industrialization and urbanization, small tributaries that flow through or near urban settlements often begin to deteriorate, which then gradually affect higher order rivers. These changes often have an adverse effect on rivers and waterbodies. In modern times the deterioration of rivers/ water resources has equally devastating consequences for humans. Unexpected floods, droughts and water-borne diseases are the most common problems. Due to the changing lifestyles of human beings and the increasing and changing pattern of water use, water resources have come upon increasing pressure, which compels us to consider optimum utilization of water resources. Restoration and conservation of rivers is of utmost importance in order to sustain the benefits of rivers and waterbodies for both the present as well as future generations.

Water Resources and River Conservation: A Cyclic Process

In considering river restoration and conservation, it is necessary to understand that the causes or factors underlying river degradation also have an effect on the lives of humans and other living beings; hence some of the following points need to be addressed in river conservation.

- To what extent can the importance or impact of artificial factors affecting rivers be reduced, and what should be the limits of river-derived benefits for sustainable conservation of rivers?
- What is the maximum possible change in the natural state of rivers to derive maximum tangible and intangible benefits sustainably from rivers?
- Economic development should be seen in synchronization with the conservation of river and water resources.

Restoration and conservation of rivers is an ever-changing process dependent on changing human needs, activities and developments.

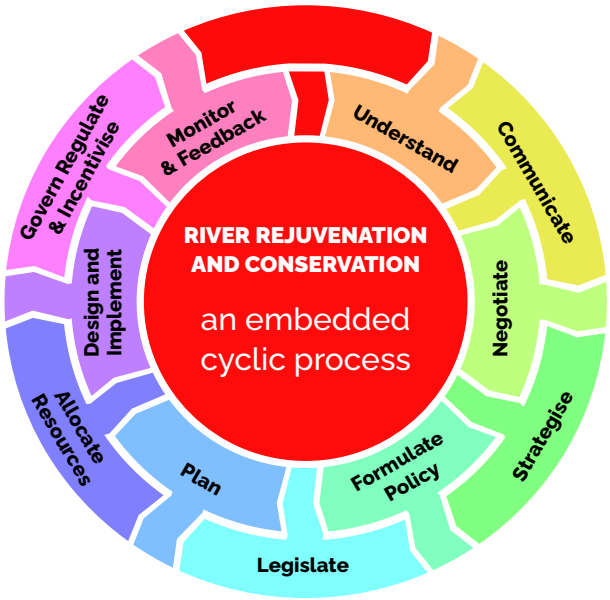

Figure 3a: River rejuvenation and conservation - An embedded cyclic process

Figure 3b: Various components of negotiation and trade-off

River conservation works are often decided informally without proper assessment. While initiating river conservation to achieve the right goals, understanding the complex impacts of river processes and human activities, and conveying this understanding to stakeholders through discussions and consensus, strategy and policy formulation – if necessary, by enacting legislation – suitable projects should be executed through appropriate resource allocation, planning, design, evaluation and feedback. As shown in the figure 3 a&b dialogue and negotiations with stakeholders is a very important step in the whole process. Expert knowledge, comprehensive discussions on the subject, identification of various options, effective discussions among stakeholders on the options, identification of stakeholder interests, and achieving consensus through extensive discussions and trade-offs are key components of the process. All these components together form a cyclic process that improves itself over time based on feedback from the previous cyclic process, new scientific knowledge, and understanding of new anthropogenic impacts on rivers.

Some of the Most Important Facts in The Cyclic Process are as Follows:

- Proper understanding of various issues related to rivers so that they can be easily explained to other stakeholders and appropriate issues can be discussed.
- Appropriate solutions to resolve contentious issues can be discussed dispassionately and impartially amongst all stakeholders, so that the proposed solutions do not serve only individual interests of any specific stakeholder at the expense of rivers.
- Various aspects of coordinating river conservation and necessary economic and regional development should be discussed.

The restoration of small rivers/ "nala"s (i.e. natural drains) brings timely economic, environmental, aesthetic and cultural benefits, and they influence large population groups. As discussed earlier in this digest, the revival of tributaries/ nalas can have a huge impact on the revival of higher order rivers in the basin. It is a bottom-up approach (building a perfect pyramid) that ensures stability as opposed to a top-down process (inverted pyramid). If the maximum basin area of a river lies in the plains, but a particular tributary comes from an upland area, then this tributary may probably be the only source of sediment supply needed by the main river and the flora and fauna in it. Thus, for the maximum possible use of any river, it is also necessary that all its tributaries should contribute their maximum. Rivers contribute continuously to the economic development of their downstream areas in ways such as providing water for irrigation, fertile lands, sand for construction, drinking water source, etc. To sustain this development it is necessary that the extent of the benefits derived from rivers through alterations in their natural state be fixed within certain limits.

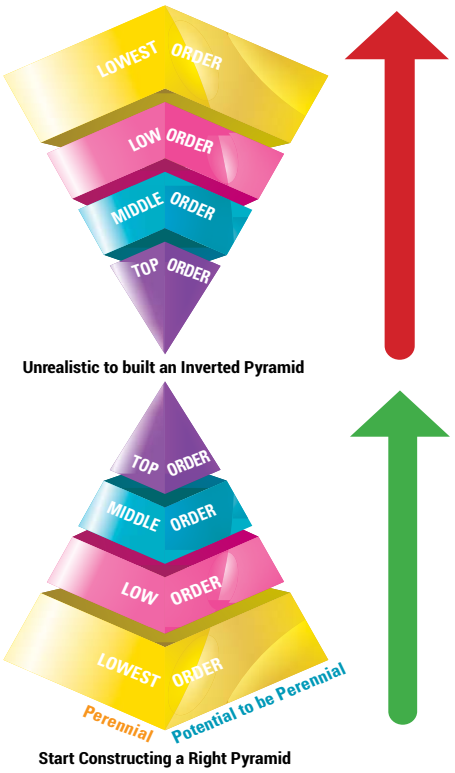

Figure 4: Identification of right and suitable approach (top-down and bottom-up) and its use

Implementation Mechanism for River Basin Management: Identification and Involvement of Stakeholders

The work of conservation and basin management of any river should not be a static process but should be adaptable to changing circumstances. The measures needed for identification and rectification of environmental problems related to river systems keep on changing according to the knowledge and resources existing at a given time. In formulating solutions, the opinions of various individuals, political leadership, social workers, dignitaries, religious leaders, scientific and technical experts, industrial organizations, government agencies, executive and other institutions, news media, and stakeholders, etc., always play decisive roles. Since they may all have their own individual interests, it is necessary to bring them on a single platform through negotiations and consensus so that appropriate decisions for river basin conservation can be made.

As far as possible, with the participation of all the above, a working group/ committee should be formed for the management of each river basin at the local level, which can complete some of the following major works on the basis of regional priority keeping river conservation in mind:

- Determination of the degree of river restoration and conservation to be carried out on the basis of all necessary data and information.
- Identification of factors hindering river conservation in the basin area.
- Identification of required water flows in the river, cross-sectional flow area of the river, and related water structures, fauna, morphology, etc.
- Determination of immediate and long-term goals of river conservation on a priority basis, and communicating that knowledge and concerned issues to common stakeholders and finding solutions consensually.

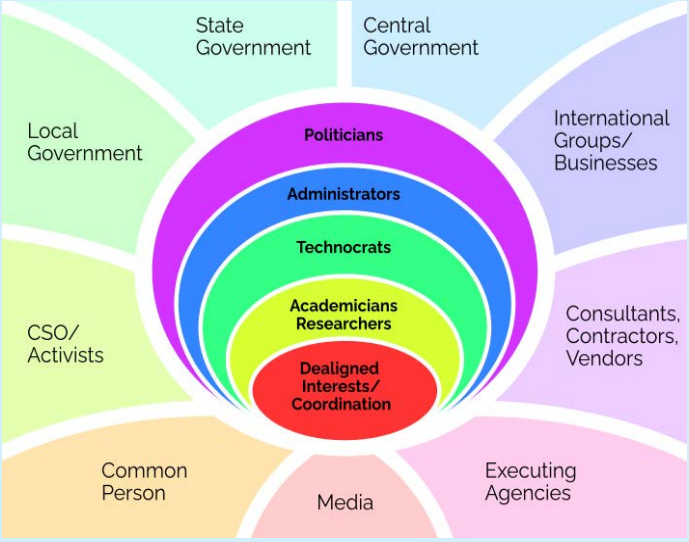

Figure 5: Identification of stakeholders and their role in water and river conservation

River Basin Management: Special Works to Reach the Goal

River basin management should be a continuous process in which some specific tasks may be suggested as follows:

Aviral Dhara (i.e. Continuous Flow): It is necessary to ensure the continuous flow of water, silt and other natural flow components in all perennial rivers or those rivers which can be made perennial. While determining the flows, it is essential to take into account all factors and the nature of aquatic life and the river. Regional water budget can play an important role in such flow assessment.

Nirmal Dhara (i.e. Unpolluted Flow): The water quality of a river is an essential factor for its biodiversity and the tangible and intangible benefits derived from it. Therefore, it is necessary to identify various pollution sources in the area and determine measures for their proper disposal.

Ecological Restoration: Immediate and effective steps should be taken to prevent loss of aquatic biodiversity due to anthropogenic causes. Many species have become extinct or are on the verge of extinction due to manmade or natural changes in the flow of water, water pollution, lack of necessary silt and soil, and loss of habitat and breeding sites.

Sustainable Agriculture: Modern farming methods and the use of chemical fertilizers and pesticides are the main reasons for poor soil fertility in most agricultural lands. In addition, the effects due to high water use in agriculture, irrigation systems, monoculture farming, etc. should be studied to find solutions based on the local water situation and other environmental and geographical conditions.

Geological Safeguarding: Changes in the geological integrity of rivers due to sand mining and other anthropogenic factors, excessive groundwater extraction, geological mining in the river basin, and construction of large dams and reservoirs, etc., necessitate suitable measures after studying their effects.

Basin Protection against Disasters: Efforts should be made for suitable protective measures during floods, droughts, heavy rains, forest fires, storms, landslides, etc. In this context, works for drainage of water-logged areas, removal of encroachments from flow paths, wetlands for flood protection and other possible uses, etc. should be carried out.

River Hazardous Management: In recent years, many river related disasters bear testimony to the fact that human disturbances have increased the intensity of these disasters and vulnerability of communities towards these. Hence it is necessary to identify hazards related to anthropogenic disturbances on rivers and to formulate suitable means to reduce the risk.

Environmental Knowledge Compilation, Dissemination and Sensitization: Necessary information and facts should be collected to study the water, land and biological resources and processes in the basin. In India, considerable information about water and water resources are available in ancient texts. With the proper combination of such ancient knowledge with modern science, possible environmental impacts in the basin should be studied and disseminated among common people. In this manner, awareness about river conservation will develop among the general populace. In this task, it is first of all very important to collect necessary data and information. Full assessment of the water resources of the area, their number, condition, relationship with each other, effects on them or their natural and artificial components and processes, etc., are very important.

GRBMP MAIN PLAN DOCUMENT AND OTHER SUPPORTING REPORTS

These all reports can be downloaded from cGanga and NMCG website

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