

## Chapter 9

# Integrated River Basin Management: Lessons Learned from the Nepal Himalaya

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### Abstract

Water and watershed resources have been degraded due to population growth combined with unplanned urbanization, industrial growth, and inappropriate farming systems worldwide. An effective, efficient, and holistic management system is crucial for reversing the degradation. In the Himalayan landscape, integrated river basin management (IRBM) could play an important role, especially due to the topographical challenges and governmental structures, and inconsistencies between hydro-physical boundaries and administrative boundaries. In Nepal, since early 2005 several studies have been carried out on basin-level management. However, the Government of Nepal adopted a basin-level management approach for implementing IRBM only after 2017, a few years after federal restructuring. This paper aims to review the progress made in the political, legislative, and institutional arenas for the implementation of IRBM in Nepal. The study is based on policy analysis and a literature review. It highlights that Nepal is in the preparatory phase of establishing a legal-institutional framework for IRBM and lacks proper institutional mechanisms for translating the principles of IRBM to actions on the ground. The chapter identifies the strengths and gaps in existing institutional arrangements and sheds light on the practical aspects of IRBM implementation, which would be useful learning for the countries aiming to implement IRBM in similar landscapes globally. Based on the study, it is concluded that an integrated approach based on collaboration among the different tiers and sectors of government is essential for implementing IRBM and ensuring the sustainability of water resources.

### Keywords

Institutions; IRBM; Policy; Resources; Watershed Management

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## 1. Introduction

Management approaches related to water and watersheds have undergone substantial changes in the last few decades (Gleick, 2000). The focus has shifted from political-administrative boundaries to transboundary hydrological boundaries (Giakoumis and Voulvoulis, 2018). Water resource management approaches that focus on administrative boundaries rather than hydro-physical boundaries are ineffective and non-inclusive (Easter, Dixon and Hufschmidt, 1991). The common approaches to water resource management include integrated water resource management (IWRM), integrated river basin management (IRBM) or integrated catchment management (ICM), and integrated watershed management (IWM) (Bach *et al.*, 2011; Mitchell and Hollick, 1993).

Among the various approaches to water resource management, IRBM is gaining widespread popularity in recent decades (Jewitt, 2002). IRBM seeks to focus on implementing water resource management on the basis of better coordination amongst operating and water management entities within a river basin (Karki, Shrestha and Winiger, 2011). IRBM secures an integrated, participatory, and coordinated approach to planning and managing the natural resources of the river basin with due consideration of multiple environmental, social, and economic nexuses in a catchment/watershed setting (Hooper, 2005). IRBM considers the management of naturally functioning river ecosystems with the integration of policies, and wider cross-cutting interests agreed upon by all major stakeholders' active participation and strategic decision-making through well informed, coordinated, and transparent process (Evers, 2016; WWF, 2002).

Globally, discussions on the need for integrated water resource management gained momentum after the Dublin Statement on Water and Development at the 1992 International Conference on Water and Environment (ICWE, 1992; Pangare *et al.*, 2006). The need for the river basin approach emphasizing IRBM became clear as water became a finite and vulnerable resource in the context of climate change and changing institutional arrangements (Eastham *et al.*, 2008; Song *et al.*, 2010). This approach focuses on using an integrated approach considering not just the water within the system (Dinar, 1999), but also the entire range of users and drivers and also adapts the principles of IWRM to a river system, thus considering the river (or lake) basin as an integrated whole (Pegram, Li and Quesne, 2013).

The application of the IRBM approach is being identified and practiced via enabling environment, institutional arrangements, and management instruments (Kattelus, 2009). The Global Water Partnership (GWP) promotes IRBM through the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (Abdel-Magid and Ahmed, 2002). Presently, the Water Resources Policy has been drafted by different international communities and countries (Meinzen-Dick, 2007) with the objective of obtaining the maximum social, environmental, and economic benefits from the available water resources at the basin level by adopting the principle of IWRM (Gooch and Stålnacke, 2010).

Water resource management in the Himalayan landscape is being increasingly challenging (Mukherji *et al.*, 2015) than in other parts of the world due to the unique geographical features, coupled with climate change, land-use change, and demographic diversity (Lepcha, Pandey and Ranjan, 2021; Tyler and Fajber, 2009). The activities and processes in the upstream areas have marked consequences in downstream areas (Tiwari and Joshi, 2012) and there is a need for particular attention to the linkages (Nepal, Flügel

and Shrestha, 2014). IRBM is being more significant due to the integration of processes and impacts driven by topography in the process, and for supporting all the Sustainable Development Goals across the 2030 Agenda aligned with water sustainability (Silva *et al.*, 2020; Shivakoti, 2021).

National water policies, strategies, and legislation adopted by many Asian nations have been aligned to promote water resources management at the river basin scale (Molle and Hoanh, 2011). Along with other Himalayan and Asian countries, Nepal has also shown growing interest in watershed management over the last few decades (Fleming, 1983). The formation of river basin organizations (RBOs) at multiple tiers such as local, national, as well as transboundary can be considered as an important attempt to set up an institutional structure to execute policies, acts, regulations, and laws related to water resources management in an integrated way (Shivakoti, 2021). Nepal, being a Himalayan mountainous landscape has also started to implement IRBM by setting up different plans policies, and legislative bodies. The IRBM approach has been applied with a legal and institutional instrument with different names such as basin commissions, catchment councils, river basin management centers (RBMCs), public RBOs, and corporate RBOs, among others (Clausen, 2011; Hooper, 2005; ÖlundWingqvist and Nilsson, 2015; Selek and Selek, 2020).

In Nepal, the concept of IRBM has gained increased attention recently (Pradhan *et al.*, 2014) after federal restructuring in the year 2015. In Nepal, various laws and bylaws are being revised to align them with the spirit and provisions of the new Constitution promulgated in 2015 (Upadhyaya, 2019). Also, a high-level committee chaired by the forest minister was formed in 2017 to coordinate river basin management approaches, and four river basin management committees (RBMCs) were established (Paudel, Pal and Dhimi, 2019). Political support, legal instruments, and sufficient financial and human resources (Gourbesville, 2008) with good water governance (Tortajada, 2010) are important for managing water resources in a holistic, equitable, efficient, and sustainable manner (Global Water Partnership, 2000). Establishing proper institutional mechanisms can help ensure integration, participation, coordination, and collaboration in river basin management (European Commission, 2002; Franzén, Hammer and Balfors, 2015). Several legal provisions required for initiating basin management have been introduced and related institutions have been formed to address issues of water-resource management-related conflicts (Suhardiman *et al.*, 2018) and develop interrelationships among water, soil, and land use in Nepal (MoFE, 2021). Nepal has performed with a slower working speed than its neighboring countries (Pradhanang and Tamanna, 2020). However, still, a number of acts and regulations are expected to be formulated sooner at the local and provincial levels to implement and execute IRBM to its full potential.

In this context, this chapter aims to review the progress made in the legislative and institutional arenas for the implementation of IRBM in Nepal. It further briefly identifies the concerned institutions in water resource management and tries to shed light on the practical aspects of IRBM evolution in Nepal. These experiences, steps, and lessons learned can be useful resources to policymakers who are attempting to implement IRBM in their country.

## 2. Key Features of IRBM

The IRBM approach is aimed at promoting the sustainable use of water in a river basin (Barrow, 1998). The river basin is a well-defined hydro geographical zone delineated by the topographical system, comprising surface and subsurface water, drained into a

common outlet (Teodosiu, Barjoveanu and Teleman, 2003; Wester and Warner, 2002). IRBM has been defined and used in diverse ways over the last century (Watson, 2004). In the words of the World Wildlife Fund for Nature (2002), IRBM is defined as 'the process of coordinating conservation, management, and development of water, land, and related resources across sectors within a given river basin, to maximize the economic and social benefits derived from water resources equitably while preserving and, where necessary, restoring freshwater ecosystems. IRBM has occasionally been applied as a method for strengthening ecosystem amenities with greater representation of wider stakeholders and maximizing the return benefits basin network (Cai, Marston and Yingchun, 2015).

The IRBM approach requires institutional provisions that ensure participation, coordination, and collaboration at the river basin level (Andersson, Petersson and Jarsjö, 2012; Franzen *et al.*, 2015). The approach seeks to build synergy between policies, programs, and practices (Burns *et al.*, 2001) related to water and river basins in order to protect the environment (Karki, Shrestha and Winiger, 2011). The key principles of IRBM should form the basis of relevant legal and institutional structures and guide every stage of operation – from planning to evaluation – of IRBM programs (Andersson, Petersson and Jarsjö, 2012; European Commission, 2000). Although IRBM programs may vary according to the context of each country/region, there is a wide agreement on the fundamental principles of IRBM. The IRBM safeguards the continuity of natural resources and ecological services. Discussions on IWRM normally propose the river basin as a logical unit for conducting water management interventions (Newson, 1997); as a subset of IWRM, IRBM focuses on integration at all levels (Chenoweth, Malano and Bird, 2001).

Top-down institutions that operate from a distant center are inappropriate for river basin management. Besides, a solo entity cannot address conflicts over water resources within a community and the pressure faced by water sources in river basins (Molle *et al.*, 2007). It is important to harmonize efforts to conserve, manage, and develop water, land, and associated resources in a particular river basin. Such integration is necessary for ensuring the equitable distribution of financial and social rewards for the sustainable use and management of water resources and for preserving essential freshwater ecosystems (Global Water Partnership, 2000).

Other key features of IRBM include the harmonization of different activities related to water resource management and the decentralization of decision-making power across central, provincial, and local levels (Molle and Hoanh, 2009). Participation of local communities and stakeholders enhances resource management in the river basin, resulting in better planning and implementation (Carr, 2015). Therefore, public consent, acceptance, and full participation of concerned stakeholders must be emphasized (Dungumaro and Madulu, 2003). Likewise, sensitization and awareness-raising, institutional capacity enhancement, and the use of suitable techniques should be incorporated to support public participation (Ahmed, Mokhtar and Alam, 2020; Elfithri, Mokhtar and Zakaria, 2019; Poppe, Weigelhofer and Winkler, 2018).

IRBM normally requires collaboration among multiple stakeholders across several spatial and temporal scales in a river basin (Lim *et al.*, 2022; Surr ridge and Harris, 2007). Such collaboration is necessary for the effective provisioning of resources, social mobilization, and technical services (Hooper, 2005; Panten *et al.*, 2018). Along with the physical and operational aspects of water and land management, IRBM considers water diplomacy and transboundary cooperation, governance and institutional stakeholders, gender, and other socio-economic drivers of change (Nepal *et al.*, 2019).

Although there is no rulebook for successful IRBM, the aforementioned elements are crucial, together with good governance, justice, accountability, and information sharing for regulating the approach (Kerr, 2007; Korkmaz, Alkan and Altunbaş, 2009). The concept of IRBM can address existing challenges such as the degradation of land and water resources, ever-increasing conflicts over the use of resources, and lack of coordination among relevant actors. It is an important tool for managing supply and demand or the allocation of resources to different sectors, and for establishing strong upstream-downstream linkages across the river basin.

### 3. Global Approaches to IRBM Implementation:

Realizing the importance of IWRM, many governments in the world have adopted the IRBM approach as a promising management approach. When a river passes from the headwaters (upstream) to the floodplains (downstream), it connects different bio-physical elements of a river basin, thereby creating physical and socio-cultural interlinkages. Globally speaking, discussions on the need for integrated water gained momentum after the Dublin Statement on Water and Development at the 1992 International Conference on Water and Environment. They focused on reforming institutional arrangements for enhanced coordination between the sub-sectors at a national level over a geographical scale and setting up institutional arrangements for managing water and related resources.

Similarly, UN-Water (2008) prepared a status report on the integrated water resource management, and water efficiency plans for the Commission on Sustainable Development 16 (CSD16). The report highlights that in the developed nations, 6 out of 27 (22%) countries have fully implemented national IWRM plans whereas 10 (37%) have plans in place and have partially implemented them. In the case of developing countries, 17 (22%) out of 77 countries, partially executed IWRM plans, and an additional 2 countries (3%) have fully implemented these plans.

Since, IWRM can be applied to a particular location, whereas IRBM looks at the whole basin including full ranges of scales from location to basin level, IRBM is gaining attention and is in the phase of implementation in different parts of the globe at different scales has shown promising results (Boekhorst *et al.*, 2010; Mokhtar *et al.*, 2011; Song *et al.*, 2010). Such as the implementation of this IRBM framework led to substantial improvements in the Liao River Basin (Leendertse, Mitchell and Harlin, 2008). Pollution loads have been reduced by 60% and the quality of river water has improved considerably. Similarly, in Colombia, after the IWRM approach was implemented for the conservation of La Cocha Lagoon at a local level, threats to the lagoon and surrounding wetlands were reduced (Lynch *et al.*, 2016). Likewise, there have been success stories of IWRM from Sri Lanka, the USA, China, and other parts of the world (Fulazzaky, 2014; Jianping and Haizhou, 2015; Moore, 2021).

### 4. Methodology

In this paper, we reviewed available literature on IRBM and investigated current policy frameworks to understand IRBM practices and possible pathways in Nepal. In order to accomplish this, three broad steps were taken. As a starting point, all institutions with a shared goal of water resource management under the government of Nepal were identified through informal discussions with other key stakeholders. In the second step, all relevant

policies, legislation, plans, and program documents were gathered and reviewed (Table 1). The documents were gathered by visiting the institutions and meeting with the heads of departments and ministries. Several documents were accessed from the official websites of government institutions. As a third step, we collected and reviewed the various journals, newsletters, and infographics produced by different government departments and non-government organizations and referred in this article. There was an effort to ensure that all documents related to water, water resource, watershed, catchment, and river basin are prioritized and not overlooked.

Table 1: List of documents reviewed (within Nepal)

S. No.	Reviewed documents	Number
1.	Constitutions of Nepal	1
2.	Strategies	2
3.	Policies	6
4.	Plans	15
5.	Acts	8
6.	Rules and regulations	11

Additionally, expert consultation (n=10) was done with the professionals working in the sector of water, forest, and land resource management at different provincial governments and local governments to gain a better understanding of the issues and challenges. Since water resource management is concerned with multidisciplinary areas of conservation and development, we selected 5 experts from the government sector (federal government = 1, provincial government = 2, local government = 2), 2 from INGOs, 2 from civil society actors and 1 from media having an experience of more than 3 years in this sector. The questions were open-ended conversations inclined to understand the personal observations with the existing plans, policies, and water resources management policies in Nepal. It helped to understand mechanisms, lesson learned and the way forward. Also, during the literature review process, the activities launched by the different boards and conservation partners, and their coordination with the Government of Nepal was closely observed. The full titles of the documents (Strategies, policies, plans, acts, rules, and regulations) reviewed are presented in tabular form (Tables 2, 3, 4 and 5).

## 5. IRBM Approach in Nepal

Indigenous communities across Nepal have been managing water and watersheds in their habitats for generations. The traditional approach of watershed management involved managing land, water, biota, and other resources in a defined area for harnessing ecological, social, and economic benefits (Bogati, 1997). Although water management practices may vary across communities, their goal has always been conservation and effective management of the river basin. Examples of such practices include – protecting and maintaining the cleanliness of the wetland '*chisapan*' area; construction and continuation of the recharge '*aahal*' area; planting of the pipal (*Ficus religiosa*) near a spring; and the community-based water allocation and diversion system '*paalo baadney*' (Sharma, Bajracharya and Sitaula, 2009). Although not documented in scientific papers, these practices were widespread and passed down orally over generations. Integrated watershed



management (IWM) approaches practiced at watershed level has increased land cover, supplied benefits to nearest communities and reduced number of disasters (Thapa, Chaudhary and Dasgupta, 2022). Policy and programme level interventions in water management were implemented after the third Five-Year Plan (1965-1970). Watershed management activities started formally in Nepal with the formation of the Department of Soil Conservation and Watershed Management (DSCWM) under the Ministry of Forests and Environment (MoFE) in 1974. Several policies, acts, regulations, and institutions have been established for managing water and watersheds in Nepal as described in following sections.

### *5.1 Existing Plans/Policies/Strategies that support IRBM*

Since the formation of the Water and Energy Commission Secretariat (WECS) in 1975, Nepal has launched various efforts to manage its river basins. Based on the recommendation from the WECS and other studies about water resource management, the government realizes the importance of IWRM, and internalized its program in subsequent periodic five-year development plans of the country (Khanna *et al.*, 2016). Table 2 shows the different sectoral policies related to basin management. Forest policy is the master policy for forest, soil and water conservation, biodiversity, and watersheds. Forest policy envisions the management of soil and water through a participatory and integrated approach that promotes coordination and linkages between upstream and downstream communities (MoFE, 2019). National Water Resources Policy 2020 seeks to bring economic prosperity and social transformation by using water resources according to the river basin plans. Similarly, Hydropower Development Policy 2001 focuses on hydropower generation. Both policies consider the whole river basin as the unit for the management and use of water resources, an essential concept in IRBM; these policies are implemented by the Ministry of Energy, Water Resources, and Irrigation (MoEWRI). Other policy interventions from the government include the irrigation policy 2013, climate change policy 2019, and wetland policy 2012 which have embraced the importance of integrated water resource management for sustainable development.

National Water Plan 2005 is one of the important documents developed by WECS, adopts IWRM as a principal component, and envisions the establishment of powerful river basin institutions. Similarly, Water Resources Strategy 2002 recognizes the need to manage water resources in an integrated and sustainable way through a participatory approach. National Water Supply and Sanitation Sector Policy 2014 aims to address water supply and sanitation issues – an essential part of IRBM – in both rural and urban areas. Irrigation Policy 2013 envisions that irrigation projects shall be guided by the principle of IRBM. In 2015, Nepal promulgated a new Constitution providing for a multitier government structure namely federal, provincial, and local government (Adhikari, 2021). The government seeks to promote holistic management of land and water resources as well as provide multiple benefits of water to communities. The government also aims to address climate and water-induced disasters through an integrated watershed management approach. Meanwhile, IRBM has been adopted as a conceptual framework for water resources planning and management worldwide (UNEP, 2012; UN-Water, 2008; Van der Zaag, 2005).

Table 2: Policies, plans, and strategies related to the water sector in Nepal

<i>Policies/Plan/Strategy</i>	<i>Key provision on water management</i>	<i>Ministry/Department</i>
Hydropower Development	Hydropower generation	MoEWRI

Policy 2001		
Water Resources Strategy 2002	Access to sufficient water and sanitation	WECS
National Water Plan 2005	Management of water resources on a basin-scale rather than on a project scale	WECS
National Wetland Policy 2012	Wetlands management	MoFE/DNPWC
Irrigation Policy 2013	Sustainable irrigation	MoEWRI/ Department of Water Resources and Irrigation (DWRI)
National Biodiversity Strategy and Action Plan 2014-2024	Payment for Ecosystem Services (PES) in selected sub-watersheds	MoFE/Department of National Parks and Wildlife Conservation (DNPWC)
National Water Supply and Sanitation Sector Policy 2014	Drinking water supply and sanitation for rural and urban areas	MoEWRI
Forest Policy 2019	Forest, watershed, biodiversity	MoFE
National Climate Change Policy 2019	Climate change adaptation through integrated watershed management	MoFE
National Water Resources Policy, 2020	Achieve economic prosperity and social transformation by using water resources according to river basin plans	MoEWRI
The Constitution of Nepal	Provisioned as fundamental rights	Government of Nepal (GoN)

### *5.2 Evolution of Watershed/Basin Management in National Plans*

In Nepal, periodic plans for national development are prepared and implemented along with other sectoral plans. Since the 1956, several periodic development plans have been formulated and implemented in the country. The National Planning Commission (NPC) is mandated by the GoN to formulate national periodic plans (Table 3) for the nation's development.

During the Fourth Five-Year Plan (1970-1975) period, the Department of Soil and Water Conservation (DoSWC) under the Ministry of Forest was established in 1974. Likewise, the Fifth Plan (1975-1980) envisioned a massive erosion control program to implement soil and watershed conservation and education programmes nationwide. During the Sixth Five-Year Plan period (1980-1985), Soil Conservation and Watershed Management Act 1982 and Regulations 1985 came into existence. After this, the Seventh Plan (1985-1990) made the mandatory provision of environmental assessment for development projects and during that period the environment division was established in the DoSWC. During the Ninth Plan (1997-2002) period, an integrated watershed management approach was envisioned. Then consecutively, the Tenth (2002-2007), Eleventh (2007-2010), Twelfth (2010-2013), and Thirteenth plans (2013-2016) highlighted that soil and watershed

management programmes would be designed using a basin approach across the country. The Fourteenth Plan (2014-2019) has envisioned inter-watershed water diversion using surface, subsurface, and groundwater for irrigation, hydropower generation, dry land management, and climate change management through a basin approach. The development process became more complex in the last 20 years as the development paradigm shifted from a focus on economic growth to human, societal, and environmental development. Similarly, an approach paper for the Fifteenth Plan (2019-2024) states that the policy and plans shall be prepared for four major river basins, and an integrated watershed management approach shall be used for disaster risk minimization and water management.

Table 3: Nepal's periodic plans and evolution of watershed /basin management approach

<i>Periodic Plan Year</i>	<i>Provisions related to the watershed, water, and environment in policies/plans</i>
1965-1970 (Third Plan)	Importance of soil and water conservation recognized;
1970-1975 (Fourth Plan)	DoSWC established, in 1974.
1975-1980 (Fifth Plan)	Regional development concept in SCWM introduced; Fourteen WM projects implemented; Concept of integrated WM formally introduced; River training work continued.
1980-1985 (Sixth Plan)	River control work transferred to the Ministry of Water Resources; Soil Conservation Act 1982 and Regulations 1985 passed; Environment Impact Study Project 1980 implemented under DSCWM.
1985-1990 (Seventh Plan)	Twenty-Five-Year Master Plan for the Forestry Sector endorsed with SCWM as a priority programme.
1992-1997 (Eighth Plan)	Expansion of the number of SCWM offices in the country (District offices established).
1997-2002 (Ninth Plan)	Nepal Environment Protection Action Plan 1998 endorsed SCWM as a priority; 45 permanent and 10 temporary district soil conservation offices established.
2002-2007 (Tenth Plan)	Emphasized Churia/Siwaliks, people's participation, and integrated watershed management. SCWM programmes through a basin approach nationwide.
2007-2010 (Eleventh Plan)	Execution of watershed improvement activities mentioned in the National Water Resources Strategy and the National Water Plan. Upscaling of SCWM initiatives countrywide.
2010-2013 (Twelfth Plan)	River basin management approach for integrated conservation and management of watersheds. Integrated Chure watershed conservation plan preparation, upstream-downstream linkage for watershed management at a landscape level.
2013-2016 (Thirteenth Plan)	Basin approach for watershed management in large rivers, water disaster control.
2016-2019 (Fourteenth Plan)	Inter-watershed water diversion using surface, subsurface, and groundwater. Dryland management and climate change adaptation through watershed management, basin approach continued.

2019-2024 (Fifteenth Plan)	Integrated watershed management plans for river basins namely Koshi, Gandaki, Karnali, and Mahakali to be prepared and implemented.
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### 5.3. Provisions for Water and Watershed Management in Existing Acts

Nepal has no separate Act regarding IRBM, but the IRBM concept is reflected in many legislative documents in the country. Nepal has been amending and revising the legal framework to better manage water and the environment. Existing laws in Nepal can be categorized into following five main categories.

1. Constitution
2. Statutes/Act
3. Rules and regulations
4. Policies
5. International treaties/conventions
6. Formation orders
7. Others(guidelines/circulars)

Primary legislation such as Acts, and Regulations are formed in the parliament and executed by the GoN. There are several Acts concerning the management of water, land, forest, environment, and other natural resources (Table 4).

Table 4: Major Acts related to water and water resources

<i>Acts</i>	<i>Key provision on water management</i>	<i>Ministry/Department</i>
Soil and Watershed Conservation Act 1982	Watershed management, Disaster risk reduction	MoFE/DoFSC
Electricity Act 1993	Water as a main source of hydropower	MoEWRI, DoED
Water resource Act 1993	Management and utilization of water resources	MoEWRI/DoWRI
Local Self Governance Act 1999	Water source, environment and sanitation, irrigation, and river training	Ministry of Federal Affairs and General Administration (MoFAGA)
Solid Waste Management Act 2011	Environment and waste management	MoFAGA
Disaster Risk Reduction and Management Act 2017	Relief from water-induced disasters	(Ministry of Home Affairs) MoHA
Local Government Operation Act 2017	Drinking water supply, watershed conservation	MoFAGA
Environment Protection Act 2019	Assessment of development activities and water pollution	MoFE/Department of Environment (DoE)
Forest Act 2019	Watershed, water cycles and watershed services	MoFE/DoFSC

Currently, there are nine Acts (Table 3) with some provisions for watershed management. These Acts include the Electricity Act 1993, which considers water as a main

source of hydropower and states that negative impacts on water sources should be minimized. The MoEWRI is responsible for implementing this Act. Forest Act 2019 regards watershed services as part of ecosystem services, and development activities are prohibited in erosion-prone areas. Soil and Watershed Conservation Act was endorsed in 1982 and it envisions integrated watershed management as the main approach for water and soil conservation, but this Act has been dormant for the last 25 years. Water Resource Act was enacted in 1993 to protect, manage and utilize surface and subsurface water sources. The Act prohibited activities that would have adverse effects on water and the environment and may trigger soil erosion, flood, and landslides. Environment Protection Act was formulated in 1993 for the protection of the environment with proper use and management of natural resources. Under this Act, projects that may have adverse effects on the environment must carry out an Initial Environment Examination (IEE) and an Environment Impact Assessment (EIA) prior to commencement.

#### *5.4. Provisions on Water and Watershed Management in Existing Regulations*

Table 5 presents the rules and regulations related to the water and water resource management sector. These rules and regulations elaborate on the provisions of related Acts. They cover the protection of aquatic animals, rainwater harvesting, pollution control, drinking water, irrigation system, water flow and use, and soil conservation and management. Similarly, Shivpuri Nagarjun National Park Rules 2019 also highlighted that water sources from the national park are affected by excessive extraction and need to be conserved. In this regard, payment for use of water resources has been envisioned in the Rules, and the Park administration is to monitor the implementation of the provision.

Table 5: Rules and regulations related to the water sector in Nepal

<i>Rules/Regulations</i>	<i>Key provision on water management</i>	<i>Ministry/Department</i>
Aquatics (Contract) Rules 1962	Water or Aquatics Contract, Protection of Aquatic animal	Ministry of Agriculture and Livestock Development (MoALD)/Department of Agriculture (DoA)
Water Resources Regulation 1993	Water resource management	Ministry of Water Supply (MoWS)
Environment Protection Regulation 1997	Sets standards for pollution control	MoFE/Department of Environment (DoE)
Drinking-Water Rules 1998	Drinking-Water supply, Maintain quality of water	MoWS/ Department of Water Supply and Sewerage Management (DWSSM)
Local Self Governance Regulation 1999	Water-related plan and project implementation	Ministry of Federal Affairs and General Administration (MoFAGA)
Irrigation Rules 2000	Irrigation system, Surface water/ Groundwater	MoEWRI, Department of Irrigation (DoI)

Mountaineering Expedition Rules 2002	Environment protection, pollution control	Ministry of Culture, Tourism and Civil Aviation (MoCTCA)/ Department of Transport (DoT)
Mines and Mineral Matter(1 <sup>st</sup> Amendment) Regulation 2003	Mines and minerals extraction, water flow and use, surface, groundwater	Ministry of Industry, Commerce, and Supplies (MICS) / Department of Mines and Geology (DMG)
Rafting Rules 2013	Water entertainment/travel	MoCTCA
Soil and Watershed Conservation Regulation, Amendment 2013	Soil and water conservation (SWC)	MoFE/DoFSC
Shivpuri Nagarjun National Park Rules 2019	Payment for the use of water resources from national parks and buffer zone	MoFE/DNPWC

### 5.5. Consortium, Participatory Approach for Conservation

The active involvement of people is a key component of water resource management in Nepal. Participation of locals, primary stakeholders, and government/non-government organizations plays a huge role in the implementation of the IRBM concept in Nepal (Sharma *et al.*, 1997). The government has also introduced policies to support the role of the public/private sector in hydropower development. The Community-Based Water Resource Development and Management (CBWRDM) programme is being carried out in different locations; however, it is implemented at the local level scale such as in the Durlung watershed (Khanna *et al.*, 2016).

Likewise, the non-government sector has made some effort to promote the concept such as FAO, WWF, IUCN, ICIMOD, WaterAid, and other organizations are actively promoting the concept of IRBM. Past donor-funded projects on improving watershed management include the CARE International funded Begnas Tal-Rupa Tal (BTRT) Watershed Management Project, Swiss/German funded Tinau watershed project, European Union funded Bagmati watershed project, the ADB-funded Building Climate Resilience of Watersheds in Mountain Eco-Regions (BCRWME) projects in West Seti and Budhi Ganga watersheds, JICA supported Participatory Watershed Management and Local Governance Project (PWMLGP) (Achet and Fleming, 2006; Kayastha, Bjracharya and Shrestha, 1997; Fleming, 1983; Suelzer and Sharma, 1986). However, these projects were short-lived. Effective and long-term implementation of the IWRM/IRBM approach requires a more robust approach (Suhardiman, Clement and Bharati, 2015).

Several projects have adopted IRBM approaches in Nepal. Koshi River Basin Management Project (KRBM) piloted the IRBM approach in 2009 to operationalize the National Water Plan 2005. Initiated by WECS in association with WWF Nepal, this project aims to make optimum use of water and related resources from the Koshi basin for socio-economic development while maintaining ecological balance. Bagmati River Basin Improvement Project (2014-2021) was initiated by the GoN for improving the river environment and managing floods. ICIMOD in collaboration with the Department of Forests

and Soil Conservation (DoFSC) has promoted integrated river basin management through the Koshi Basin Initiative (2018-2021).

### 5.6. Shift in the Water Resource Management Approach to IRBM

Earlier, water resources/watershed management programmes used a top-down approach that focused on managing a small portion of the river basin. Figure 1 shows how the approach to resource conservation has shifted over time, and how the strategy and policy for water resource management have been changing according to the needs of present times and the changing global context. Water resource management encompasses different aspects of IRBM. To promote the concept of the IRBM, Nepal is shifting from a site-specific micro-watershed management approach towards a broader scale river basin management approach that involves multitier governments and stakeholders related to the river basin within the country and sometimes transboundary institutions as well.

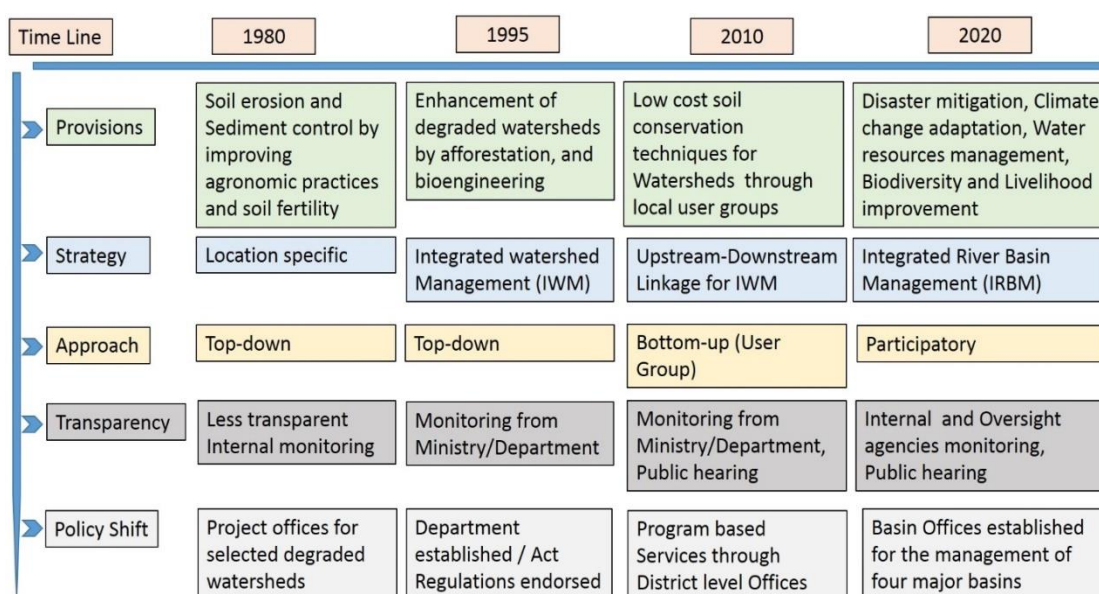


Figure 1: A paradigm shift in water resources/watershed management in Nepal

### 5.7. Current Organizational Structure and Arrangement for IRBM

The Constitution of Nepal 2015 is the overarching legislation guiding the conservation, management, and use of environmental resources including water in the country. The constitution mentioned the need to reduce poverty and promote shared prosperity through the holistic management of natural resources of the river basin (*Clause 51 of the Constitution*). The Constitution has ensured the separation of powers among the three tiers of government (federal, provincial, and local) for the formulation of policy and the use, safeguarding, and management of available water resources (Gautam and Kumar, 2019).

In general, we have identified several central, provincial, and local level institutions working on the common theme of water resource management is presented in figure 2 in a hierarchical position. This study has not presented their detailed role and responsibilities but only presented the way they are linked and share information with the central government. Ministries, departments, provincial government, local government, commissions/boards, and conservation partners exchange the information produced or collected in vertical and horizontal ways among each other and with the central

government (Shown by the two-way arrow in figure 2). The sectoral entities submit the data to the higher authorities and the respective higher authorities are responsible to compile the data to make the meaningful information (Shown by one way arrow in figure 2). In this context to coordinate several organizations the National Development Action Committee (NDAC) chaired by the Prime Minister, at its 39<sup>th</sup> meeting in 2017, decided to form an authorized High-level committee chaired by the Minister of Forest and Environment to look after river basin management approaches. The high-level committee further formed a technical committee consisting of the Joint Secretary of the NPC (as the chairperson) and representatives from various ministries and departments to prepare an approach paper on IRBM (GoN/NPC, 2017). NDAC and the High-level committee were chaired by political personnel. The technical committee was formed to include the experts and specialists in the field of water resource management to study IRBM and recommend the High-level committee for decision-making about IRBM policy and programs.

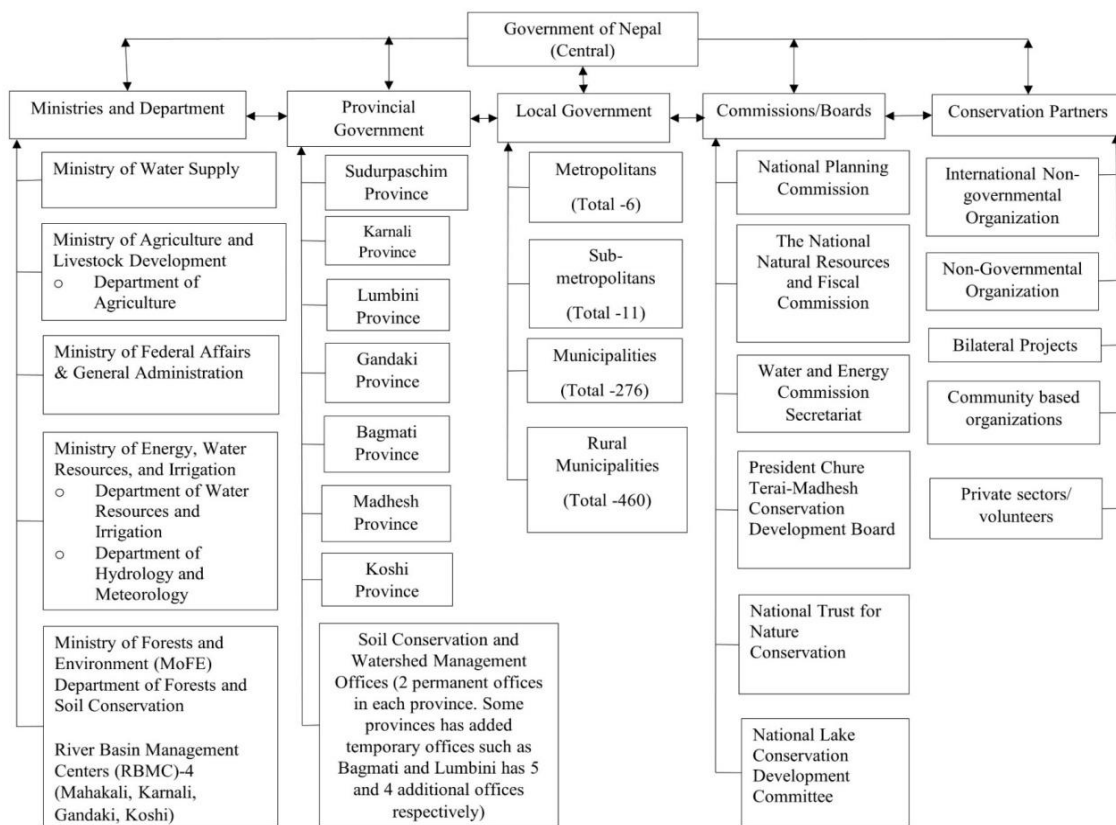


Figure 2: Various institutions related to water resource management and data/information sharing direction to their higher authorities

More specifically, in this context, by the Federal government, under the MoFE, four river basin management centers (RBMC) have been established to carry out targeted interventions in the large river systems of Nepal, namely Koshi, Gandaki, Karnali, and Mahakali (Table 6, Figure 3) (GoN/OPMCM, 2018).



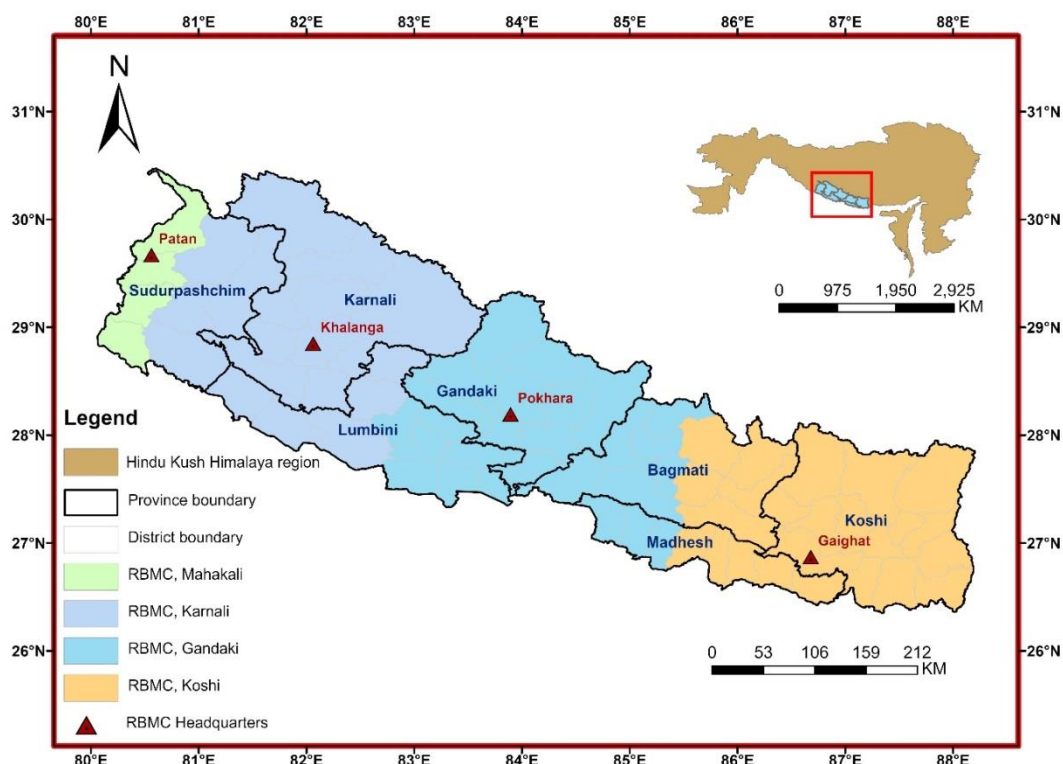


Figure 3: River Basin Management Centre (RBMC) working area and provinces boundary in Nepal

These Basin Management Centers (BMCs) are mandated to carry out watershed management interventions using a river basin approach. For this, they have to coordinate and collaborate with the line agencies. The BMCs are supposed to generate data related to watershed management, provide technical assistance to state ministries, and facilitate basin management issues in interprovincial affairs. They are currently organizing awareness programs, holding workshops and seminars, and preparing plans for the river basins in collaboration with the central government and conservation partners working in the respective basins. The unit for carrying out their interventions is the sub-watershed. However, these institutions lack sufficient human and financial resources for addressing complex problems as they have a large working area starting from 68.69 sq. km in the Mahakali basin to 55,328.61 sq. km in the Karnali basin.

Table 6: River Basin Management Centre's working area and districts covered

<i>Working area</i>	<i>Headquarters' location</i>	<i>No. of districts covered</i>
Basin Management Centre, Koshi (42,090.90 sq. km)	Udayapur, Gaighat	24 districts
Basin Management Centre, Gandaki (43,399.86 sq. km)	Kaski, Pokhara	28 districts
Basin Management Centre, Karnali (55,328.61 sq. km)	Jajarkot, Khalanga	21 districts
Basin Management Centre, Mahakali (6969.46 sq. km)	Baitadi, Patan	4 districts

*Note:* The area of the Basin Management Centre is calculated based on information provided by the local level portal of MoFAGA and includes fringe areas of independent sub-basins

## 6. Issues, Challenges, and Lessons Learned

Nepal is starting to adopt the IRBM approach for water resource management, but various challenges remain. Government programs in the water sector are fragmented and implemented by different institutions, departments, and offices. There is a lack of a holistic approach for carrying out IRBM activities, and different ministries have different policies on river basin management. During the federal restructuring, the hydro-physical boundary was neglected to define local units' and provincial units' boundaries. These boundaries are serving as a territorial and administrative demarcation that was based on political decisions to capture certain resources and include certain actors. But the river basins are intersecting these administrative boundaries and extend beyond political boundaries requiring institutions not only at the provincial level but also at the national level and transboundary level. This further necessitates coordination among various institutions and stakeholders for their active participation in the planning and implementation of water resource management interventions to achieve IRBM objectives as mentioned by Clement, Suhardiman and Bharati, 2017. Likewise, there are many departments/ministries working on the same water and related natural resources; so, it seems necessary to establish a powerful authority to coordinate multi-provincial water resource management issues in a holistic way. The focus should now shift from the formulation of plans and policies to carrying out institutional reforms from the central to local level for effective water resource management. A proper feedback loop mechanism from the local level to the central level has not been set up yet. The River Basin Management Centers have recently been established and their functions have been defined but they lack sufficient human as well as financial resources to function and operate at the river basin level.

## 7. Conclusion and A Way Forward

The IRBM is a broad framework for the management of water and watershed resources. This paper shows how Nepal is moving towards the IRBM approach as the country has shifted from the unilateral system to the federal system. It highlights three major points. First, practices of water resource management are changing with time and demand an integrated approach that can ensure the participation of various stakeholders in all phases, from planning to implementation, as well as coordination and collaboration. Site-specific interventions and fragmented development activities only deteriorate the quality of the river basins rather than ensuring the sustainability of water resources. The IRBM approach is a promising approach, and it needs to be carefully implemented to improve the management of watersheds and thus enhance the livelihood, achieve prosperity, and create resilient communities. Second, the implementation of IRBM demands a great degree of political will along with well-resourced institutions. The Basin Management Centers, if empowered with strong policies and adequate resources, could be the best option for implementing the IRBM approach in Nepal. Third, after federal restructuring, local and provincial governments have gained the right to make their own policies and legislation. And there could be some conflict of interest in water resource management as the

administrative boundaries do not follow the hydrological boundaries. Diverse legislative authorities govern the management of water resources and basins through different ministries and departments. So, a powerful authority is needed to bridge the relations among local, provincial, and federal governments for sustainable management of water resources. Resource management efforts in Nepal have yet to realize the full potential of the IRBM approach. However, with adequate political will, resources, and collaboration at all levels, IRBM could help ensure the sustainability of the river basins as well as improve the livelihood of communities. The lessons learned from Nepal will be helpful for other countries that are aiming to implement IRBM in their countries.

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## About the Author(s)



**Prakash Singh Thapa** is currently pursuing a Ph.D. in Ecosystem-based Solutions for Disaster Risk Reduction (Eco-DRR) at Ishikawa Prefectural University, Japan. He holds a master's degree in forestry from Tribhuvan University, Nepal and was honored with a Gold Medal from the Rt. Honorable President of Nepal for his outstanding academic performance. Concurrently, he serves as an Under-secretary in the Department of Forests and Soil Conservation under the Ministry of Forests and Environment, Government of Nepal. He has earned nearly 15 years of experience as a Government Officer in various facets of expertise, including Forest Management, Reducing Emissions from Deforestation and Forest Degradation (REDD+), Soil Conservation & Watershed Management, and Springshed Management. He recently achieved noteworthy milestones as a project coordinator for two watershed initiatives: "Landslide Prevention and Stabilization of Slopes in the Most Earthquake Affected District of Nepal," carried out in collaboration with the Government of Nepal and FAO TCP/NEP/3601; and "Building Resilience to Landslides through Support for Community-Based Rehabilitation and Mitigation Actions and the Establishment of Early Warning Systems in Nepal," executed in partnership with the Government of Nepal, FAO, and USAID OSRO/NEP/602. These endeavors were undertaken in response to a significant earthquake in Nepal. Mr. Thapa's contributions extend to scholarly pursuits, reflected in his publication record encompassing articles in national and international journals concerning forestry and watershed management.



**Sunita Ranabhat**, from Nepal is working as Provincial Coordinator at the JICA funded Project for Climate Change Adaptation through Sustainable Forest Management in Nepal. She brings more than 10 years' experience in the sector of forest and ecosystem services, climate change adaptation and policy analysis. She has published articles on national and international journals. Ms. Ranabhat holds B.Sc in Forestry from Institute of Forestry, Tribhuvan University Nepal and M.Sc. in Forest Sciences and Forest Ecology from University of Göttingen, Germany.



**Kishor Aryal** is a PhD researcher in ecosystem services from the University of Southern Queensland (UniSQ), Australia. He has done two master's degrees, one from Wageningen University of The Netherlands and another from Tribhuvan University of Nepal. Throughout his career, he has received various fellowships for research and training (i.e., NUFFIC Scholarship, UNEP fellowship, Australian Government RTP scholarship). He has co-produced 26 peer-reviewed articles in international refereed journals (21 of them in Q1 journals & 17 of them as the lead author), and few more articles are under review. He won the Student Publication Excellence Award in 2023 and was awarded as the 'Featured Student' in 2021 at UniSQ. He has been involved in research and teaching programs in various subjects at UniSQ. He taught into B.Sc. Forestry courses for 3 years at the Kathmandu Forestry College and served the roles of training officer and technology extension officer for the government of Nepal. Further, he has worked for ICIMOD (an inter-governmental research organization of 8 Hindu-Kush Himalayan Countries) as a researcher. For the last 15 years, he has been working with the Government of Nepal, and is equipped with policy and practical knowledge and experience in environmental science and ecosystem management. He has a unique capacity to operationalize the science-policy

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**Bindu Ghimire** is pursuing her Ph.D. specializing in investigating the cause and effect of the Bagmati River's (independent sub-basin) as well as its tributaries' slumping condition in central Nepal. Her research addresses the impacts of the deterioration in water quality of Bagmati river on both livestock and human populations. Her academic pursuits are based at Nepal's Tribhuvan University where she is serving as associate professor since 2017. She has dedicated herself to imparting knowledge to and guiding graduate students through this capacity. She is conversant on wide range of topics, including climate change, livelihood and health. A solid grounding in environmental microbiology combines alongside with this wide-ranging expertise. She has played a significant part in contributing to numerous published articles and book chapters.



**Kabi Raj Khatiwada** is an environmental graduate, specializing in climate change, water resources, and greenhouse gas assessment. He employs modeling tools and climate data products for the analysis, interpretation, and visualization of climatic and biogeological information at various scales. He is passionate about understanding the changing climate and the different components of the water cycle, watershed management, future scenarios, and climate induced disasters. His experience includes working as a water resource analyst at the esteemed ICIMOD, where he was extensively engaged in responsibilities encompassing

promotion of sustainable watershed management, the analysis of hydrometeorological data, and assessments of water balance dynamics. Additionally, he has conducted training sessions for professionals from both governmental and private sectors, educating them on the effective utilization of data for policy formulation and decision-making. Through these engagements, he has fostered comprehensive information on the intricate interplay between water systems and the surrounding environment.