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Research Article

Planning for Sustainable Water Conservation in a Globalized Regional Framework to Balance Long-Term Vision with Short-Term Goals

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ABSTRACT

This paper investigates the efficiency and effectiveness of global trade and conservation, particularly regarding water resources, in light of the increasing frequency of floods and droughts and their impacts on ecosystems and human activities. Human actions, especially fossil fuel combustion, disrupt the thermal energy exchange between the atmosphere and space, contributing to global climate change. The rise in atmospheric carbon dioxide and other greenhouse gases due to human activity has intensified these effects on the Earth's atmosphere. The paper also assesses sustainable development strategies, focusing on the rise of environmental refugees caused by extreme weather events, including floods and droughts. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) primarily aimed to encourage industrialized nations to limit carbon dioxide emissions, a precursor to broader agreements such as the Kyoto Protocol and the Paris Agreement. These initiatives emphasizes global climate goals to limit temperature rise to 2°C by reducing fossil fuel use, promoting forest conservation and implementing sustainable development, land use planning and specific measures for flood and drought-prone areas. Additionally, this paper analyzes water conservation and development issues within the context of India's National Institution for Transforming India (NITI) Aayog policies, emphasizing both long-term and short-term strategies for mitigating droughts and floods. It offers a strategic approach to water resource planning that considers geophysical structures and fluvial processes along river basins, aiming to address conservation and sustainable development needs effectively.

Keywords: Renewable energy; Geographical; Global; Climate change; Flood prone; Drought prone

INTRODUCTION

Global concerns for climate change problems deliberated at Kyoto and Paris summit for environmental conservation and sustainable development programme are the indicators of growing concerns for regulating the environmental quality and sustainable development at all level of ecosystem to regulate the emission of greenhouse gas. UNFCCC is establishing the basic principle and goals for future agreement on climate change [1]. In 1992 adopted the United Nations Framework Convention on Climate (UNFCC) is incredible, ambitious remarkable international agreement to stabilized the global greenhouse gas concentration at level that will prevent the human activity under the interference of climate change in globalization [2]. Kyoto Protocol represent first agreement to reduction of global greenhouse gas emission under the regional frame work in globalization [3]. Many of the developing countries which followed centralized planning with socialistic objectives focused on centralized industrialization in post-colonial period. These countries neglected the traditional cultural values and agrarian civilization of the past, which was based upon preservation of life cycle in adaptive relationship with nature [4]. The rapid advancement of industrial civilization has significantly endangered global ecosystems, contributing to climate change, environmental disputes and widespread migration as communities are displaced by deteriorating environmental conditions [5]. The conflict between the trajectory of industrial growth and the need for a balanced ecosystem has highlighted the necessity of sustainable development. Economic strategies focused solely on Gross Domestic Product (GDP) growth are gradually being replaced by more inclusive frameworks that prioritize sustainability and human welfare [6]. However, policies and programs aimed at sustainability lack uniformity at both regional and global levels. Institutional priorities on trade expansion and industrialization often undermine environmental conservation efforts, impeding

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global climate change mitigation [7]. The predominant reliance on fossil fuels, which contribute substantial carbon emissions, remains a major principle of climate change. This emphasizes the urgent need for renewable energy sources and increased efforts to meet rising energy demands with sustainable alternatives [8].

Under deteriorating environmental conditions, the frequency of floods and droughts has risen, along with numerous other ecological disruptions affecting life cycles [4]. Historically, India's centralized planning emphasized the construction of large dams, primarily aimed at enhancing irrigation in specific regions [9]. While these structures provided localized irrigation benefits, the environmental costs of extensive mining and quarrying in resource-rich areas were largely overlooked [10]. Consequently, environmental degradation escalated, and efforts to restore ecosystems and manage water resources for mitigating floods and droughts were neglected. In areas vulnerable to these extreme events, responses have typically focused on immediate rescue, relief and rehabilitation as short-term solutions [11,12]. It was not until the 1980s that the watershed mission was introduced, marking the beginning of integrated water resource management a mission that continues to evolve [13,14]. These efforts have not made any significant impacts on the flood-prone areas along the major rivers and the tributaries in Himalayan and plains in Gangetic and Yamuna basins. Melting of ice as result of climate change in Himalayan and sub-Himalayan regions are result of continued deforestation and mining as result of neglect resource conservation in planning process [15].

The drought and floods are closely related with environmental changes in the resource region and are taking place in core periphery relation by the metropolitan core regions in centralized and globalization process. In view of degradation in geographical landscape along the river basins and integrated approach of water treaty and water sharing has been started with countries of Himalayan regions [16]. One of the approach was suggested for inter-basin water transfer between the flood-prone and drought prone regions on the basis of technical and economic feasibility [16]. In view of the above, the water resource management and planning would require spatial and temporal integration for different objective criteria of saving human and animal life, restoration of infrastructural facilities for as rehabilitation, reduction of flood and drought as planning and management activities, water management for integrated environmental, economic and social sustainability, conservation and developmental activities etc. [17].

The planning generally is perspective, structural and strategic planning in view of the many challenges and objectives in this paper, long- and short-term strategic planning is purposed at regional levels and national level. The institutional strategy of drought and flood management is to create regional and national level rescue and rehabilitation activities [18]. The drought and flood proofing would require integrated management of water resource in the river basins and the tributaries and would require large scale restoration activity of environmental balance, culturally sustainable development, prevention and regulation of developmental activities which affects local and regional environment [19].

MATERIALS AND METHODS

Regional planning approach

The regional planning approach for water resources were related to large scale dam and canal construction. Later, the programme was developed for watershed development since 1980 as Rajiv Gandhi water mission. The integrated water resource management advocates for the water resource conservation and development in geographical landscape in forest, grazing areas, agricultural areas and urban areas. This also refers to the creating water balance between ground and surface water. The inter-sectoral use of water resource as functional approach to water management for agriculture, industry, fishery, horticulture, recreation activities etc., created imbalance between rural and urban areas. Despite efforts to combat it, climate change continues to intensify, leading to the melting of glaciers and, consequently, an expansion of flood-prone and drought-prone regions. These two phenomena flooding and drought are interconnected effects of climate change, which have been exacerbated by widespread deforestation and extensive fossil fuel use tied to industrialization. In response, the Government of India has introduced various environmental, economic and social forestry programs aimed at creating a balanced relationship between the environment and human activity. However, increased mining activities, coupled with privatization and public-private partnerships, have emerged to meet the growing demand for resources needed for construction, dam building, road infrastructure and energy in the global market. This demand has unfortunately undermined the sustainability goals of forestry initiatives, including joint forest management programs.

The entire Himalayan and Northern plain is flood affected and severity of flood has increased and the problem continues in Ganga, Jamuna and Jhelum basin region. Therefore, an integrated water conservation and management Programme should be developed for flood and drought mitigation would require integration of forestry planning, water conservation, land use planning, regulation of mining and other quarrying activities, taking place in vulnerability sensitivity zone.

RESULTS AND DISCUSSION

Short term strategic planning for water conservation development

India faces a critical issue with the decline of traditional water conservation practices in both rural and urban areas. Traditionally managed by local communities, methods like traditional water tanks and village-level water management systems have largely been replaced by modern systems such as tube wells and hand pumps for water supply. Although various initiatives have been undertaken, such as recharging traditional water bodies, building dams, and constructing stop dams for watershed development, these efforts have often fallen short. Key factors hindering their success include deforestation, mining and wasteland formation, especially in forest areas. These environmental issues have had cascading effects on nearby agricultural regions, contributing to climate change impacts like droughts that affect environmental, economic and social stability. Integrated water conservation seeks to balance surface water and groundwater resources through various recharging techniques. However, rising demands for water from industrial and urban sectors exacerbate water distribution challenges between rural and urban regions. Water pollution is also a growing concern, as contaminants from industrial and urban areas enter lakes, rivers, and marine ecosystems. Additionally, the problems of floods and droughts have intensified environmental degradation, driven by unchecked urban expansion, resource extraction, and the decline in agricultural and livestock zones,

which are often relegated to the public sector with insufficient conservation focus.

To effectively manage droughts and floods within river basins, it's need to adopt integrated resource management and promote sustainable development across geographic landscapes. This approach involves implementing strategies that regulate water management both seasonally and annually. Conservation and development efforts should be prioritized through *in situ* mechanisms, while also creating inter-state and international cooperation as part of a broader *ex situ* strategy. A cohesive plan would include the integration of large dams with watershed development and localized conservation programs to enhance water resource sustainability and mitigate the effects of extreme weather events.

Short-term programme would include safety, relief, and rehabilitation activities in problematic areas. Advance meteorological information to farmers and policy makers are being provided for preparedness plan, the regional monitoring and management capacities need to be develop for mitigating the problem of drought and flood as shown in Table 1.

Table 1: Examples of extreme primary and secondary climatic events.

Primary climatic events	
Floods	Encompasses different types like riverine, rain-induced, storm, flash floods, and glacial lake outburst floods
Droughts	Various types including hydrological, meteorological, and agricultural droughts
Tropical cyclones	Includes hurricanes, typhoons and similar intense storm systems
Heatwaves and cold waves	Periods of extreme high or low temperatures
Coastal storms and surges	Severe storms along coastlines leading to elevated sea levels and storm surges.
Secondary events (potentially climate-driven)	
Malnutrition and hunger	Often due to infrastructure damage and issues with access to resources and employment
Disease outbreaks	The spread of diseases or epidemics following climatic events
Water shortages	Affecting both rural and urban areas, often exacerbated by distribution and equity issues
Agricultural failures	Includes failures in crop planting or harvesting
Landslides, mudflows and saline intrusion	Soil movement events and saline water penetration into fresh water areas, often triggered by climatic conditions.

Integrated water management in geographical landscape

Geographical regions in India have human habitation in developed adaptive systems with the natural resource and developed cultural, economic, and social architecture systems. Large scale of mining and deforestation through centralized planning has resulted in serious environmental issues and ecological degradation problems resulting in droughts and floods. Since water resources are one of the environmental resources, and integrated resource management would require for the restore all setting in environment.

Restoration of ecosystems equilibrium in regional framework: This will have needed forest conservation programme for ecological, social and at the same time economic forestry in geographic landscape.

- Launch intensive water shed development programme across all natural regions.
- International water treaty for integration water management in sharing of benefits in multipurpose development programme
- Economic and engineering-evaluated inter-basin water transfer as shown in Figures 1 and 2.

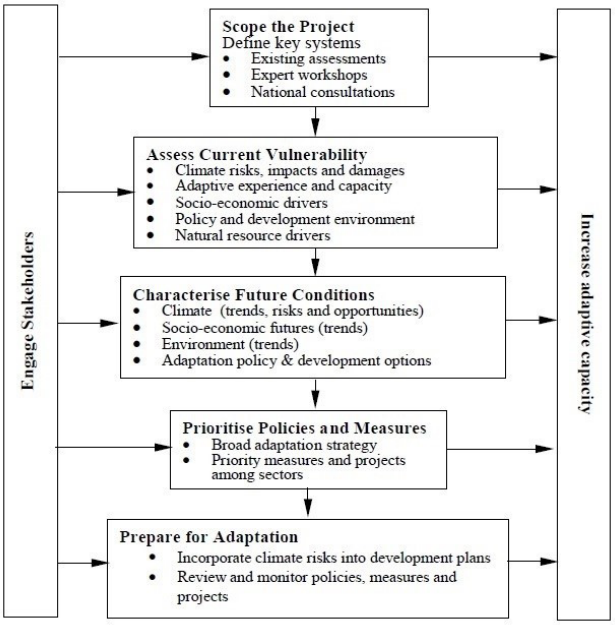

Figure 1: The adaptation policy framework or second generation frame work [1,12].

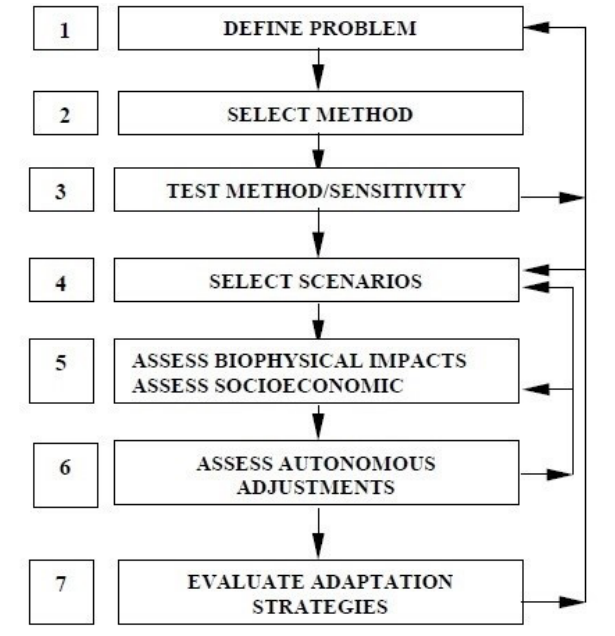

Figure 2: The seven impacts of climate assessment [12].

Integration of short, medium and long term water conservation programme

The government of India in cooperative competitive federalism has on the one hand provided greater autonomy to the states government and introduced long term transformational model of regional and national development all short-term programme are interlinked to the medium and long term programmers for economic, social, and environmental developmental goals and objectives. Since the recurring flood and drought conditions are caused due to prolonged neglect of environment conservation and development of agrarian region in centralized planning process, integration of agricultural, forest and mountain region would take longer duration for region economic, social and environmental development.

The decentralized planning programme in globalization will not successful unless agricultural regions developed and integrated with industrial development in India. For this water resource, conservation development is important for environmental, economic and social development programme. For this, the inter-basin linkages of river and sea basins would be initiated inter-basin trade transport corridors if the water resource conservation and development are initiated in integrated watershed development framework. A proper evaluation monitoring of micro, meso and macro watershed level plan and programme need to develop along with problems of floods in Himalayan and sub-Himalayan and coastal area suffering from cyclone etc.

CONCLUSION

The global concerns of climate change and water crises resulting from drought and floods indicate to a global phenomenon and hence its needs to planned at local, regional and global levels. Water as one of the integral part of the environment and development can be planned as short term, medium term, and long term planning strategies in system dynamic framework. The National Institution for Transforming India (NITI) Aayog has identify annual plan, strategic plan of three years and long term plan for fifteen years. These plans could be effective for resolution of local, regional, and national level planning by identifying the problems, cause and effect relationship and sustainable resource use and development in spatial and temporal dimensions including inter-sectoral demand for water at region and national levels. The drought and flood is serious problem of different region in India that effect of human and natural physical environment and loss of economic in agricultural sector. The government and other non-government agencies take a long term planning for major vulnerable regions in India that effected drought and flood natural climates. The planning must be practical graphed and effective in vulnerable regions of India. Fossil fuel burning is primary source of carbon dioxide emission on the atmosphere and other gases. The use of energy is necessary for life cycle of human. Removing these gases after the burning is technical challenge for the scientist, engineer and other technical staff.

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