सत्यमेव जयते



स्प्रिंग की प्रथम गणना रिपोर्ट

First Spring Census Report

Volume II

Bihar, Karnataka, Kerala, Ladakh, Sikkim, Tamil Nadu

भारत सरकार

GOVERNMENT OF INDIA

जल शक्ति मंत्रालय

MINISTRY OF JAL SHAKTI

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA REJUVENATION

First Census of Springs

Volume II

Bihar, Karnataka, Kerala, Ladakh, Sikkim, Tamil Nadu



Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation

सी आर पाटील
C R Paatil



सत्यमेव जयते

जल शक्ति मंत्री
भारत सरकार
Minister of Jal Shakti
Government of India

Message

Springs play a vital role in local communities, providing essential resources for drinking water, irrigation, and livestock care. Beyond their practical importance, springs hold cultural and spiritual value, often regarded as sacred by the local populations. However, overexploitation and the impacts of climate change threaten the sustainability of these water sources. Protecting and restoring springs through community-driven management and scientific interventions is crucial to ensuring water security and maintaining the delicate ecological balance of mountainous regions. Springs are not only natural resources but lifelines for both biodiversity and humanity.

To effectively manage these vital resources, it is essential to establish a systematic database and implement periodic monitoring. Such data is invaluable for the development of springshed management projects and for advancing scientific understanding of spring systems. Since 1986-87, the Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, has been conducting a Minor Irrigation (MI) Census under the centrally sponsored scheme 'Irrigation Census. Six MI censuses have been completed, with the first Census of Water Bodies conducted in convergence with the 6th MI Census during the period 2019-2022.

In light of the growing need for springshed management to enhance water recharge and increase water yield in mountainous regions, the Ministry of Jal Shakti is undertaking the first-ever nationwide Spring Census. This census will encompass all springs across the country, with geo-tagged data collected digitally. This ambitious initiative is critical for safeguarding the nation's water resources and ensuring future water security.

I extend my sincere congratulations to the Minor Irrigation (Statistics) Division, DoWR, RD&GR, Ministry of Jal Shakti, for bringing out this highly useful and comprehensive document in collaboration with the scientists of the National Institute of Hydrology, Roorkee and technical support from NIC.

This State-wise report for six States/UT namely Bihar, Karnataka, Kerala, Ladakh, Sikkim and Tamil Nadu will serve as a foundational reference for policymakers and implementing agencies to ensure the effective planning and execution of springshed management interventions in these States.

I am confident that this report will benefit State and Central Government Departments, academic and research institutions, non-governmental organisations, and other stakeholders, and will contribute significantly towards the conservation and rejuvenation of these pristine water resources, thereby ensuring their sustainable flow for future generations.

C R Patil

C R PAATIL

जल शक्ति अभियान
संचय जल, बेहतर कल

Office : 210, Shram Shakti Bhawan, Rafi Marg, New Delhi-110 001
Tel: No. (011) 23711780, 23714663, 23714200, Fax : (011) 23710804
E-mail : minister-jalshakti@gov.in

डॉ. राज भूषण चौधरी
Dr. Raj Bhushan Choudhary

सत्यमेव जयते

जल शक्ति राज्य मंत्री
भारत सरकार
नई दिल्ली-110001
MINISTER OF STATE FOR JAL SHAKTI
GOVERNMENT OF INDIA
NEW DELHI - 110001



Message

Springs are the lifeline of the people residing in the mountainous regions of our country and approximately 200 million Indians, constituting around 15% of the country's population, depend on springs for their daily water needs. These springs are widely distributed across the mountainous areas, nourishing countless small and large streams that support the growth of civilization, agriculture, industry and economic activities in our nation. Protecting and restoring springs through community-led management and scientific interventions is crucial for water security and ecological balance in mountainous regions. Springs are vital not just for human use but also for biodiversity.

Recognizing the importance of springs for water as well as ecological security, now the Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD & GR), Ministry of Jal Shakti, Govt. of India has placed these traditional water resources as highest priority for sustaining the sources across the country. However, it has been observed that non-availability of basic scientific data on these traditional water resources are the major causes due to which springs could not receive due importance in the policy and planning. Therefore, the development of a scientific database and further identifying the vulnerable springs, becomes imperative for managing water requirements for various developmental and household needs.

To address the need for improved springshed management and enhanced groundwater recharge, the Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD&GR), Ministry of Jal Shakti, Government of India, successfully undertook the first nationwide Spring Census. This landmark initiative has generated a comprehensive, geo-tagged database of springs across the country and represents a significant step towards safeguarding India's water resources and strengthening long-term water security.

The completion of the First Spring Census is the result of months of dedicated and sustained efforts by the officials of the Minor Irrigation (Statistics) Division and the scientists of the National Institute of Hydrology, Roorkee. I congratulate the Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, for conceptualising and implementing this important programme and for bringing out this State-wise report for six States/UT namely Bihar, Karnataka, Kerala, Ladakh, Sikkim and Tamil Nadu which will serve as a valuable reference for State Governments and implementing agencies in planning and executing springshed management interventions in these States.

(Dr. Raj Bhushan Choudhary)

215, श्रम शक्ति भवन, रफी मार्ग, नई दिल्ली -110 001, 215, Shram Shakti Bhawan, Rafi Marg, New Delhi-110 001
दूरभाष : (011) 23708419, 23718759, Tel. : (011) 23708419, 23718759
ई-मेल/E-mail : mos-mowr@nic.in

व्ही. एल. कान्ता राव, भा.प्र.से.
सचिव
V. L. KANTHA RAO, IAS
Secretary

सत्यमेव जयते

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION



FOREWORD

Springs are the visible expression of groundwater and constitute the primary source of drinking water for millions of people living in the mountainous regions of India, including the Indian Himalayan Region, Western Ghats, Eastern Ghats and Central Indian highlands. These springs support domestic needs, river baseflow, biodiversity and local livelihoods. However, climate change, population pressure, deforestation and unplanned development have severely impacted their recharge zones, leading to drying and seasonal behaviour of many springs. Despite their importance, springs remained inadequately documented and insufficiently integrated into water resource planning due to the absence of a systematic database.

Recognising this critical gap, the Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD&GR), Ministry of Jal Shakti, Government of India, accorded high priority to spring conservation and launched the First Spring Census with technical guidance from the Steering Committee on Springshed mapping and management. The Ministry has published a brief report presenting results of first Census for six States/UT Bihar, Karnataka, Kerala, Ladakh, Sikkim and Tamil Nadu who completed their Census work in time-bound manner. This State-wise report is an important outcome of that effort and provides a robust scientific basis for planning and implementing springshed management interventions in these states.

I commend the officers of DoWR, RD&GR and the experts associated from NIH, Roorkee with this initiative for their sustained efforts in completing this pioneering exercise. I am confident that this report will serve as a key reference for State Governments and implementing agencies and will significantly strengthen evidence-based policy, scientific planning and coordinated action for conservation and rejuvenation of springs, thereby contributing to long-term water and ecological security in mountainous regions of the country.

(V. L. Kantha Rao)

श्रम शक्ति भवन,रफी मार्ग, नई दिल्ली-110 001 / Shram Shakti Bhawan, Rafi Marg, New Delhi-110 001
Tel. : 011-23710305, 23715919, Fax : 011-23731553, E-mail : secy-mowr@nic.in, Website : http://www.mowr.gov.in

PALLY KUNDU
Additional Director General
Minor Irrigation (Stat.)

सत्यमेव जयते

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION



Preface

Recognizing the increasing concern over springs depletion, a Working Group of NITI Aayog emphasized the need for a systematic national inventory and mapping of springs. A national inventory is essential to assess the current status of springs across the country, identify vulnerable and critical springs, and ensure their protection during infrastructure development and expansion activities. It would also enable the preparation of robust, actionable Detailed Project Reports (DPRs) for the effective implementation of Springshed Management Programmes in the future. Measurement and mapping of springs constitute the first and most critical step toward conserving this vital resource, particularly in the context of unplanned construction and climate change–induced hydrological variability.

Keeping in view the strategic importance of springs in ensuring water security in mountainous regions, the Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD&GR), Ministry of Jal Shakti, initiated the first-ever Springs Census in the country. The 1st Springs Census has been undertaken, along with the 7th Minor Irrigation (MI) Census and the 2nd Census of Water Bodies under the Centrally Sponsored Scheme "Irrigation Census".

The objective of the Springs Census is to generate reliable, standardized, and geo-referenced data on springs across the country to support evidence-based planning, scientific springshed management, and informed policy formulation at the State and National levels. On the occasion of World Water Day, I am pleased to release the glance report of the 1st Census of Springs for early-completing States and a Union Territory—Bihar, Karnataka, Kerala, Ladakh, Sikkim and Tamil Nadu. All the data captured through an Android-based mobile application and managed through a centralized web platform control at the Block, District, State, and Central levels.

कमरा नं. 2, दूसरी मंजिल, बी विंग, लोक नायक भवन, नई दिल्ली–110003
Room No. 2, 2nd Floor, B Wing, Lok Nayak Bhawan, New Delhi-110003
ई–मेल / Email: adg-mowr@nic.in, टैलीफोन/Phone : 011-24691080

I take this opportunity to place on record my appreciation for the cooperation extended by the State Governments, nodal departments, field staff, and all stakeholders associated with the conduct of these censuses, and especially the sincere, honest, and laborious efforts put in by the officials of NIC, MI (Stat) Wing (Ms. Priyanka Kulshreshtha, DDG, the then Director, Shri Pavan Kumar, Ms. Vineetha O.K., Jt. Director, Ms. Deepika Verma, Jt. Director, the then Dy. Director, Dr (Ms.) Anshika Bhatnagar, Niharika Singh, Dy. Director, Shri Sahil Ghanghas, ASO, Shri Sandeep Kumar, ASO) and officials from National Institute of Hydrology, Roorkee (Dr. Soban Singh Rawat, Scientist 'F', Dr. Deepak Singh Bisht, Scientist 'C' and Shri Sumit Kumar, Project Scientist 'II') and Shri Anoop Sharma from Velosis.

(Pally Kundu)

Table of Contents

Sl. No.	Chapters	Page No.
1.	General Background	**1-3**
2.	Methodology for 1st Census of Spring	**4-5**
3.	State wise Census Report	**6-38**
	3.1 Karnataka	**7-12**
	3.2 Ladakh	**13-17**
	3.3 Sikkim	**18-22**
	3.4 Tamil Nadu	**23-28**
	3.5 Kerala	**29-33**
	3.6 Bihar	**34-38**
	Annexure-I - Questionnaire	**39-42**
	Annexure-II – Scrutiny Checks	**43**
	Annexure-III – Validation Checks	**44**

Chapter 1

General background

1.1 Background

Springs, defined as natural discharge points of groundwater emerging at the surface, constitute a critical water source in the mountainous regions of the country. These springs provide drinking water, domestic supply, and livelihood support to a substantial segment of the population. The dependence is particularly significant in the Indian Himalayan Region (IHR), the Western Ghats (Sahyadri range), the Eastern Ghats, and parts of Central India including the Satpura and Vindhhya ranges.

As per the estimates of the Working Group constituted by NITI Aayog in its report titled "Inventory and Revival of Springs in the Himalayas for Water Security" (2018), 15 percent (about 200 millions) of the country's population relies directly or indirectly on spring water to meet its water requirements.

Consequently, the 23rd Report (2022–23) of the Parliamentary Standing Committee on Water Resources urged the Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD&GR) to take necessary measures for revival and sustainable management of springs in the mountainous regions of the country, where a significant population depends exclusively on spring water for drinking, domestic, and agricultural needs.

DoWR, RD&GR constituted a steering committee on "Springshed Mapping of Indian Himalayan Region (IHR) Including Mountainous Regions of the Country and Springshed based Watershed Management Plan" to expedite the springshed management work in the country. The Committee assessed the existing framework for springshed management in the country and identified the absence of a systematic mechanism, uniform formats, and standardized techniques for spring and springshed mapping as the primary constraint. To address this critical gap, the Committee prepared a Resource Book on "Springshed Management in the Mountainous Regions of India", which serves as a technical guidance document for agencies and departments undertaking spring and springshed mapping across the country.

1.2 Importance of Springs in Mountainous Regions

The strategic importance of springs in these regions underscores their role in sustaining water security, ecological balance, and rural livelihoods. In hilly and mountainous terrains, human settlements are predominantly located along ridgelines due to strategic, safety, and climatic considerations. Rivers generally flow through deep valleys, while glaciers and other perennial sources lie at higher elevations, making water abstraction from such sources technically challenging and economically unviable.

Under these conditions, local springs function as the primary, and often the only, source of water for drinking, domestic use, and at some extent for agricultural activities for mountain populations.

Springs also play a crucial role in sustaining baseflows of rivers during lean seasons, thereby maintaining downstream hydrological regimes. It is widely acknowledged that a substantial proportion of rivers in mountainous regions derive a part of their dry-season discharge from spring-fed systems. Consequently, springs constitute a critical natural asset for ensuring water security and mitigating scarcity in mountain ecosystems.

1.3 Need for Spring Mapping

Recognizing the increasing concern over spring depletion, Working Group–I of NITI Aayog emphasized the need for a systematic national inventory and mapping of springs. Such an inventory is essential to assess the current status of springs across the country, identify vulnerable and critical springs, and ensure their protection during infrastructure development and expansion activities. It would also enable the preparation of robust, actionable Detailed Project Reports (DPRs) for the effective implementation of springshed management programmes in the future.

The rationale for spring mapping is guided by the principle that "what is not measured cannot be managed." Accordingly, measurement and mapping of springs constitute the first and most critical step toward conserving this vital resource, particularly in the context of unplanned construction and climate change–induced hydrological variability.

1.4 Launch of the First Spring Census

In view of the strategic importance of springs in ensuring water security in mountainous regions, the Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD&GR) launched the first-ever Spring Census of the country. The Spring Census was undertaken concurrently with the 7th Minor Irrigation (MI) Census, the 2nd Census of Water Bodies and first census of Major Medium Irrigation Projects under the Centrally Sponsored Scheme "Irrigation Census" with the reference year 2023–24.

The objective of the Spring Census was to generate reliable, standardized, and geo-referenced data on springs across the country to support evidence-based planning, scientific springshed management, and informed policy formulation at the State and National levels. The First Spring Census was conducted entirely in digital mode, with auto filled State/District/Sub-District (Development Block) / village LGD codes in the mobile app of the enumerator. The hierarchy used in LGD codes is State/ District/ Sub District (Development Block)/villages in rural area and State/ District/ Town/Ward in urban area. The data was captured through an Android-based mobile application and

managed through a centralized web platform control at the Block, District, State, and Central levels.

The mobile and web applications for the Spring Census were launched by Shri C. R. Patil, Hon'ble Minister of Jal Shakti, on 03 April 2025.



Fig. 1.1 Launching of the Web and Mobile Applications for the 1st Census of Springs by the Hon'ble Union Minister and the Hon'ble Minister of State for Jal Shakti

1.4 Definition of a Spring

A spring is a focused discharge of naturally occurring groundwater on the Earth's surface. In general springs can be seen either as a free flow or seep spring.



Fig. 1.2(a) Free flow spring

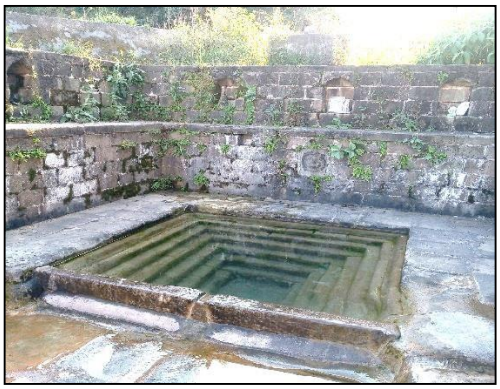


Fig. 1.2(b) Seep Spring

The detailed information on spring like type of spring, nature and discharge from spring, temperature, dependency on spring, prominent land cover, resource threat and degree of threat etc. were collected during the census. The Schedule for 1st Census of Springs is given in the Annexure-I.

Chapter 2
Methodology for 1st Census of Spring

2.1.1 The 1st Census of Springs was conducted entirely digitally through a mobile application, eliminating the need for paper-based data collection. The ultimate unit of enumeration was the village in rural areas and ward in urban areas. To ensure smooth execution, nodal departments in States/UTs designated State Level Officers (SLOs), District Level Officers (DLOs), Block Level Officers (BLOs), and Enumerators. The SLO was responsible for creating user accounts at the district level, which was cascade down to block-level officers, who will then assign villages to enumerators. Each village/ward was assigned to a single enumerator, ensuring no duplication.

2.1.2 The enumerator begun by surveying all springs by the village. Spring located in the forest was entered under the nearest village. The mobile application, functioning in both online and offline modes, was used for data collection, requiring enumerators to capture latitude/longitude and images of each scheme.

2.1.3 Six regional training workshops were conducted including including hands on training in field visit. Following the regional workshops, State-level and District-level training programmes were organized by the States with the support of Central teams. In addition, several online sessions were conducted to build proficiency among State agencies in the use of the mobile and web applications. A dedicated Help Desk was also established by NIC to ensure continuous technical support to the implementing agencies.

2.2 Field work

2.2.1 The First Spring Census was conducted under the overall charge of the nodal department of the concerned State/UT. In certain States, the fieldwork was undertaken directly by the nodal department, while in others it was entrusted or outsourced to agencies considered appropriate by the respective State/UT Governments, keeping in view the available infrastructure and field capacity.

2.2.2 The primary task of data collection was carried out by enumerators in both rural and urban areas. An honorarium for enumerators was prescribed according to the category of the State, taking into account variations in topography and accessibility.

2.3 Scrutiny

2.3.1 To enhance data quality and ensure timely completion of work, officials from the State at the Tehsil (sub-district), Block, District, and State Headquarters levels, as well as officers from the Central Government, undertook regular field visits and inspections during the data collection period and interacted closely with field

functionaries. Based on the analysis of potential measurement errors, selected parameters were identified as scrutiny check points and validation check points.

Subsequently, a dedicated Scrutiny and Validation Portal were developed and integrated with the web-based application, enabling States to systematically identify springs that did not meet the prescribed scrutiny and validation criteria. The State accordingly rectified the deficiencies observed in respect of such records. In certain cases, particularly where a spring did not pass specific validation checks, detailed justifications were provided by the concerned State authorities. The parameters adopted for scrutiny and validation check points are given in Annexure–II and III.

2.4 **Progress Monitoring**

2.4.1 The progress of the First Census of Springs was monitored on a real-time basis through a web portal (dashboard). A dedicated team at the Central level as well as at the State/UT Headquarters proactively monitored the progress of work and resolved issues, if any, on a priority basis. To strengthen the monitoring mechanism, a multi-layer monitoring system was adopted at the Centre, State, District, and Sub-district (Tehsil)/Block levels.

2.4.2 At the Block level, the Block Level Officers (BLOs) had access to the dashboard, which displayed the list of villages categorized as completed, in progress, or not started. At the District level, the District Level Officers (DLOs) were able to view the status of all blocks assigned to them, as well as the status of individual blocks and the villages within those blocks. At the State level, the State Nodal Officers (SNOs) had access to a dashboard displaying the status of all districts, as well as the status of specific districts and the blocks and villages within those districts. At the Central level, the dashboard displayed the status of all States, as well as the status of specific States and their corresponding Districts, Blocks, and Villages.

2.5 **Help and Support**

2.5.1 A dedicated call centre and web-based helpdesk are available for resolving queries by the field functionaries. A web-based helpdesk module was incorporated in the web portal, and BLO/DLO and SLO can raise queries through the system.

Chapter 3
State- wise Reports

The first ever spring census was launched in April 2025. In this State Report, five States that completed their census work earlier have been considered: Bihar, Karnataka, Kerala, Ladakh, Sikkim and Tamil Nadu. A glance report on key findings of this Census in respect of these States is summarized below.

3.1 Karnataka

The State of Karnataka is situated in the southern part of India. It is bounded on the north by Maharashtra, on the north-east by Telangana, on the east by Andhra Pradesh, on the south by Tamil Nadu and Kerala, and on the west by the Arabian Sea.

Karnataka exhibits diverse physiographic features, comprising the Western Ghats along the western margin, the coastal plains of Karavali, the Malnad region, and the Deccan Plateau forming the eastern and interior parts of the state. The climate is predominantly tropical monsoon, with heavy rainfall along the Western Ghats and coastal belt and comparatively drier conditions in the interior plateau. Major rivers include the Krishna, Cauvery, Tungabhadra, Sharavathi, Kali, Netravathi, and Hemavathi.

The geographical area of Karnataka is about 191,791 sq km, and the total population is 61,095,297 as per the 2011 Census of India. Administratively, the state is divided into 31 districts. A significant proportion of the population lives in rural areas, and agriculture is a major livelihood, with principal crops including paddy, ragi, maize, sugarcane, cotton, and coffee.



Fig. 3.1 A spring located near the village of Humcha in Hosanagara Block of Shivamogga District, Karnataka State

3.1.2 Major findings of the census

In the First Spring Census, a total of 274 springs were enumerated, of which 93.5% (256) are located in rural areas and 6.5% (18) in urban areas. Springs are widely distributed in the hilly and forested tracts of Karnataka, especially along the Western Ghats and Malnad region. Prominent spring occurrence is reported in districts such as Belagavi (59), Uttara Kannada (31), Kodagu (23), Chamarajanagar (23), Dakshina Kannada (17) and Shivamogga (14), where high rainfall, steep slopes, and fractured hard rock aquifers favor the emergence of springs. In many rural and tribal settlements of these districts, springs constitute an important source of drinking water.

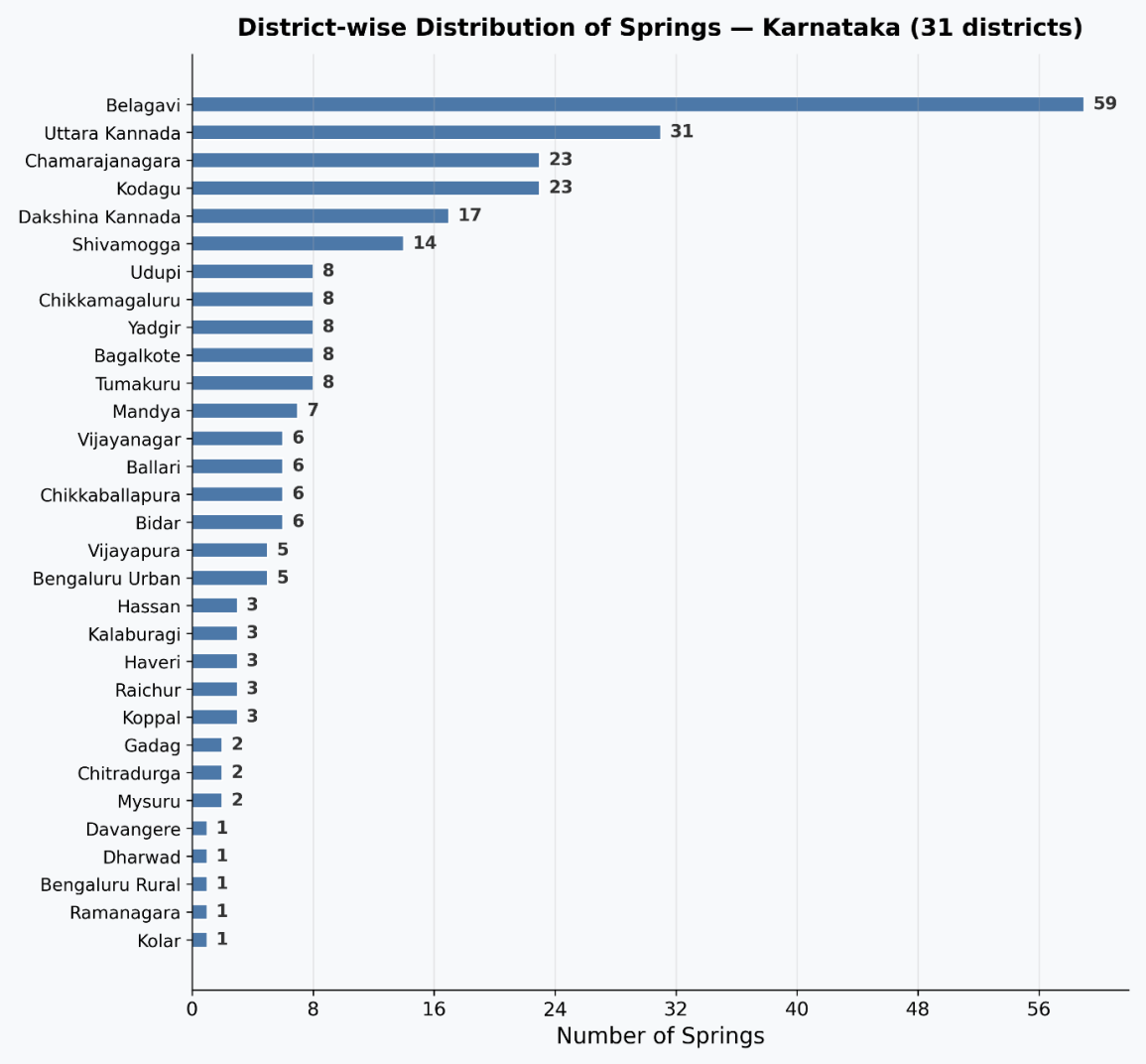


Fig. 3.2 District-wise distribution of spring

In terms of flow type, 57.3% (157) of the springs are of seep type, while 42.7% (117) are free-flowing. Out of the total enumerated springs, 52.6% (144) of the springs are perennial, 41.6% (114) are seasonal, and 5.8% (16) are reported as dried. With respect to ownership, 79.8% (206) of the springs are public, whereas 20.2% (52) are under private ownership (Fig. 3.3). Dried springs were excluded from the calculation of ownership as well as other subsequent parameters while estimating percentages.

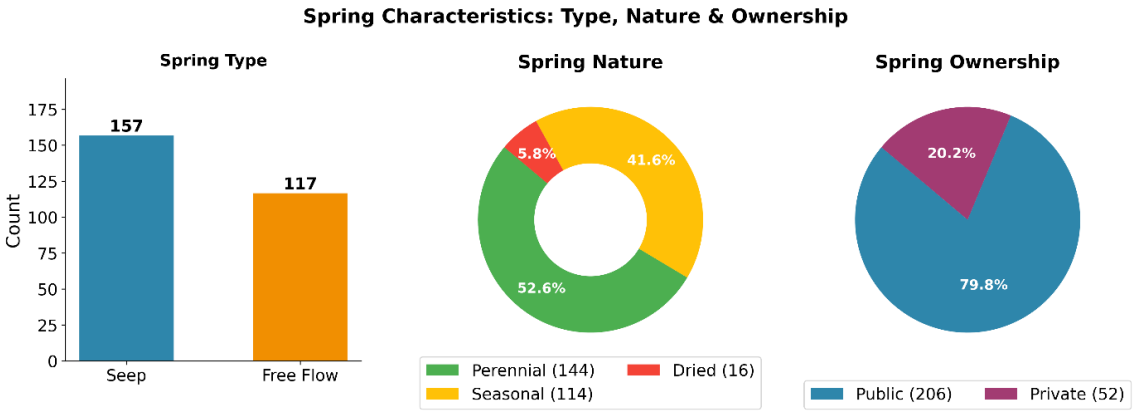


Fig. 3.3 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency, the usage and reliance patterns were analysed across three primary groups i.e., residents, non-residents, and wild animals. Out of the total springs enumerated (excluding Dried and Hot Springs), Non-residents use 44.0% (113), while Wild animals access 18.7% (48). Residents, who exhibit varying levels of dependency, utilize the remaining springs. Within the resident group, 56.2% (54) of the springs show a moderate level of dependency, 32.3% (31) show low dependency, and 11.5% (11) are reported to have high dependency (Fig. 3.4).

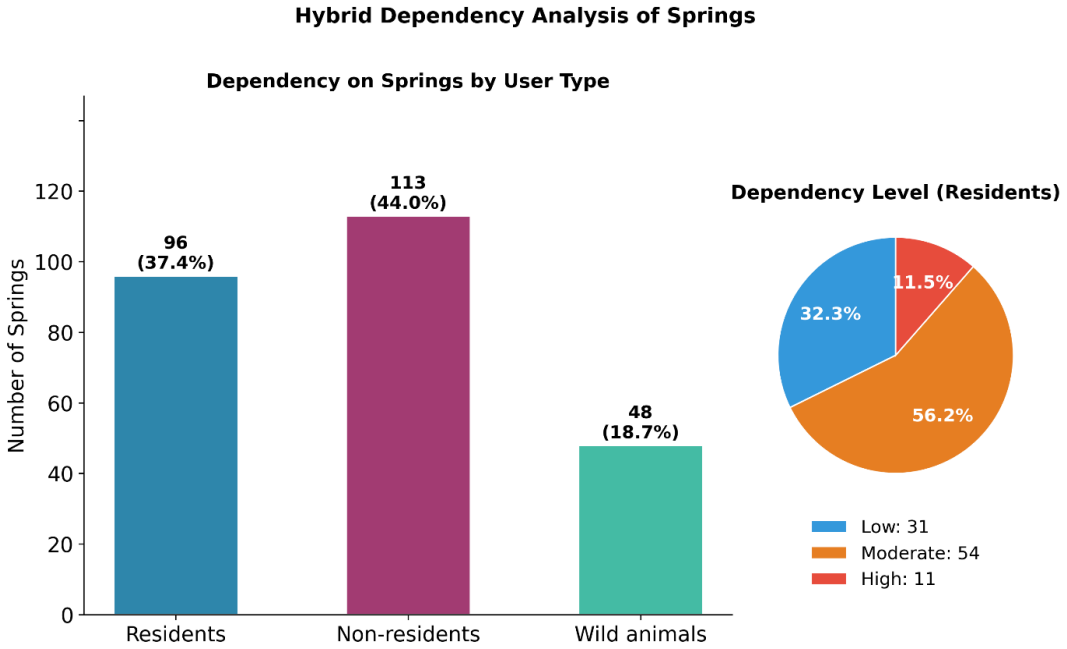


Fig. 3.4 Spring dependency

In the survey of spring discharge, a total of 177 springs were measured for their flow rate. Out of these, the largest proportion, 64.0% (113), fall into the lowest discharge category of <=5 LPM. This is followed by 21.9% (39) of springs in the 5–20 LPM range. Smaller percentages are seen in the higher flow categories, with 7.9% (14) measuring 20–50 LPM and 6.2% (11) measuring 50–100 LPM. No springs were recorded with a discharge exceeding 100 LPM (Fig. 3.5).

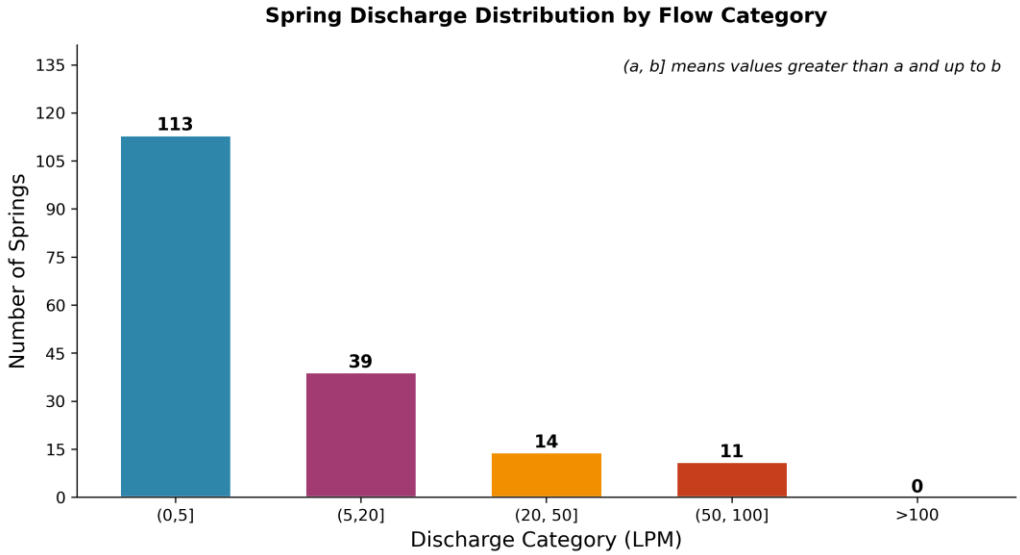


Fig. 3.5 Spring discharge distribution

In the survey of resource threats to the springs, a total of 257 springs (excluding Dried and Hot Springs) were analyzed for their threat status. Out of these, 97.3% (250) of the springs are reported to have no resource threat, while 2.7% (7) are identified as having a threat. Among the springs where a threat was identified, 100% (7) exhibit a low degree of threat, with no springs reported as having moderate or high threat levels (Fig. 3.6).

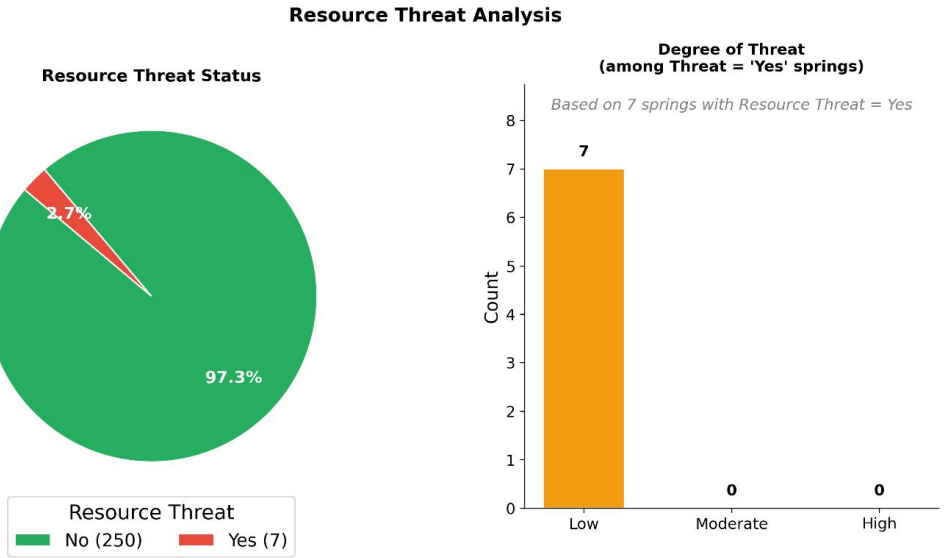


Fig. 3.6 Resource threat analysis

The Table 3.1 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Karnataka.

Table 3.1 Overview of spring attributes and associated parameters for the state of Karnataka

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	**Total Number of Springs**	Count	274	100.0%
	Springs in Rural Areas	Count	256	93.5%
	Springs in Urban Areas	Count	18	6.5%
2.	**Springs by type**			
	Free Flow	Count	117	42.7%
	Seep	Count	157	57.3%
3.	**Springs by Nature**			
	Perennial	Count	144	52.6%
	Seasonal	Count	114	41.6%
	Dried	Count	16	5.8%
4.	**Springs by ownership**			
	Public	Count	206	79.8%
	Private	Count	52	20.2%
5.	**Springs with chamber/tank to collect the water**	Count	121	46.9%
6.	**Springs with piped water supply**	Count	65	25.2%
7.	**Springs where discharge could be measured**	Count	177	68.6%
8.	**Spring by Colour of its water**			
	Colourless	Count	244	94.5%
	Coloured	Count	14	5.5%
9.	**Springs by Smell/odour of its water**			
	Agreeable	Count	227	87.9%
	Non-Agreeable	Count	31	12.1%
10.	**Springs by taste of its water**			
	Objectionable	Count	21	8.1%
	Unobjectionable	Count	237	91.9%
11.	**Springs by its water temperature**			
	Hot	Count	1	0.4%
	Cold	Count	257	99.6%
13.	**Springs by resource threat**			
	Yes	Count	7	2.7%
	No	Count	250	97.3%
14.	**Springs by degree of threat**			
	Low	Count	7	100.0%
	Moderate	Count	0	0.0%
	High	Count	0	0.0%
15.	**Spring by type of dependents**			
	Residents	Count	96	37.3%
	Non-residents	Count	113	43.9%
	Wild animals	Count	48	18.6%
16.	**Spring by dependency level (Residents)**			
	Low	Count	31	32.3%
	Moderate	Count	54	56.2%
	High	Count	11	11.5%

3.2 Ladakh

The Union Territory of Ladakh is located in the northernmost part of India. It is bounded by Jammu and Kashmir to the west, Himachal Pradesh to the south, on the North by China and on the east by Tibet, while Pakistan lies to the north-west.

Ladakh is characterized by an extremely rugged and high-altitude cold desert physiography, comprising the Karakoram Range, Ladakh Range, and Zanskar Range, with deep valleys carved by the Indus and its tributaries. The climate is cold and arid, with very low annual precipitation, most of which occurs as snowfall. Major rivers include the Indus, Zanskar, Shyok, and Nubra rivers.



Fig. 3.7 A spring located near the village of Khardong in Diskit Sub-District of Ladakh District, Ladakh State.

The geographical area of Ladakh (UT) is about 59,146 sq km, and the total population is 274,289 as per the 2011 Census of India. Administratively, the UT is divided into two districts: Leh and Kargil. Settlements are sparse and mostly located along river valleys, and livelihoods are based on agriculture, animal husbandry, and tourism.

3.2.1 Major findings of the census

Springs are widely distributed across the high-altitude desert landscape of Ladakh, particularly concentrated in the rugged terrains of the Kargil and Leh districts. A total of 1,512 springs were enumerated across the state of Ladakh, of which prominent spring occurrence is reported in Kargil, which accounts for the majority of the enumeration with 989 (65.4%) and followed by Leh Ladakh with 523 springs (34.6%) (Fig. 3.8). The unique geological formations and glacial melt in these Himalayan districts favour the emergence of springs, which serve as vital water sources in this rain-shadow region.

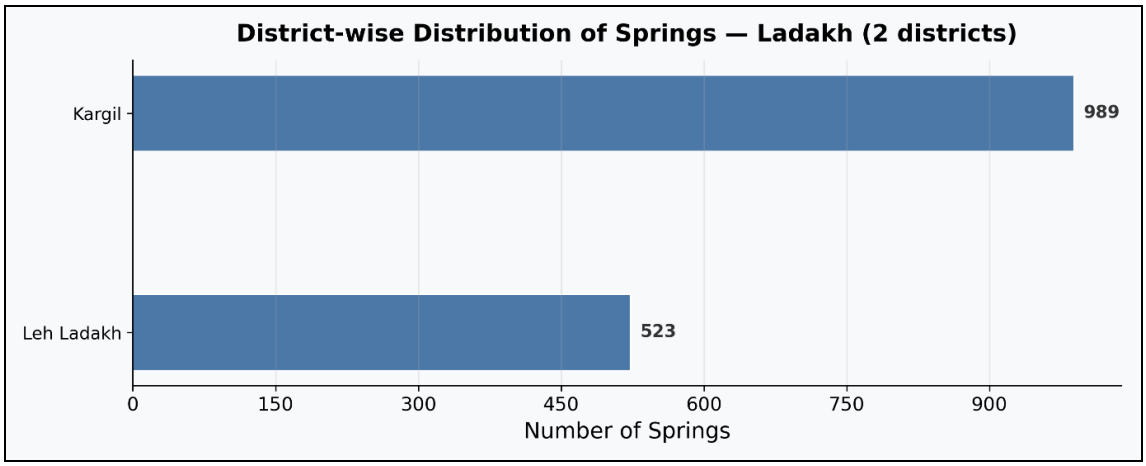


Fig. 3.8 District-wise distribution of spring

In terms of flow type, 74.1% (1,121) of the springs are free-flowing, while 25.9% (391) are of seep type (Fig. 3.9). Out of the total enumerated springs, 81.0% (1,225) of the springs are perennial, 14.8% (224) are seasonal, and 4.2% (63) are reported as dried. With respect to ownership, 96.6% (1400) of the springs are public, whereas 3.4% (49) are under private ownership. Dried springs were excluded from the calculation of ownership as well as other subsequent parameters while estimating percentages.

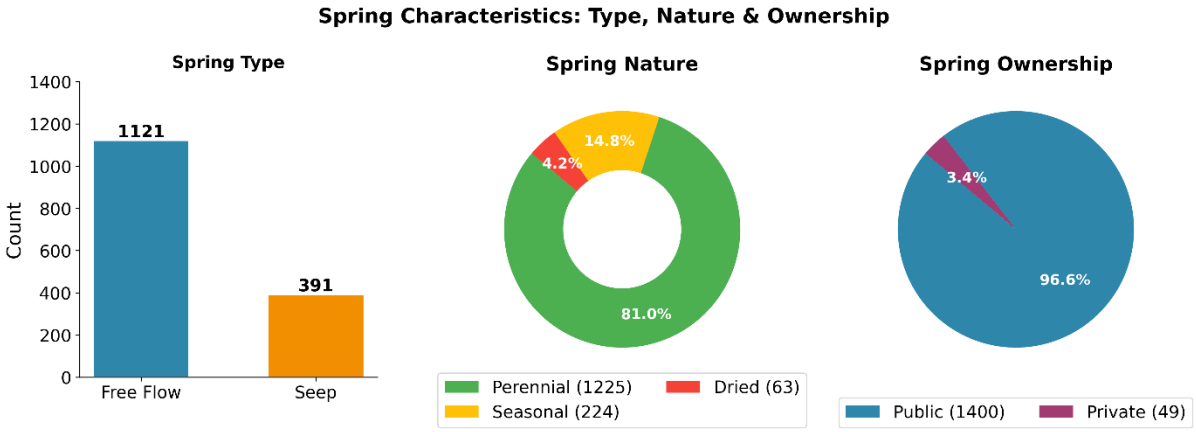


Fig. 3.9 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency across the state of Ladakh, usage and reliance patterns were analyzed across three primary groups i.e., residents, non-residents, and wild animals (Fig. 3.10). Out of the total 1,512 springs enumerated (excluding Dried and Hot Springs), Residents are the primary users, utilizing 76.0% (1,085) of the springs. Within this resident group, the dependency levels vary: 54.7% (593) exhibit a moderate level of dependency, 25.5% (277) show low dependency, and 19.8% (215) are reported to have high dependency. Additionally, Wild animals access 15.8% (225) of the springs, while Non-residents utilize 8.3% (118) of the total sources.

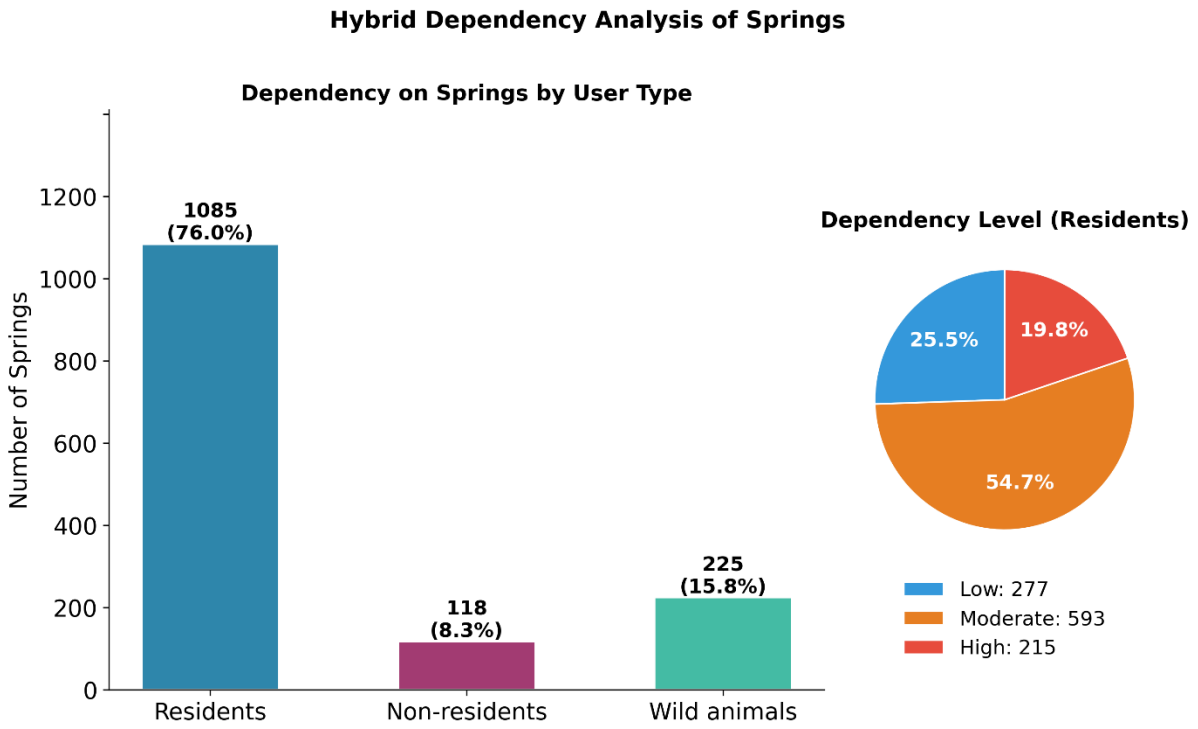


Fig. 3.10 Spring dependency

In the survey of spring discharge across the state of Ladakh, the flow rates were measured and categorized for 1007 springs (Fig. 3.11). Out of the total springs with recorded discharge, the vast majority fall into the lowest flow category, with 54.2% (546) measuring <=5 LPM. This is followed by 33.0% (333) of springs in the 5–20 LPM range. Higher discharge rates are less common, with 7.6% (77) measuring 20–50 LPM, 2.9% (31) in the 50–100 LPM category, and only 2.1% (20) recorded with a high discharge exceeding 100 LPM.

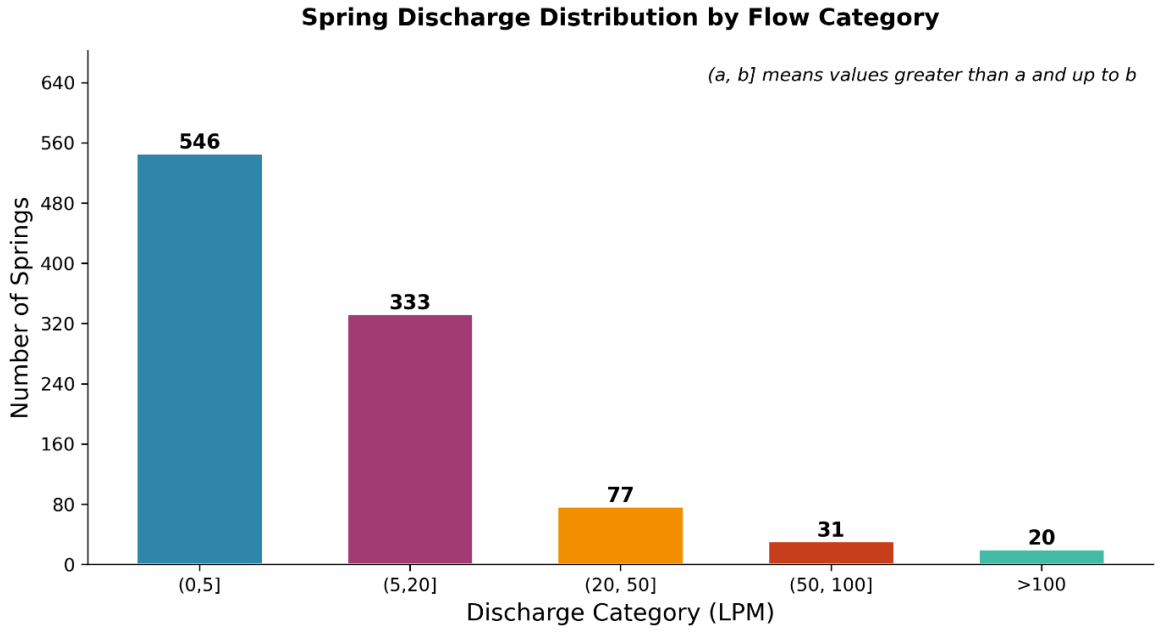


Fig. 3.11 Spring discharge distribution

In the survey of resource threats to the springs in Ladakh, a total of 1428 springs (excluding Dried and Hot Springs) were analyzed for their threat status (Fig. 3.12). Out of these, 72.8% (1040) of the springs are reported to have no resource threat, while 27.2% (388) are identified as having a threat. Among the springs where a threat was identified, 40.7% (158) exhibit a low degree of threat, 37.8% (147) are classified under a moderate threat level, and 21.4% (83) are reported as having high threat levels.

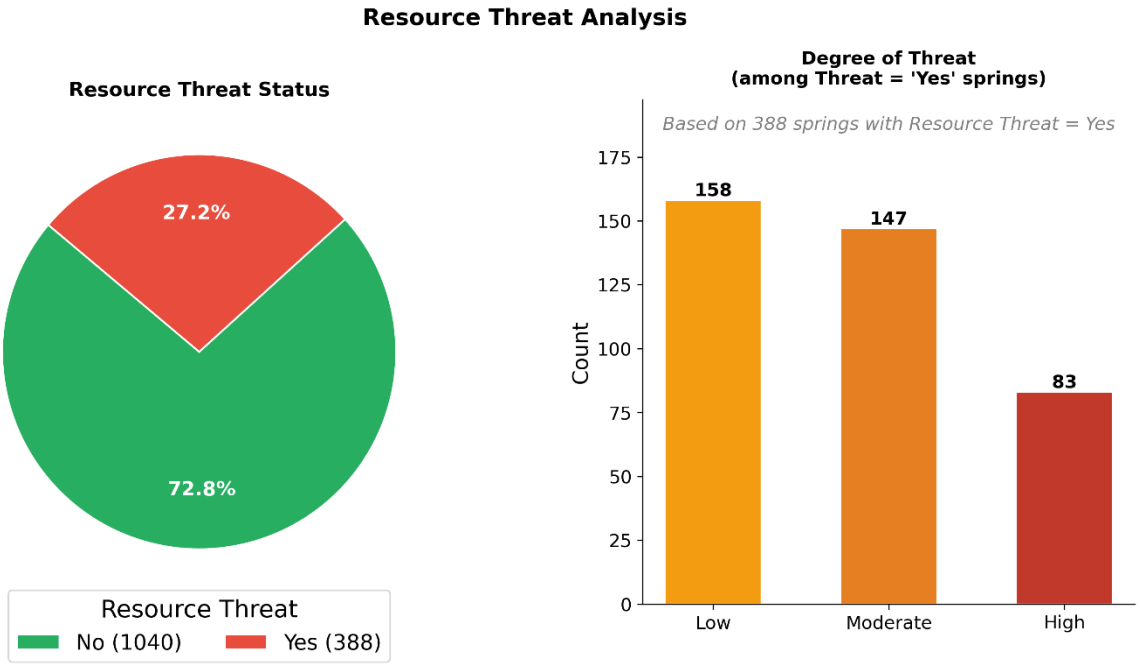


Fig. 3.12 Resource threat analysis

The Table 3.2 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Ladakh.

Table 3.2 Overview of spring attributes and associated parameters for the state of Ladakh

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	**Total Number of springs**	Count	1,512	100.0%
	Springs in Rural Areas	Count	1,485	98.2%
	Springs in Urban Areas	Count	27	1.8%
2.	**Springs by type**			
	Free Flow	Count	1,121	74.1%
	Seep	Count	391	25.9%
3.	**Springs by Nature**			
	Perennial	Count	1,225	81.0%
	Seasonal	Count	224	14.8%
	Dried	Count	63	4.2%
4.	**Springs by ownership**			
	Public	Count	1,400	92.6%
	Private	Count	49	3.4%
5.	**Springs with chamber/tank to collect water**	Count	238	16.4%
6.	**Springs with piped water supply**	Count	230	15.8%
7.	**Springs where discharge could be measured**	Count	1007	69.5%
8.	**Spring by Colour of its water**			
	Colourless	Count	1411	97.4%
	Coloured	Count	38	2.6%
9.	**Springs by Smell/odour of its water**			
	Agreeable	Count	1418	97.9%
	Non-Agreeable	Count	31	2.1%
10.	**Springs by taste of its water**			
	Objectionable	Count	45	3.1%
	Unobjectionable	Count	1404	96.9%
11.	**Springs by its water temperature**			
	Hot	Count	21	1.4%
	Cold	Count	1428	98.6%
13.	**Springs by resource threat**			
	Yes	Count	388	27.2%
	No	Count	1040	72.8%
14.	**Springs by degree of threat**			
	Low	Count	158	40.7%
	Moderate	Count	147	37.9%
	High	Count	83	21.4%
15.	**Spring by type of dependents**			
	Residents	Count	1,085	76.0%
	Non-residents	Count	118	8.3%
	Wild animals	Count	225	15.8%
16.	**Spring by dependency level (Residents)**			
	Low	Count	277	25.5%
	Moderate	Count	593	54.7%
	High	Count	215	19.8%

3.3 Sikkim

The State of Sikkim is situated in the north-eastern part of India in the Eastern Himalaya. It is bounded by Tibet to the north and north-east, Bhutan to the east, West Bengal to the south, and Nepal to the west.

Sikkim is a predominantly mountainous state, characterized by steep slopes, deep valleys, and high-altitude terrain, and includes part of the Kangchenjunga range, the highest peak in India. The state experiences a temperate to alpine climate with heavy monsoon rainfall and snowfall in higher altitudes. Major rivers include the Teesta and Rangeet rivers and their tributaries.



Fig. 3.13 A spring located near the Ward of Gangyap in Namchi Municipal Council Town of Namchi District, Sikkim State.

The geographical area of Sikkim is about 7,096 sq km, and the total population is 610,577 as per the 2011 Census of India. Administratively, the state is divided into 6 districts. A large proportion of the population lives in rural and mountainous areas, and agriculture, horticulture, and tourism form the main sources of livelihood.

3.3.1 Major findings of the census

Springs are widely distributed throughout the Himalayan state of Sikkim, particularly concentrated in the rugged and high-rainfall terrains of the eastern and southern districts. In the First Spring Census, a total of 2535 springs were enumerated across the state of Sikkim, of which 44.8% (1,136) are located in the Pakyong district, 14.6% (369) in Soreng, and 12.9% (327) in Namchi (Fig. 3.14). The steep slopes, fractured rock aquifers, and heavy monsoon precipitation characteristic of this region favor the emergence of these "Dharas," which serve as the primary lifeline and vital water sources for the majority of rural households in the state.

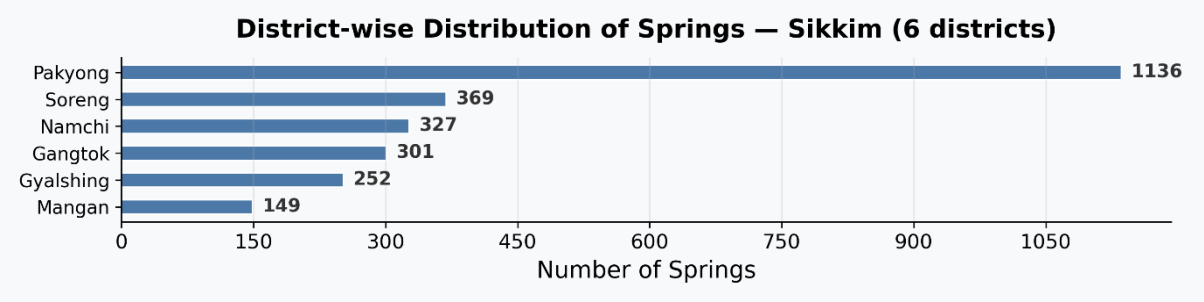


Fig. 3.14 District-wise distribution of spring

In terms of flow type, 54.0% (1369) of the springs are of seep type, while 46.0% (1,166) are free-flowing (Fig. 3.15). Out of the total enumerated springs, 90.8% (2,303) of the springs are perennial, while 9.2% (232) are seasonal. With respect to ownership, 66.0% (1672) of the springs are public, whereas 34.0% (863) are under private ownership. Dried springs were excluded from the calculation of ownership as well as other subsequent parameters while estimating percentages.

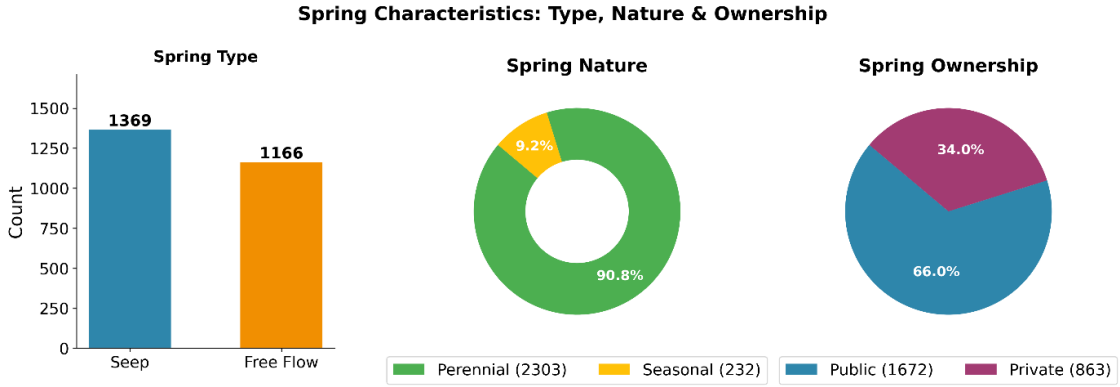


Fig. 3.15 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency across the state of Sikkim, usage and reliance patterns were analyzed across three primary groups i.e., residents, non-residents, and wild animals. Out of the total springs enumerated (excluding Dried and Hot Springs), Residents are the primary users, utilizing 94.6% (2,399) of the springs. Within this resident group, dependency levels vary: 39.0% (935) exhibit a high level of dependency, 31.5% (755) show low dependency, and 29.6% (709) are reported to have moderate dependency. Additionally, Non-residents utilize 4.7% (120) of the total sources, while Wild animals access only 0.4% (11) of the springs (Fig. 3.16).

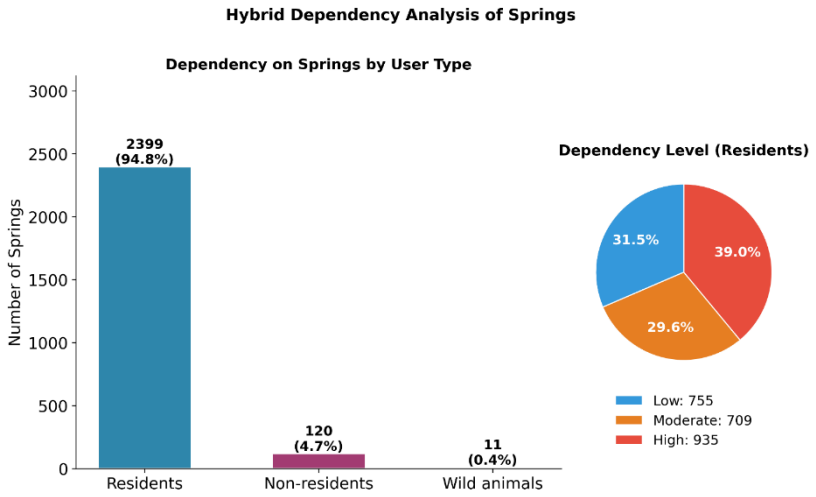


Fig. 3.16 Spring dependency

In the survey of spring discharge across the state of Sikkim, the flow rates were measured and categorized for 2,175 springs. Out of the total springs with recorded discharge, the largest proportion falls into the 5–20 LPM range, with 40.1% (872) of the springs. This is followed by 30.2% (657) of springs in the 20–50 LPM range. Moderate to high discharge rates are also present: 15.0% (326) measure 50–100 LPM, while 5.7% (123) recorded a high discharge exceeding 100 LPM. The lowest flow category of <=5 LPM accounts for 9.0% (197) of the surveyed springs.

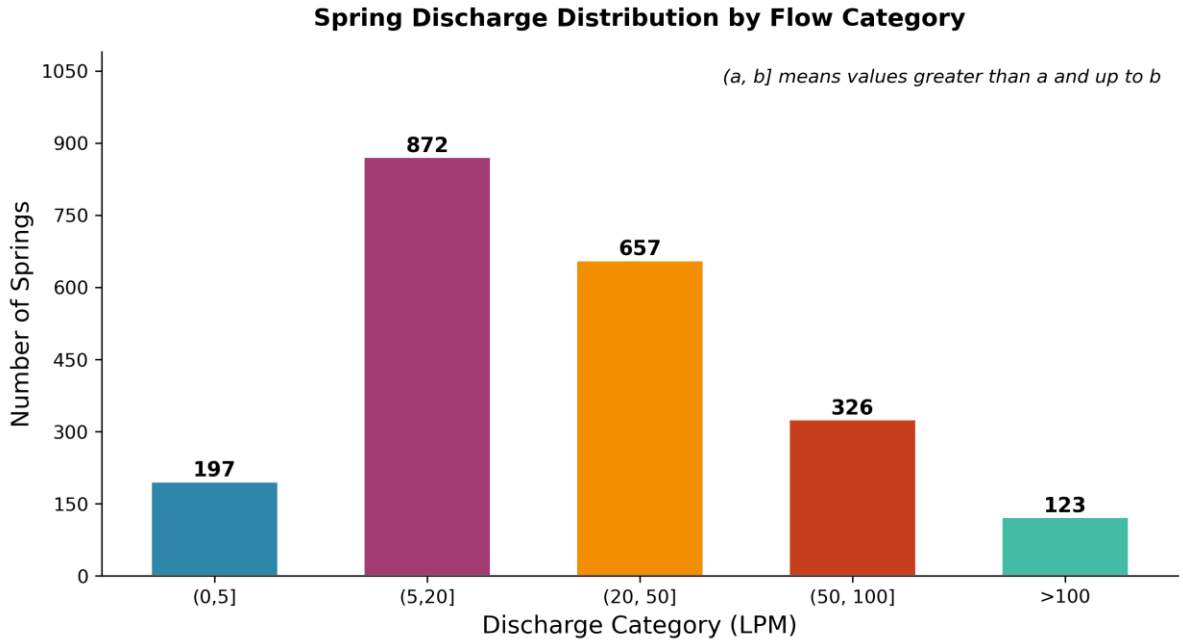


Fig. 3.17 Spring discharge distribution

In the survey of resource threats to the springs in Sikkim, a total of 2,530 springs (excluding Dried and Hot Springs) were analyzed for their threat status. Out of these, 98.6% (2,499) of the springs are reported to have no resource threat, while 1.2% (31)

are identified as having a threat (Fig. 3.18). Among the springs where a threat was identified, 58.1% (18) exhibit a moderate degree of threat, 22.6% (7) are reported as having a high threat level, and 19.4% (6) show a low degree of threat.

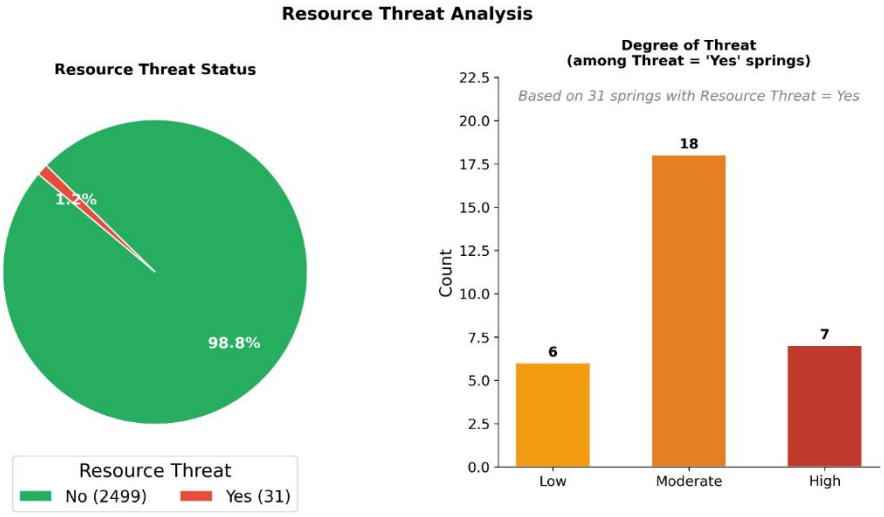


Fig. 3.18 Resource threat analysis

The Table 3.3 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Sikkim.

Table 3.3 Overview of spring attributes and associated parameters for the state of Sikkim

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	**Total Number of Springs**	Count	2535	100.0%
	Springs in Rural Areas	Count	2435	96.1%
	Springs in Urban Areas	Count	100	3.9%
2	**Springs by Type**			
	Free Flow	Count	1166	46.0%
	Seep	Count	1369	54.0%
3	**Springs by Nature**			
	Perennial	Count	2303	90.8%
	Seasonal	Count	232	9.2%
	Dried	Count	0	0.0%
4	**Springs by Ownership**			
	Public	Count	1672	66.0%
	Private	Count	863	34.0%
5	**Springs with chamber/tank to collect water**	Count	837	33.0%
6	**Springs with piped water supply**	Count	2149	84.8%
7	**Springs where discharge could be measured**	Count	2173	85.8%
8	**Spring by Colour of its water**			
	Colourless	Count	2534	100.0%
	Coloured	Count	1	0.0%
9	**Springs by Smell/odour of its water**			
	Agreeable	Count	2469	97.4%
	Non-agreeable	Count	66	2.6%
10	**Springs by taste of its water**			
	Objectionable	Count	12	0.5%
	Unobjectionable	Count	2523	99.5%
11	**Springs by its water temperature**			
	Hot	Count	5	0.2%
	Cold	Count	2530	99.8%
12	**Springs by resource threat**			
	Yes	Count	31	1.2%
	No	Count	2499	98.8%
13	**Degree of Threat**			
	Low	Count	6	19.4%
	Moderate	Count	18	58.1%
	High	Count	7	22.6%
14	**Spring by type of dependents**			
	Residents	Count	2399	94.6%
	Non-residents	Count	120	4.7%
	Wild Animals	Count	11	0.4%
15	**Spring by dependency level (Residents)**			
	Low	Count	755	31.5%
	Moderate	Count	709	29.6%
	High	Count	935	39.0%

3.4 Tamil Nadu

The State of Tamil Nadu is situated in the southern part of India. It is bounded on the north by Andhra Pradesh and Karnataka, on the west by Kerala, on the east by the Bay of Bengal, and on the south by the Indian Ocean.

Tamil Nadu exhibits diverse physiographic features, comprising the Western Ghats along the western boundary, the Eastern Ghats in the northern and north-central parts, extensive coastal plains along the Bay of Bengal, and the interior plateau and river basins forming the central and southern regions of the state.



Fig. 3.19 A spring located near the village of Valaikkulam R.F. in Srivilliputtur Block of Virudhunagar District, Tamil Nadu State.

The geographical area of Tamil Nadu is about 130,058 sq km, and the total population is 72,147,030 as per the 2011 Census of India. Administratively, the state is divided into 38 districts. A substantial proportion of the population resides in rural areas, and agriculture remains a major source of livelihood, with principal crops including paddy, millets, sugarcane, cotton, banana, coconut, and groundnut.

3.4.1 Major findings of the census

Springs are distributed across the diverse topographical landscape of Tamil Nadu, with significant occurrences recorded in 18 districts. In the First Spring Census, a total of 215 springs were enumerated across the state of Tamil Nadu, of which 23.2% (50) are located in The Nilgiris, 19.5% (42) in Kanniyakumari, and 13.4% (29) in Viluppuram (Fig. 3.20). The presence of the Western Ghats and varying geological formations in these districts favor the emergence of springs, which serve as essential water sources for local communities and ecosystems.

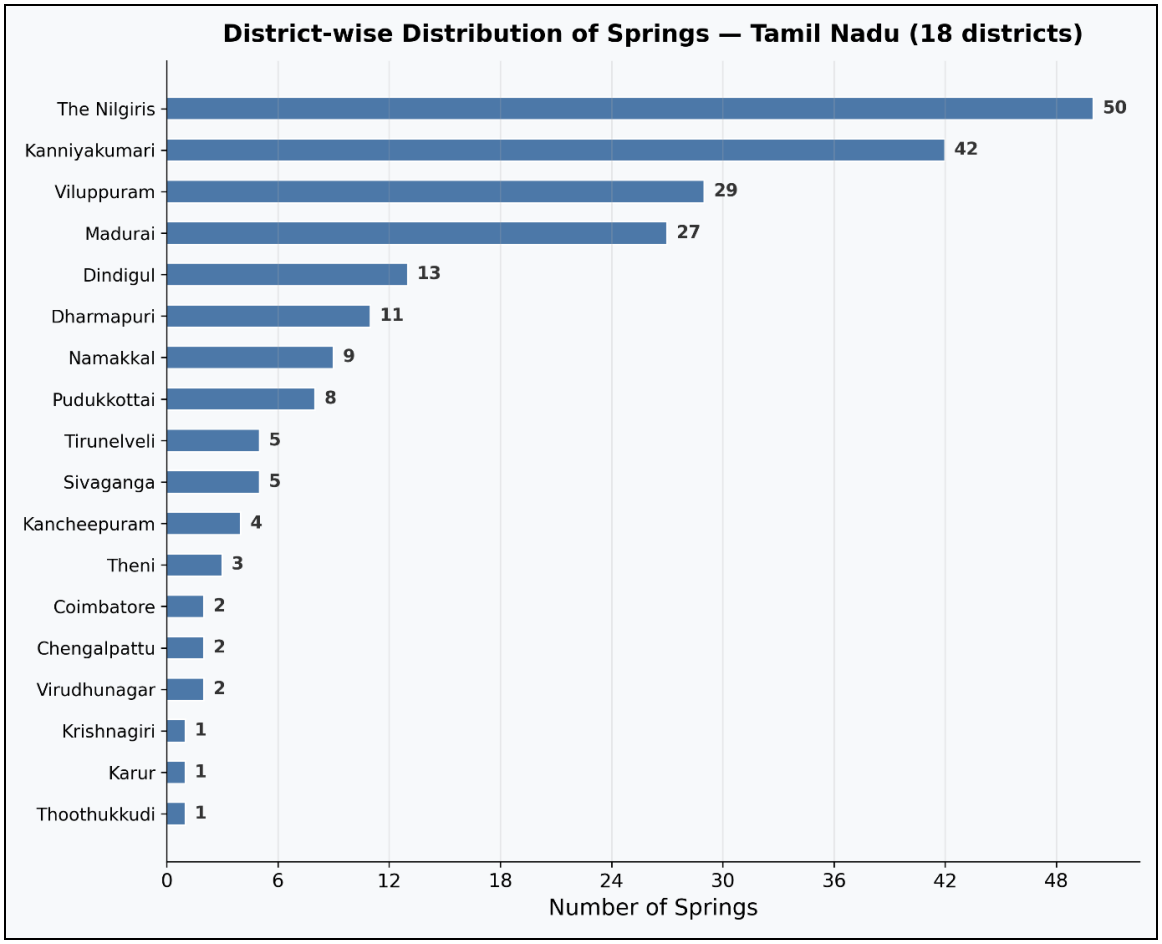


Fig. 3.20 District-wise distribution of spring

In terms of flow type, 68.4% (147) of the springs are of seep type, while 31.6% (68) are free-flowing (Fig. 3.21). Out of the total enumerated springs, 76.7% (165) of the springs are perennial, 19.5% (42) are seasonal, and 3.7% (8) are reported as dried. With respect to ownership, 94.7% (196) of the springs are public, whereas 5.3% (11) are under private ownership.

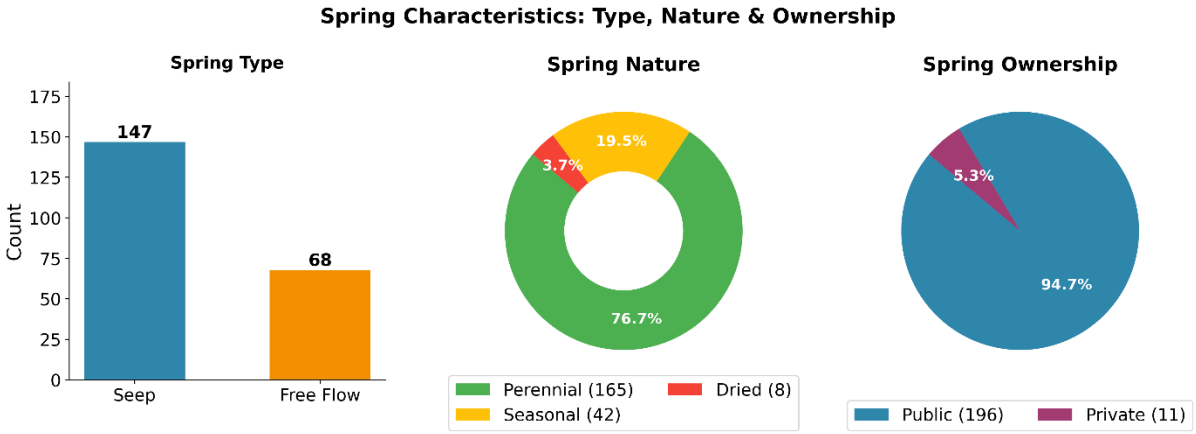


Fig. 3.21 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency across the state of Tamil Nadu, usage and reliance patterns were analyzed across three primary groups i.e., residents, non-residents, and

wild animals (Fig. 3.22). Out of the total springs enumerated, Residents are the primary users, utilizing 61.4% (127) of the springs. Within this resident group, dependency levels vary: 66.9% (85) exhibit a moderate level of dependency, 23.6% (30) show low dependency, and 9.4% (12) are reported to have high dependency. Additionally, Non-residents utilize 33.8% (70) of the total sources, while Wild animals access 4.8% (10) of the springs.

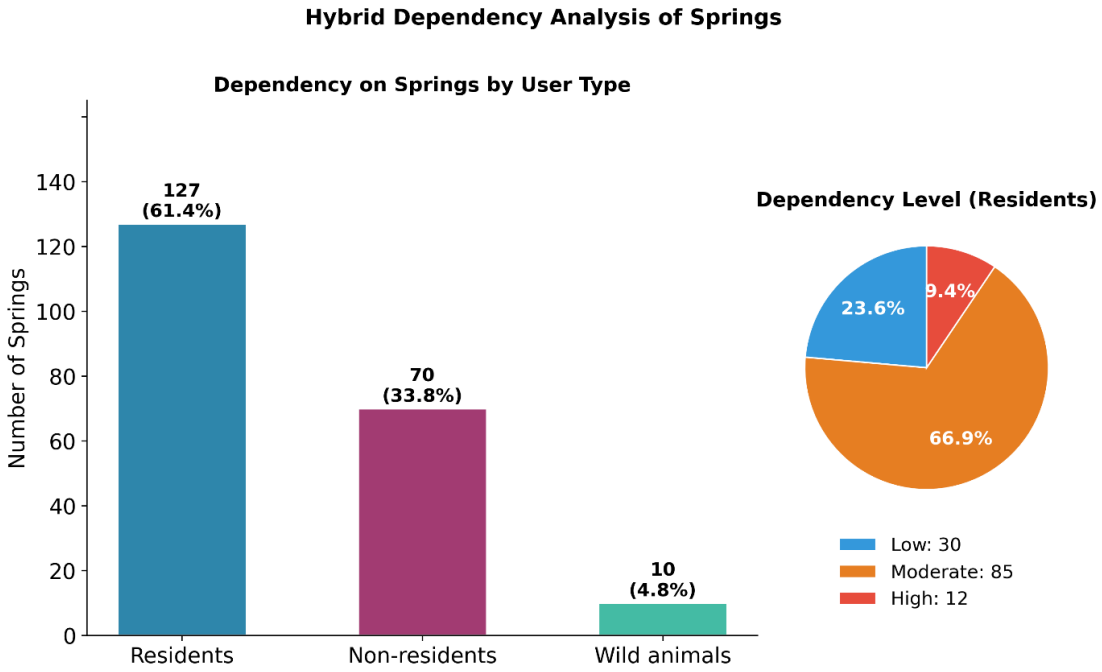


Fig. 3.22 Spring dependency

In the survey of spring discharge across the state of Tamil Nadu, the flow rates were measured and categorized for 115 springs (Fig. 3.23). Out of the total springs with recorded discharge, the largest proportion falls into the 5–20 LPM range, with 53.9% (62) of the springs. This is followed by 37.4% (43) of springs in the <5 LPM category. Higher discharge rates are less common, with 7.0% (8) measuring 20–50 LPM and only 1.7% (2) falling in the 50–100 LPM category. No springs were recorded with a high discharge exceeding 100 LPM.

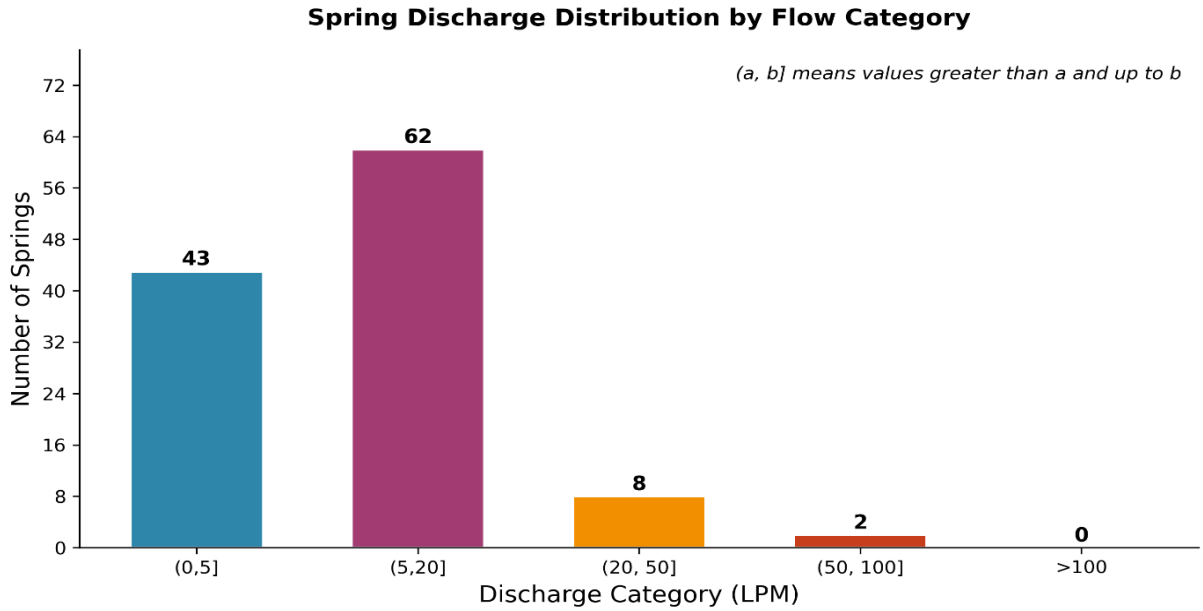


Fig. 3.23 Spring discharge distribution

In the survey of resource threats to the springs in Tamil Nadu, a total of 207 springs were analyzed for their threat status (Fig. 3.24). Out of these, 94.2% (195) of the springs are reported to have no resource threat, while 5.8% (12) are identified as having a threat. Among the springs where a threat was identified, 41.7% (5) exhibit a high degree of threat, 33.3% (4) are classified under a moderate threat level, and 25.0% (3) show a low degree of threat.

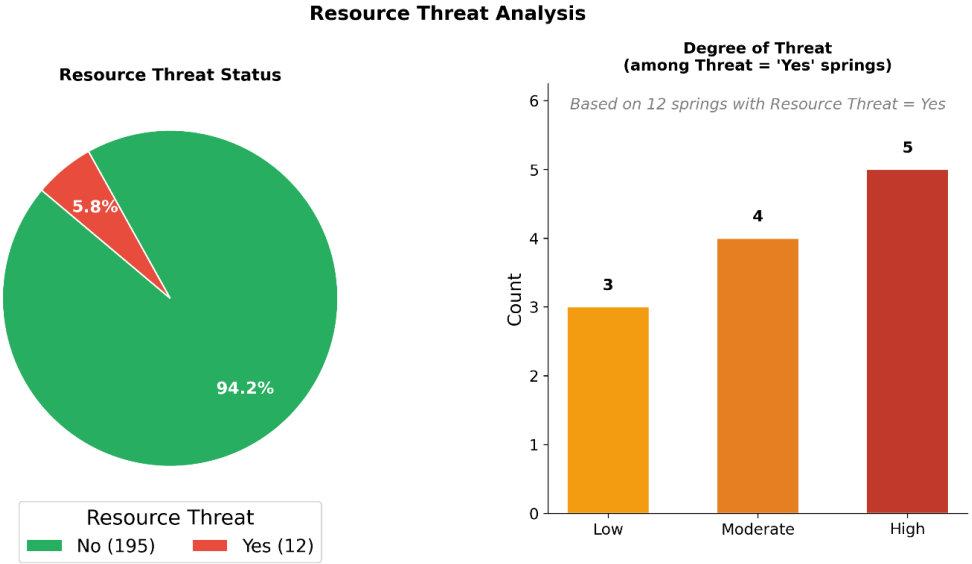


Fig. 3.24 Resource threat analysis

The Table 3.4 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Tamil Nadu.

Table 3.4 Overview of spring attributes and associated parameters - Tamil Nadu

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	Total Number of springs	Count	215	100.0%
	Springs in Rural Areas	Count	159	74.0%
	Springs in Urban Areas	Count	56	26.0%
2.	Springs by type			
	Free Flow	Count	68	31.6%
	Seep	Count	147	68.4%
3.	Springs by Nature			
	Perennial	Count	165	76.7%
	Seasonal	Count	42	19.5%
	Dried	Count	8	3.7%
4.	Springs by ownership			
	Public	Count	196	94.7%
	Private	Count	11	5.3%
5.	Springs with chamber/tank to collect water	Count	81	39.1%
6.	Springs with piped water supply	Count	64	30.9%
7.	Springs where discharge could be measured	Count	115	55.5%
8.	Spring by Colour of its water			
	Colourless	Count	158	76.3%
	Coloured	Count	49	23.7%
9.	Springs by Smell/odour of its water			
	Agreeable	Count	167	80.7%
	Non-Agreeable	Count	40	19.3%
10.	Springs by taste of its water			
	Objectionable	Count	50	24.1%
	Unobjectionable	Count	157	75.9%
11.	Springs by its water temperature			
	Hot	Count	0	0.0%
	Cold	Count	207	100%
12.	Springs by resource threat			
	Yes	Count	12	5.8%
	No	Count	195	94.2%
13.	Springs by degree of threat			
	Low	Count	3	25.0%
	Moderate	Count	4	33.3%
	High	Count	5	41.7%
14.	Spring by type of dependents			
	Residents	Count	127	61.4%
	Non-residents	Count	70	33.8%
	Wild animals	Count	10	4.8%
15.	Spring by dependency level (Residents)			
	Low	Count	30	23.6%
	Moderate	Count	85	66.9%
	High	Count	12	9.4%

3.5 Kerala

The State of Kerala is situated in the south-western part of India along the Arabian Sea coast. It is bounded on the north and north-east by Karnataka, on the east by Tamil Nadu, and on the west by the Arabian Sea.

Kerala is characterized by three distinct physiographic regions: the Western Ghats (highlands) in the east, the midland lateritic hills, and the coastal plains in the west. The state experiences a tropical monsoon climate with heavy rainfall during the south-west and north-east monsoons. Major rivers include the Periyar, Bharathapuzha, Pamba, Chaliyar, Chalakudy, and Kallada.

The geographical area of Kerala is about 38,863 sq km, and the total population is 33,406,061 as per the 2011 Census of India. Administratively, the state is divided into 14 districts. A large proportion of the population resides in rural and semi-urban areas, and agriculture and plantation crops such as rubber, coconut, tea, coffee, and spices form the backbone of the economy.



Fig. 3.25 A spring located near the village of Kannan Devan Hills in Devikulam Block of Idukki District, Kerala State.

3.5.1 Major Findings of the Census

Springs are widely distributed across the tropical and hilly landscape of Kerala, particularly concentrated in the rugged terrains of the Western Ghats and the midland districts. In the First Spring Census, a total of 4,333 springs were enumerated across the state. The highest concentration of these springs is found in the Malappuram district, accounting for 16.4% (709) of the total, followed by Thiruvananthapuram with 14.6% (633), and Kannur with 13.2% (572) (Fig. 3.26).

The unique geological formations, including thick lateritic caps and fractured crystalline rocks, combined with heavy monsoon precipitation, favor the emergence of these springs. These sources serve as vital water supplies for domestic and agricultural needs across the region.

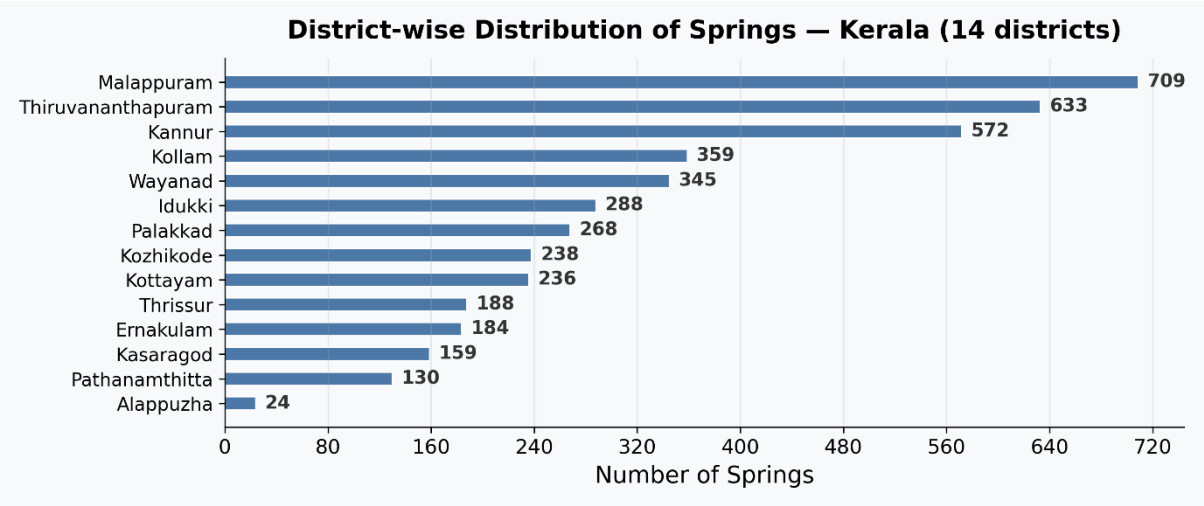


Fig. 3.26 District-wise distribution of spring

In terms of flow type, 53.3% (2,310) of the springs are free-flowing, while 46.7% (2,023) are of the seep type. Out of the total enumerated springs, 77.0% (3,335) are perennial, 20.9% (907) are seasonal, and 2.1% (91) are reported as dried.

With respect to ownership, 63.4% (2,688) of the springs are private, whereas 36.6% (1,554) are under public ownership. Dried springs were excluded from the calculation of ownership and other subsequent parameters while estimating percentages.

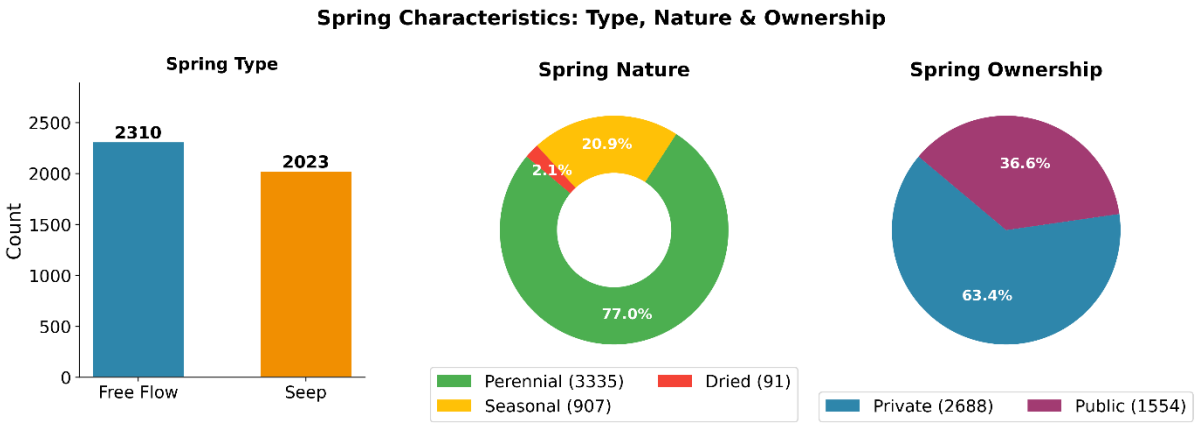


Fig. 3.27 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency across the state of Kerala, usage and reliance patterns were analyzed across three primary groups: residents, non-residents, and wild animals. Out of the total springs enumerated (excluding Dried and Hot Springs), residents are the primary users, utilizing 59.7% (2,532) of the springs. Additionally, non-residents utilize 33.5% (1,421) of the total sources, while wild animals access 6.8%

(288) of the springs. Within this resident group, dependency levels vary: 46.6% (1,181) exhibit a moderate level of dependency, 30.1% (761) show low dependency, and 23.3% (590) are reported to have high dependency.

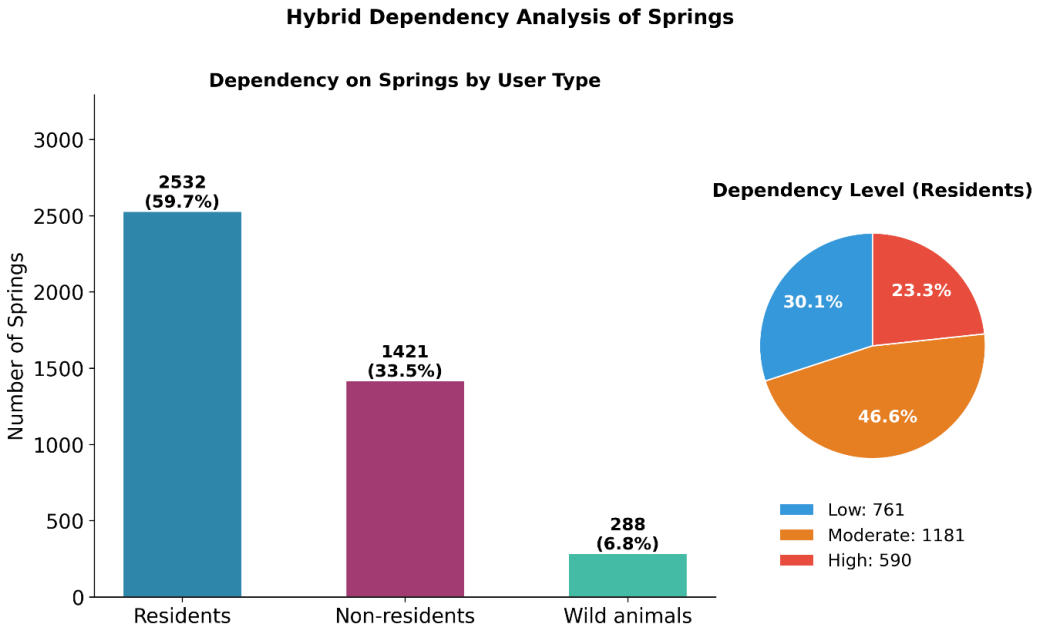


Fig. 3.28 Spring dependency

In the survey of spring discharge across the state of Kerala, flow rates were measured and categorized for 1,346 springs. Out of the total springs with recorded discharge, the vast majority fall into the lowest flow category, with 72.6% (978) measuring up to 5 LPM. This is followed by 23.2% (312) of springs in the 5–20 LPM range. Higher discharge rates are significantly less common: 2.5% (33) measured between 20–50 LPM, 1.6% (22) fell into the 50–100 LPM category, and only 0.1% (1) recorded a high discharge exceeding 100 LPM.

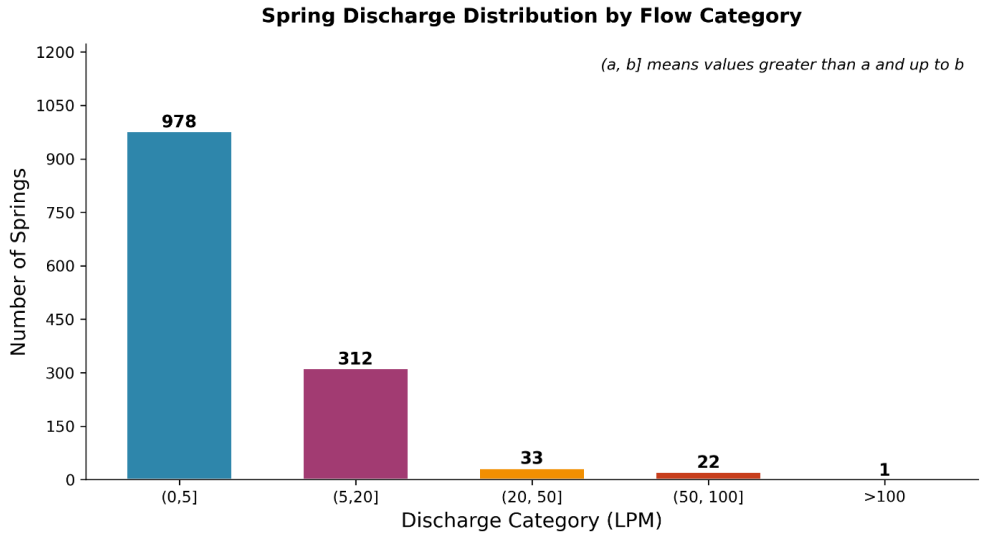


Fig. 3.29 Spring discharge distribution

In the survey of resource threats to the springs in Kerala, a total of 4,241 springs (excluding Dried and Hot Springs) were analyzed for their threat status. Out of these, 91.5% (3,880) of the springs are reported to have no resource threat, while 8.5% (361) are identified as having a threat. Among the springs where a threat was identified (n=361), 49.0% (177) exhibit a moderate degree of threat, 28.5% (103) show a low degree of threat, and 22.4% (81) are reported as having high threat levels.

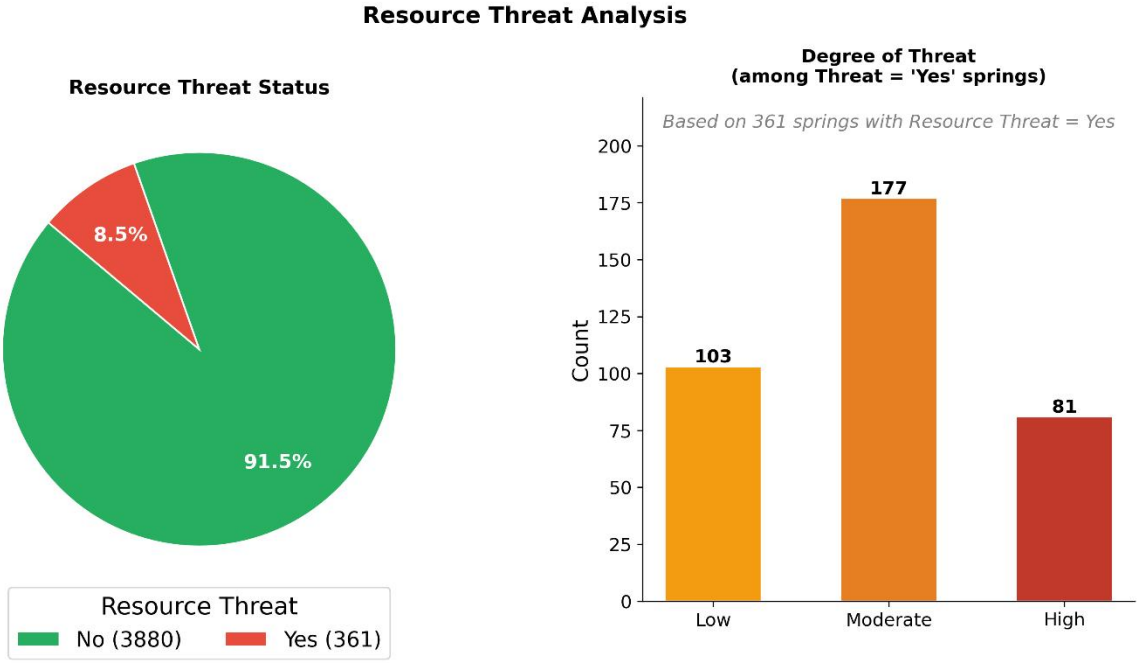


Fig. 3.30 Resource threat analysis

The Table 3.5 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Kerala.

Table 3.5 Overview of spring attributes and associated parameters for the state of Kerala

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	**Total Number of Springs**	Count	**4333**	**100.0%**
	Springs in Rural Areas	Count	**4168**	**96.2%**
	Springs in Urban Areas	Count	**165**	**3.8%**
2.	**Springs by Type**			
	Free Flow	Count	**2310**	**53.3%**
	Seep	Count	**2023**	**46.7%**
3.	**Springs by Nature**			
	Perennial	Count	**3335**	**77.0%**
	Seasonal	Count	**907**	**20.9%**
	Dried	Count	**91**	**2.1%**
4.	**Springs by Ownership**			
	Public	Count	**1554**	**36.6%**
	Private	Count	**2688**	**63.4%**
5.	**Springs with chamber/tank**	Count	**863**	**19.9%**
6.	**Springs with piped supply**	Count	**964**	**22.2%**
7.	**Discharge Measurable**	Count	**1346**	**31.1%**
8.	**Spring Water Colour**			
	Colourless	Count	**3824**	**90.1%**
	Coloured	Count	**418**	**9.9%**
9.	**Smell/Odour**			
	Agreeable	Count	**3519**	**83.0%**
	Non-Agreeable	Count	**723**	**17.0%**
10.	**Water Taste**			
	Unobjectionable	Count	**3465**	**81.7%**
	Objectionable	Count	**777**	**18.3%**
11.	**Water Temperature**			
	Cold	Count	**4241**	**99.9%**
	Hot	Count	**1**	**0.0%**
13.	**Resource Threat**			
	Yes	Count	**361**	**8.5%**
	No	Count	**3880**	**91.5%**
14.	**Degree of Threat**			
	Low	Count	**103**	**28.5%**
	Moderate	Count	**177**	**49.0%**
	High	Count	**81**	**22.4%**
15.	**Type of Dependents**			
	Residents	Count	**2532**	**59.7%**
	Non-residents	Count	**1421**	**33.5%**
	Wild animals	Count	**288**	**6.8%**
16.	**Dependency Level (Residents)**			
	Low	Count	**761**	**30.1%**
	Moderate	Count	**1181**	**46.6%**
	High	Count	**590**	**23.3%**

3.6 Bihar

The State of Bihar is situated in the eastern region of India. It is bounded on the north by Nepal, on the east by West Bengal, on the south by Jharkhand, and on the west by Uttar Pradesh.

Bihar is predominantly characterized by the alluvial plains of the River Ganga and its tributaries, forming part of the Middle Gangetic Plain. The physiography of the state mainly comprises fertile plains, with limited upland and plateau regions in the southern districts adjoining the Chotanagpur Plateau. The state experiences a tropical monsoon climate, marked by hot summers, a monsoon season with moderate to high rainfall, and cool winters. Major rivers flowing through the state include the Ganga, Gandak, Kosi, Son, Bagmati, Kamla-Balan, Mahananda, and Punpun.

The geographical area of Bihar is about 94,163 sq km, and the total population is 104,099,452 as per the 2011 Census of India. Administratively, the state is divided into 38 districts. A large proportion of the population resides in rural areas, and agriculture is the principal source of livelihood. Major crops cultivated in the state include rice, wheat, maize, pulses, and sugarcane.



Fig. 3.31 A spring located near the village of Kamal Khairwa in Nawhatta Block of Rohtas District, Bihar State

3.6.1 Major findings of the census

Springs occur only in the southern and south-western parts of Bihar, particularly in districts such as Rohtas, Mungar, Jamui, Kaimur and Nawada, which fall within the hilly and plateau fringe zones of the Chotanagpur Plateau and Vindhyan ranges. These areas are characterized by hard rock formations, fractured and weathered zones, and undulating topography, which favor the emergence of both perennial and seasonal

springs. In the First Spring Census, a total of 53 springs were enumerated, of which 98.1% (52) are located in rural areas and 1.9% (1) in urban areas. District wise distribution of springs is given below:

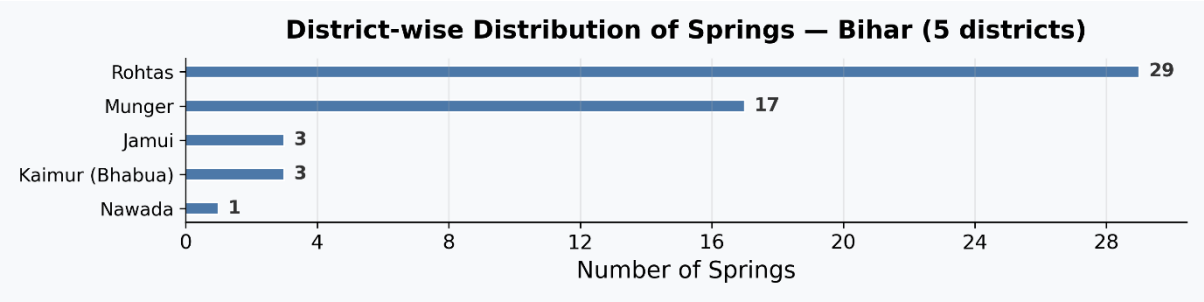


Fig. 3.32 District-wise distribution of spring

In terms of flow type, 54.7% (29) of the springs are of seep type, while 45.3% (24) are free-flowing. Out of the total enumerated springs, 47.2% (25) of the springs are perennial, 52.8% (28) are seasonal. With respect to ownership, all springs are under public category (Fig. 3.33).

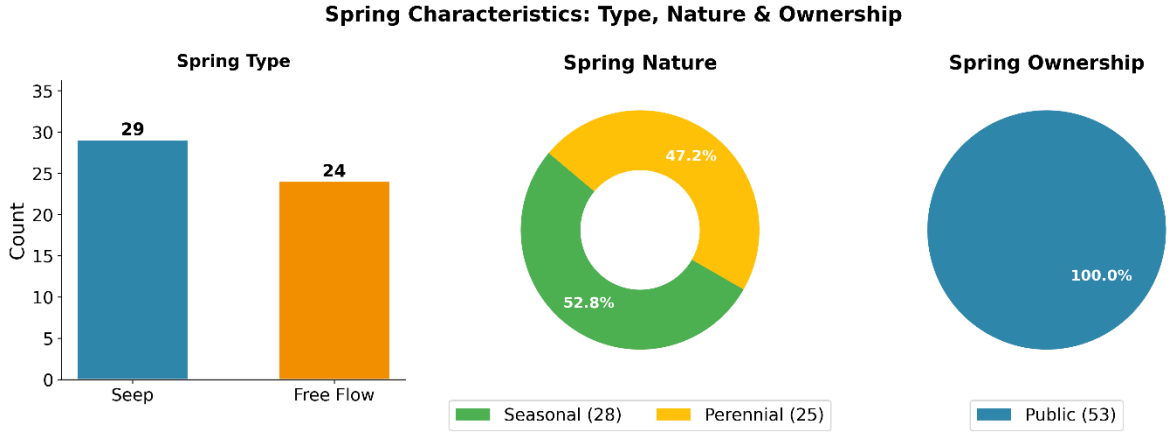


Fig. 3.33 Spring characteristics: Type, Nature & Ownership

In the survey of spring dependency, the usage and reliance patterns were analysed across three primary groups i.e., residents, non-residents, and wild animals. Out of the total springs studied, Non-residents use 26.4% (14), while Wild animals access 37.7% (20). Residents, who exhibit varying levels of dependency, utilize the remaining springs. Within the resident group, 50% (3) of the springs show a moderate level of dependency, 16.7% (1) show low dependency, and 33.3% (2) are reported to have high dependency (Fig. 3.34).

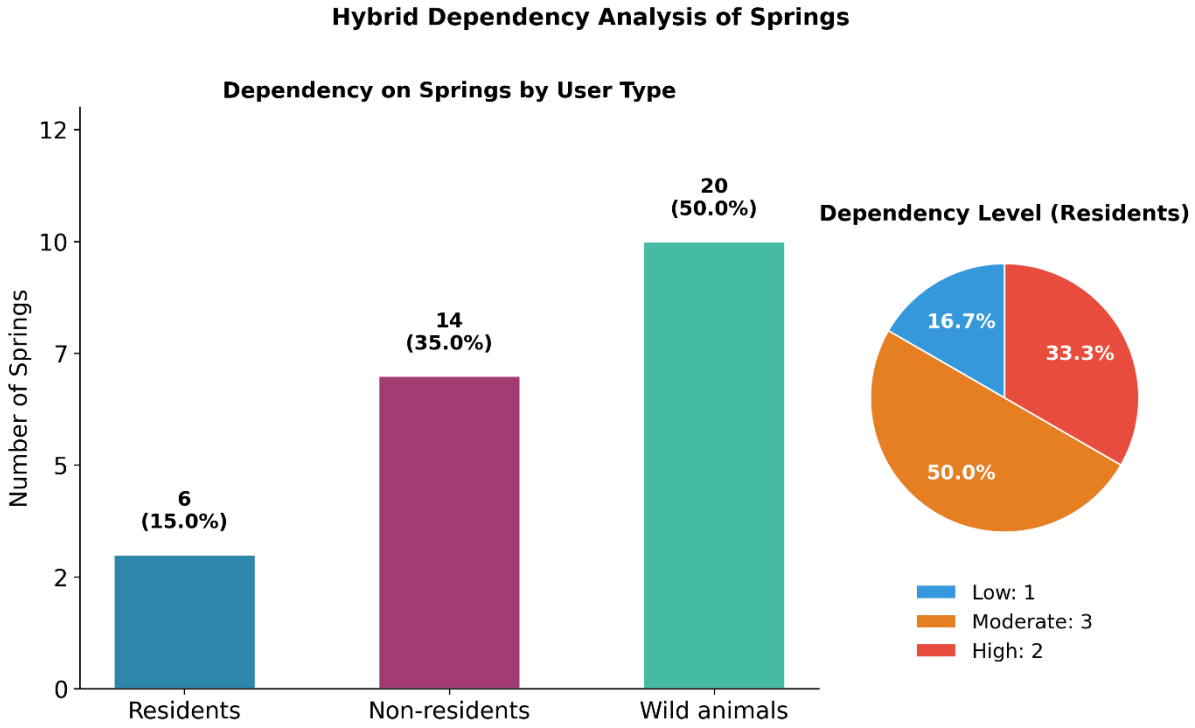


Fig. 3.34 Spring dependency

In the survey of spring discharge, a total of 21 springs were measured for their flow rate. Out of these, the largest proportion, 52.4% (11), fall into the discharge category of (20, 50) LPM. This is followed by 28.5% (6) of springs in the (5,20) LPM range. 19.1% (4) measuring (50, 100) LPM range. No springs were recorded with a discharge exceeding 100 LPM and (0, 5) ranges (Fig. 3.35).

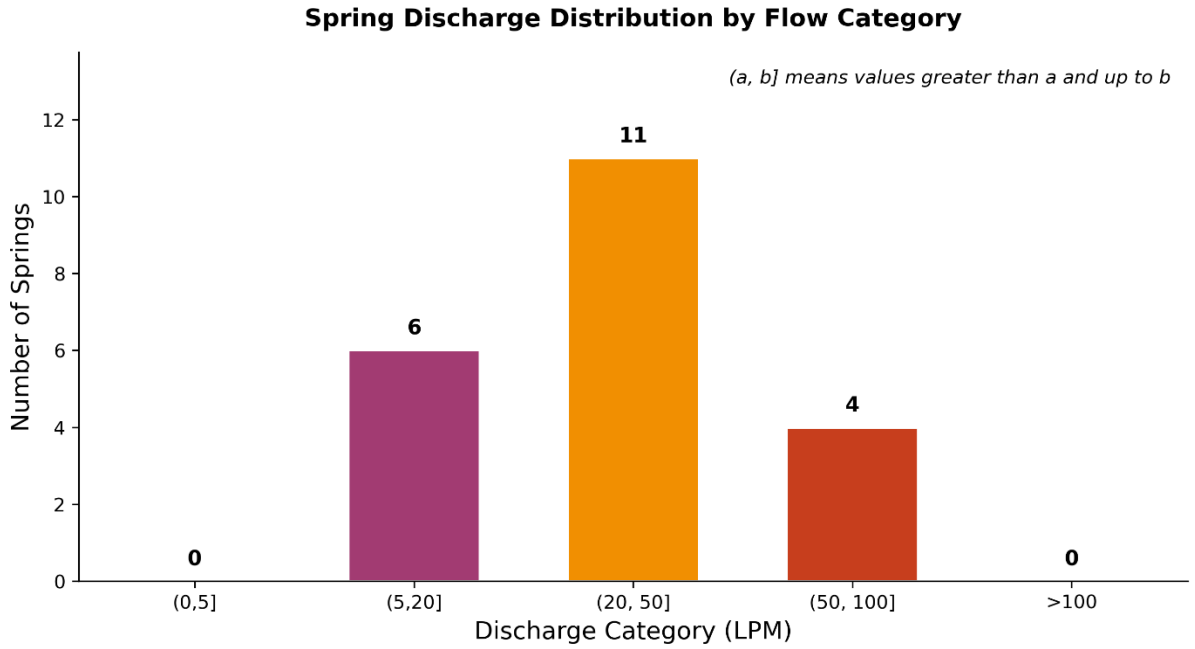


Fig. 3.35 Spring discharge distribution

In the survey of resource threats to the springs, a total of 40 springs were analyzed for their threat status. Out of these, 95% (38) of the springs are reported to have no resource threat, while 5% (2) are identified as having a threat. Among the springs where a threat was identified, 100% (2) exhibit a moderate degree of threat, with no springs reported as having low or high threat levels (Fig. 3.36).

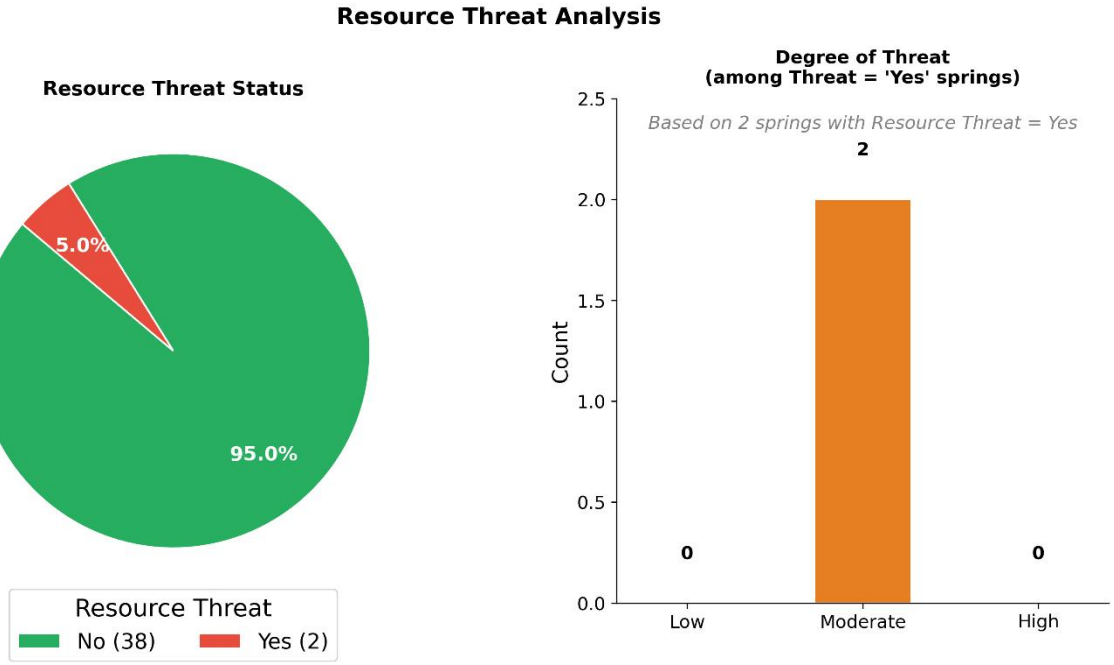


Fig. 3.36 Resource threat analysis

The Table 3.6 provides a consolidated overview of key characteristics of the inventoried springs and may be referred to for understanding the overall status, distribution, and usage patterns of spring resources in the state of Bihar.

Table 3.6 Overview of spring attributes and associated parameters for the state of Bihar

Sl. No.	Parameters	Unit	Value	Percentage of Total
1	**Total Number of springs**	Count	53	100.0%
	Springs in Rural Areas	Count	52	98.1%
	Springs in Urban Areas	Count	1	1.2%
2.	**Springs by type**			
	Free Flow	Count	24	45.3%
	Seep	Count	29	54.7%
3.	**Springs by Nature**			
	Perennial	Count	25	47.2%
	Seasonal	Count	28	52.8%
	Dried	Count	0	0%
4.	**Springs by ownership**			
	Public	Count	53	100%
	Private	Count	0	0%
5.	**Springs with chamber/tank to collect the water**	Count	8	15.1%
6.	**Springs with piped water supply**	Count	2	3.8%
7.	**Springs where discharge could be measured**	Count	21	39.6%
8.	**Spring by Colour of its water**			
	Colourless	Count	52	98.1%
	Coloured	Count	1	1.9%
9.	**Springs by Smell/odour of its water**			
	Agreeable	Count	31	58.59%
	Non-Agreeable	Count	22	41.5%
10.	**Springs by taste of its water**			
	Objectionable	Count	7	13.2%
	Unobjectionable	Count	46	86.8%
11.	**Springs by its water temperature**			
	Hot	Count	13	24.5%
	Cold	Count	40	75.5%
12.	**Springs by resource threat**			
	Yes	Count	2	5%
	No	Count	38	95%
13.	**Springs by degree of threat**			
	Low	Count	0	0.0%
	Moderate	Count	2	100%
	High	Count	0	0.0%
14.	**Spring by type of dependents**			
	Residents	Count	6	15%
	Non-residents	Count	14	35%
	Wild animals	Count	20	50%
15.	**Spring by dependency level (Residents)**			
	Low	Count	1	16.7%
	Moderate	Count	3	50%
	High	Count	2	33.3%

Annexure-I

SCHEDULE FOR 1ST CENSUS OF SPRINGS

FIRST CENSUS OF SPRINGS
REFERENCE YEAR 2023-24

Rural-1/Urban-2

I IDENTIFICATION PARTICULARS (Standard Codes to be used)

(a) State..... Code

(b) District..... Code

For Rural

(a) Block/Tehsil..... Code

(d) Villages name..... Code

For Urban

(e) Town/Municipality..... Code

(f) Ward No.

Serial no. of spring within village/town

Unique Identification Key for Spring, with prefix 'S' *(If urban give code for town and ward)*

R/U	State	District	Tehsil/Town/Block	Village/Ward	Sl. No. within village/town

Timestamp of Survey *[dd-mmm-yyyy hh:min]*

II SPRING DESCRIPTION

1. Locational Information

Latitude *(Degree Decimal)*

Longitude *(Degree Decimal)*

Altitude *(m, a.m.s.l.)*

2. Local Nomenclature of Spring...(Fetch data from the Table).....

3. Spring type: Free Flow-1, Seep-2 Code

4. Spring Nature: Perennial-1, Seasonal-2, Dried-3 Code

5. Whether this is a newly emerged spring *[within the last 10 years]:* Yes-1, No-2 Code

6. Does spring discharge muddy water in rainy season? Yes-1, No-2 Code

7. Cleanliness in and around the spring: Satisfactory-1, Unsatisfactory-2 Code

8. Spring ownership: Public-1, Private-2 Code

9. Whether there is any chamber/tank to collect the water? Yes-1, No-2 Code

10. Whether there is any pipe water supply from spring? Yes-1, No-2 Code

11. Capture three photographs for additional details

(a) Close up shot of spring *(about 2 m from the spring outlet)*
(b) Wide angle shot of spring *(about 10-20 m from the spring outlet)*
(c) Selfie with spring

III GENERAL PHYSICAL CHARACTERISTICS OF THE SPRING

1. Whether spring discharge could be measured? Yes-1, No-2 Code

2. No. of spring outlets *[If the answer of III (1) is 'Yes' i.e., Code-1]*

Volume *(litres)*	Duration *(min:sec)*	Discharge *(litre per minute)*

3. Seasonal variability of the discharge across the year: High-1, Low-2 Code

4. Spring discharge trend in last 10 years:

Highly decreased-1, Slightly decreased-2, No change-3, Increased-4 Code

5. Colour of spring water: Colourless-1, Coloured-2 Code

6. Smell/odour of water: Agreeable-1, Non-agreeable-2 Code

7. Taste of water: Objectionable-1, Unobjectionable-2 Code

8. Temperature of spring water: Hot-1, Cold-2 Code

IV OTHER INFORMATION

1. Dominant land use land cover in spring upstream:

Agriculture-1, Forest-2, Pasture-3, Shrubs-4, Settlement-5 Code

2. Land use land cover in and around spring location:

Agriculture-1, Forest-2, Pasture-3, Shrubs-4, Settlement-5 Code

3. Resource threat: Yes-1, No-2 Code

If the answer of IV (3) is 'Yes' i.e., Code-1, fill the following details,

(a) Degree of threat: Low-1, Moderate-2, High-3 Code

(b) Major stressor responsible for threat *(up to three codes, in the order of preference):*

Drought-1, Forest Fire-2, Scouring/Gully Erosion-3, Landslide/Subsidence-4, Code

Earthquake-5, Avalanche-6, Urbanization-7, Deforestation-8, Pollutant load-9, Code

Introduction of non-native plants-10, Animal grazing-11, Mining-12, Other-13 Code

4. Usage of spring water *(up to three codes, in the order of preference):* Code

Drinking/Cooking-1, Washing/Sanitation, Cattles/Livestock-3, Code

Irrigation-4, Indutrial-5, Other-6 Code

5. Dependent type: Residents-1, Non-residents-2, Wild animals-3, Not applicable-4 Code

If the answer of IV (5) is 'Residents' i.e., Code-1, fill the following details,

(a) Total dependent population:

6. Dependency level: Low-1, Moderate-2, High-3 Code

7. Other available source of water *(select multiple options, if applicable):*

Other spring-1, Piped supply-2, Hand pump-3, Dugwell-4, Pond-5, None-6, Other-7 Code

8. Whether the spring has undergone any springshed/watershed management program? Code

Yes-1, No-2, Not known-3

Remarks, if any:

Checked by:

Name:

Designation of Supervisory Officer:

Mobile No.:

Signature of Enumerator:

Name:

Designation of Enumerator:

Mobile No.:

Annexure - II

Scrutiny Check Points – Spring

1. If 2.4=1 then 3.1 can't be 2 [*If a spring is perennial then it can't not have zero discharge*]
2. If 2.4=3, then all fields after 2.4 should be blank [*For dried springs, the schedule stops at item 2.4, so there should be no entries recorded after it*]
3. If item 3.1 is yes, then item 3.2 should be >0. [*If Spring discharge could be measured,*
   then no. of spring outlets should be greater than zero]
4. If item 3.2=0 then entry in item discharge in item 3.2 should be zero [*if number of outlets is zero then there should not be any discharge*]
5. In item 3.2, Outlet 1 Discharge, Outlet 2 Discharge, Outlet 3 Discharge etc should not
   be exactly equal [*In a spring with multiple outlets, all the outlets should not have the same discharge*]
6. If 3.8=1, then all fields after 3.8 should be blank [*For hot springs, the schedule stops at item 3.8, so there should be no entries recorded after it*.]
7. If item 4.5=3, then item 4.1 and item 4.2=2 or 4 [*If dependent type is Wild animals, then Land use land cover in and around spring location should be forest, shrubs or pasture only*[1]]
8. If item 4.5 = 2 or 3, then 4.5 (a) should be blank [*If dependent type is non-residents or wild animals, then there will be no dependent population*]
9. If item 4.6=1 or 2 then, item 4.7 not equal to 6 [*If dependency level is low or moderate, then other available source of water cannot be None*]
10. If item 3.5 = 2, and item 3.6=2, then item 3.7 should be 1 (objectionable) and item 4.4. should not be 1 (Drinking use) [*If Spring water is coloured and smell of water is non-agreeable, then taste of water should be objectionable and water should not be used for drinking purpose*]

[1] This condition has been relaxed in some states since agricultural lands found close to the forest boundaries where the wild animals use the spring water.

Annexure - III

Validation Check Points – Spring

Item No.	Item/Field	Checks
3.1	Whether spring discharge could be measured?	Show warning when spring is free flow but discharge can't be measured in item 3.1
3.2	No. of spring outlets	Show warning when number of spring outlets is more than 3 in item 3.2 (outlet)
3.2	No. of spring outlets (discharge)	Show warning when spring discharge is more than 100 lpm in item 3.2 (discharge)
3.7	Taste of water	Show warning when spring water is coloured with non-agreeable smell/odour but taste is Unobjectionable in 3.7
4.4	Usage of spring water	Show warning when either spring water is coloured or non - agreeable smell/odour or objectionable taste but still is used for Drinking/cooking in item 4.4
4.5 (a)	Total dependent population	Show warning when Spring is privately owned and number of dependent populations is more than 100 in item 4.5(a)
4.7	Other available source of water	Show warning when there is high dependency on Seasonal Spring but other available source of water is 'none' in item 4.7



स्प्रिंग अध्ययन प्रकोष्ठ, राष्ट्रीय जलविज्ञान संस्थान,
रुड़की, उत्तराखंड
CELL FOR SPRING STUDIES,
NATIONAL INSTITUTE OF HYDROLOGY,
ROORKEE, UTTARAKHAND
EMAIL: CESS-NIHR@GOV.IN

लघु सिंचाई (सांख्यिकी) स्कंध
जल संसाधन, नदी विकास एवं गंगा संरक्षण विभाग
MINOR IRRIGATION (STATISTICS) WING
DEPARTMENT OF WATER RESOURCES, RIVER
DEVELOPMENT & GANGA REJUVENATION
EMAIL: MISTAT-MOWR@GOV.IN

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग, जल शक्ति मंत्रालय, भारत सरकार
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT
AND GANGA REJUVENATION, MINISTRY OF JAL SHAKTI, GOVERNMENT OF INDIA