Institution: University of Cambridge		
Unit of Assessment: UoA14 Geography		
Title of case study: Supporting public action to secure water sources in the Indian Himalayas		
Period when the underpinning research was undertaken: 2012-2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Professor Bhaskar Vira	Professor of Political Economy	January 1998 – date
Dr Eszter Kovacs	PDRA	November 2013 – May 2020
Period when the claimed impact occurred: March 2014 – December 2020 (and ongoing)		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Since 2012, Professor Bhaskar Vira has led research on the political economy of water security, ecosystem services and livelihoods in South Asia. This case study describes the work in a specific tourist town in the Indian Himalayas, Nainital, the impact of which includes:

i. improved local government support for the protection of water sources in Nainital, benefiting its resident population (c.40,000) and visiting tourists (c.750,000 per year), including a 2019 court order demanding the cessation of all unauthorised construction activities and the removal of encroachments impacting Nainital's lake catchment area
ii. wider commitments at Uttarakhand state and Indian national government level to develop approaches that recognise the roles of natural ecosystems for securing water supplies, including INR19.23 million (GBP192,000) in funding from the Government of India to support scientific research to inform political decision making in the tourist towns of Uttarakhand
iii. greater public awareness and understanding of the linkages between urban water security and natural ecosystems, including the development of school curricula which has been downloaded over 1,500 times

2. Underpinning research (indicative maximum 500 words)

Between 2014 and 2018, Professor Bhaskar Vira led a research project focusing on the political economy of water security, ecosystem services and livelihoods in the western Himalayas. The research was supported by the Ecosystem Services for Poverty Alleviation (ESPA) programme, a nine year global interdisciplinary research programme (2009-2018) funded by UK government and research councils (NERC, ESRC, DFID), which aimed to give decision-makers and natural resource users the evidence needed to address the challenges of sustainable ecosystem management and poverty reduction. The research was conducted in India and Nepal, with two local research partners, the Centre for Ecology Development and Research (CEDAR) in India, and the Southasia Institute of Advanced Studies (SIAS) in Nepal.

The project drew attention to the patterns of urban development, and associated environmental pressures across the western Himalayas [R1]. The lower hills of the Himalayas are experiencing unplanned urbanisation across a number of small towns, contributing to the exhaustion and contamination of natural surface or spring-based water sources. These are exacerbated by seasonal demands in popular tourist towns, and made worse by policy inaction [R2].

Primary research focused on six small towns and their surrounding catchments in the Western Himalayas, examining the relationships between ecosystems and urbanisation, water and environmental security, and vulnerability and risk. At each, the project examined water sources, up- and downstream demands for water and arising land-use change, and governance trends around water resources. The research highlighted the importance of 'critical water zones' across these landscapes, specific locations which are identifiable as impacting the hydrological system, and where changes in patterns of land use can result in variation in hydrological regimes [R3].

The resort town of Nainital, located at an altitude of 1,938 metres in the Indian state of Uttarakhand, depends on its central lake (*tal*) to support its growing economy. The town has a resident population of 41,372 (Census 2011), but also attracts a significant seasonal tourist influx (estimated at 758,000 in 2014). Research confirmed the role of a secondary lake, Sukhatal, which stores water from the monsoon period until later in the winter, and acts as a critical water recharge zone, providing nearly half of subsurface flow to lake Naini during the dry season. Using a combination of spatial mapping, archival records, secondary studies of the catchment system and expert review, the project team produced a report [E2] highlighting the neglected, but critical, role of Sukhatal as a buffer for the main lake.

The broader project highlighted the trade-offs that characterise decision making in the complex socio-environmental contexts of the western Himalayas, and the need to understand the political economy considerations that influence the strategies of public and private decision makers [R4]. Water users have diversified strategies to cope with multiple risks, and governments and donors planning infrastructure investments in the region need to understand these strategies [R5]. The research drew attention to the need for reciprocal water use agreements to develop resilient pathways [R3;R6], as well as suggesting that current approaches to decision making are characterised by risk aversion and administrative inertia [R3;R4]. Lack of long-term data and inadequate monitoring of social and ecological systems present significant challenges to the role of science-based decision making in these environments [R1]. The research calls for a new management paradigm in such 'data-poor' environments, with experts willing to adopt an attitude of well-informed experimentation, following adaptive strategies based on evidence and the monitoring of impacts [R3].

3. References to the research (indicative maximum of six references)

All research outputs listed below have been through a thorough peer review process

R1. Satyal, P., Shrestha, K., Ojha, H., Vira, B. and Adhikari, J., **2017**. A new Himalayan crisis? Exploring transformative resilience pathways. *Environmental Development*, doi:10.1016/j.envdev.2017.02.010

R2. Kovács, E.K., Ojha, H., Neupane, K.R., Niven, T., Agarwal, C., Chauhan, D., Dahal, N., Devkota, K., Guleria, V., Joshi, T., Michael, N.K., Pandey, A., Singh, N., Singh, V., Thadani, R. and Vira, B., **2019**. A political ecology of water and small-town urbanisation across the lower Himalayas. *Geoforum*, doi:10.1016/j.geoforum.2019.10.008.

R3. Whittaker, L., Kovacs, E.K. and Vira, B., **2018**. Reciprocal commitments for addressing forest–water relationships. In Schreckenberg, K., Mace, G. and Poudyal, M. (eds.) *Ecosystem Services and Poverty Alleviation (OPEN ACCESS)*(pp. 152-167). Routledge. https://www.taylorfrancis.com/books/e/9780429016295/chapters/10.4324%2F9780429507090-10

R4. Vira, B., Adams, B., Agarwal, C., Badiger, S., Hope, R.A., Krishnaswamy, J. and Kumar, C., **2012**. Negotiating trade-offs choices about ecosystem services for poverty alleviation. *Economic and Political Weekly*, v. 47, p.67-75. http://www.jstor.org/stable/23214477

R5. Vogl, A.L., Goldstein, J.H., Daily, G.C., Vira, B., Bremer, L., McDonald, R.I., Shemie, D., Tellman, B. and Cassin, J., **2017**. Mainstreaming investments in watershed services to enhance water security: Barriers and opportunities. *Environmental Science & Policy*, v. 75, p.19-27. doi:10.1016/j.envsci.2017.05.007

R6. Kovacs, E.K.K., Kumar, C., Agarwal, C., Adams, W.M., Hope, R. and Vira, B., **2016**. The politics of negotiation and implementation: a reciprocal water access agreement in the Himalayan foothills, India. *Ecology and Society: a journal of integrative science for resilience and sustainability*, v. 21, p.37-47. http://dx.doi.org/10.5751/ES-08462-210237

Research and impact Awards:

1. Vira B. (PI) in partnership with Centre for Ecology, Development and Research (CEDAR), India and Southasia Institute of Advanced Studies (SIAS), Nepal. *The Political Economy of Water Security, Ecosystem Services and Livelihoods in the Western Himalayas*. Funded by UKRI NERC/ESRC/DFID Ecosystem Services for Poverty Alleviation Programme (ESPA). Project code NE/L001365/1. January 2014 – December 2017. GBP462,605. https://gtr.ukri.org/project/ED2DB08E-819C-4F5B-B2C1-C67803F01647.

2. Vira B. (PI). *Exploring water and urbanisation in the Himalayas: bridging communities of practice through photography and place*. Funded by UKRI NERC/ESRC/DFID Ecosystem Services for Poverty Alleviation Programme (ESPA). Project code IAF2017-18-001. June 2017 – February 2018. GBP35,141. (https://www.espa.ac.uk/projects/iaf2017-18-001).
3. Vira B. (PI). *ESRC Impact Acceleration Account Exploring Water and Urbanisation in the Himalayas*. Funded by ESRC. April 2017 – June 2018. GBP13,600.
4. Vira B. (PI). *Pani, Pahar: Schools Project - ESRC Impact Acceleration Account, follow on fund*. Funded by ESRC. July 2018 – March 2019. GBP5,000.

4. Details of the impact (indicative maximum 750 words)

The research project led by Professor Bhaskar Vira recognised the need for a multi-pronged approach to secure governmental action in the complex Indian political economy environment. This required the communication of credible science to key decision makers (including the judiciary), supporting civic mobilisation to create a demand for enabling policy action, targeted expert meetings to influence policy change, and high profile engagement activities and new learning resources to shift public discourse and understanding. The Cambridge team, led by Vira, co-produced the project impact strategy with its Indian partner, the Centre for Ecology, Development and Research (CEDAR).

The research, and the associated impact and engagement activities, have supported change in three domains: (i) improved local government support for the protection of water sources in the hill station town, Nainital, benefiting its resident population (c.40,000) and visiting tourists (c.750,000 per year); (ii) wider commitments at Uttarakhand state and Indian national government level to develop approaches that recognise the roles of natural ecosystems for securing water supplies; (iii) greater public awareness and understanding of the linkages between urban water security and natural ecosystems.

(1) Improved and legally enforced protection for water sources in Nainital
In Nainital, an ongoing public interest litigation provided a specific opportunity for the project to engage with policy change at the local level. The petitioner was seeking redress in the High Court against illegal encroachment in the catchment area surrounding a secondary water source, Sukhatal **[E1]**. The project conducted research and convened an expert group (including hydrologists, geologists and social scientists) in April 2015 to establish the importance of this secondary source. The team's multidisciplinary expertise and the credibility of an internationally funded programme drew specific attention to the role of Sukhatal as an important recharge zone, and these findings were compiled in the project workshop report **[E2]**. The project brought this evidence to the notice of the court and local authorities, and used the project workshop, local media sources and civic mobilisation to maintain a sustained public discourse on the risks of water insecurity, and the importance of protecting this critical water recharge catchment. In July 2015, the Uttarakhand High Court took cognisance of the role of Sukhatal as "a main source of recharge of Naini Lake" **[E1]**. CEDAR facilitated a citizen's action group ('Citizens for Nainital') in Nainital, and a petition to 'Save Nainital's Lake' gathered over 10,500 signatures, including endorsements from celebrities and sports personalities **[E3, E4**]. On 3 June 2017, around 1,000 people took part in a barefoot march to raise awareness about the issue **[E4]**. This concerted pressure resulted in a court order in 2019 in which local authorities were directed to stop all unauthorised construction around Sukhatal, and to remove encroachments that were impacting the lake catchment area, "as expeditiously as possible" **[E5].** These orders are binding on the state government of Uttarakhand, and on the local urban authorities in Nainital, and the High Court continues to monitor their implementation.

(2) Securing commitments to protect natural water sources at state and national level
On the basis of the project's results and the growing visibility of the hydrological crises experienced by the town's citizens the state government released just under INR 30 million (GBP0.3 million) to rejuvenate Naini lake **[E6]**. The Governor, the Chief Minister and the Chief Secretary of the state asked Cambridge's collaborator CEDAR, along with the United Nations Development Programme (UNDP) India, to organise a stakeholder meeting in November 2017

to discuss short-, medium- and long-term solutions for Nanital **[E7]**. Recognising the need for the project's scientific input to inform decision making in the tourist towns of Uttarakhand, on 26 November 2019, the Government of India (Ministry of Jal Shakti, Department of Water Resources) sanctioned a project worth INR 19.23 million (GBP192,000) on hydro-geological and socio-economic assessment of the implications of depleting water resources in tourist towns of Uttarakhand **[E8]**. CEDAR is leading this project, and Vira chairs the scientific advisory committee for the project **[E8]**. The impact of Covid-19 immediately after this project was sanctioned has meant that activities have not yet been able to start.

(3) Improved public awareness and understanding of the linkages between urban water security and natural ecosystems

Improved public awareness and understanding of the linkages between urban water security and natural ecosystems have been achieved through three pathways:

(i) Photo exhibition, Pani, Pahar: the Waters of the Himalayas: Working with photo journalist Toby Smith, Vira curated a successful photographic exhibition, Pani, Pahar **[E9]**, which was shown in a leading Delhi gallery (Visual Arts Gallery, India Habitat Centre) as well as displayed in the Jor Bagh Metro Station, which has an average footfall of around 25,000 passengers per day **[E10]** and serves prominent government offices in Delhi. The show at the India Habitat Centre is estimated to have reached at least 5,000 visitors per month **[E10]**, and received extensive positive coverage in India's leading newspapers and magazines. A 2018 article in *The Week: India* described the impact of the exhibition: 'The inevitability of an acute water crisis in the lower Himalayas of India and Nepal is laid out bare in the ongoing photography exhibition *Pani-Pahar: Waters of the Himalayas*…Late 19th century images taken by British photographer Samuel Bourne are set against photos taken by Smith last year to bring home the extent of urban degradation and pressure on land-use in these so called "hillside havens"… For a dose of reality on how hillside communities struggle to meet their daily water needs in high-season and the ways in which they adapt to use and manage water from existing sources, head to Pani-Pahar' **[E9]**.

(ii) Web archive and Guardian photo essay: The project has archived its visual resources and photo stories in a permanent web archive **[E9]**. The work was also featured as a photo essay in The Guardian newspaper **[E9]**, which led the environment page carousel for five days in December 2017. The Guardian does not share readership statistics, but independent analysis suggests that online worldwide readership is over 20 million across multiple platforms **[E9]**.

(iii) School curricula to empower young citizens: Images and insights from the research were used to develop educational resources for Indian schools, using curriculum design expertise from an Indian educational consultant, Hearth Advisors **[E11]**. The curriculum is designed for students between the ages of 9 and 15, and is free to download for students, teachers and schools. The detailed lesson plans encourage reflection and research on the human causes of water scarcity, and some of the effects of environmental change on humans and our shared resources. It also helps students understand the meaning of activism, recognise some of the challenges associated with activism, and begin to associate activism with the needs and issues of their school. The overall aim of the curriculum is to engage students in experiential and life-changing learning and to instil a sense of responsibility towards water conservation. In the year since launch (15 January 2020), these resources have been downloaded 1,687 times by registered users on the platform **[E11]**.

5. Sources to corroborate the impact (indicative maximum of 10 references)

E1. Nainital public interest litigation. Collated document including Uttaranchal High Court writ petition
E2. Project workshop report 2015
E3. Save Nainital's Lake petition
E4. 1,000 people took part in a barefoot march to raise awareness about the lake

E5.	Reserved judgement of the Uttarakhand High Court dated 27 August 2019
E6.	The state government released just under INR 30 million to rejuvenate Naini lake
E7.	CEDAR organise a stakeholder meeting in November 2017
E8.	The Government of India sanction a project worth INR 19.23 million
E9.	Pani Pahar exhibition evidence including press reviews, Guardian article and Guardian reach. See, in particular, pages 10 and 23.
E10.	Evidence of footfall at Jor Bagh Metro Station and visitors at India Habitat Centre
E11.	Evidence related to school curricula including letter from Hearth Advisors. See, in particular, pages 1, 2 and 11.