Agricultural Water Management xxx (2009) xxx–xxx

Contents lists available at ScienceDirect

Agricultural Water Management

journal homepage: www.elsevier.com/locate/agwat

Negotiating participatory irrigation management in the Indian Himalayas☆

V.S. Saravanan *

Centre for Development Research, Walter Flex Strasse 3, 53113 Bonn, Germany

ARTICLE INFO

Article history:
Received 24 September 2009

Accepted 7 December 2009
Available online xxx

Keywords:
Bayesian network
Policy modelling
Integrated water management
Institutional integration
South Asia

ABSTRACT

Participatory irrigation management (PIM) reforms are implemented in India to facilitate farmers' participation in irrigation management, through water user groups. Although thousands of user groups have been formed, a closer examination reveals inefficient water use, social power capture by rural elites in the name of participation, inadequate support from government institutions and government's inability to alleviate poverty. Currently, there is inadequate understanding of the linkage between socio-cultural, institutional and ecological factors affecting the outcome of the PIM reforms in India. Drawing from a case study village in the Shiwalik region of the Indian Himalayas, the paper identifies the role of diverse actors to exploit historic and ecological factors to derail the PIM reforms to frame water management problems. Using a combination of research methods and with application of a Bayesian network, the paper explores the inter-linkages between socio-cultural, institutional and ecological factors in derailing the PIM reforms. The paper reveals that PIM policies are never implemented, but integrated through the negotiation with other diverse policies and socio-cultural settings in (re)shaping water resources management. The analysis demonstrates that water is managed by multifaceted governance arrangements. In this governance arrangement state-centric or market-oriented or community-centered institutional arrangements are not superior to each other, rather they incrementally and cumulatively superimpose to (re)shape water resources management. In this process, integration represents a complex blend of statutory and socially embedded actors bringing with them diverse rules to negotiate, along with contextual factors. The findings call for laying out broad principles/ideologies in the policy statements of the statutory public actors that allow other actors to integrate, adapt and make policy processes dynamic. To facilitate this processes, the paper calls for statutory public actors to regulate water distribution, build capacity of actors and offer diverse forums for actors share and debate on the available information to take informed water-related decisions for a sustainable future.

1. Introduction

Participatory irrigation management (PIM) reforms are implemented in various states in India to facilitate farmers' participation in irrigation management, through water user groups. These reforms are implemented as 'packages' that consist of policies, legislations, and administrative structures. Although thousands of user groups have been formed, a closer examination of PIM reveals inefficient use of water, an opportunity for rural elites to capture social power in the name of participation, and an increased gap between the rich and the poor (Mollinga et al., 2000; Swain and Das, 2008). In essence, these outcomes have highlighted the importance of understanding the complex linkages of the socio-ecological and institutional settings affecting the outcomes of the PIM reforms in India. Taking this forward, the paper examines an irrigation-related problem of a village in the Indian Himalayas from an institutional perspective to identify the barriers and opportunities presented by institutional factors in derailing PIM. It adopts a combination of research methods and applies a Bayesian analytical tool to identify the network of actors to exploit the historic settings, and ecological factors by drawing on diverse rules to derail the PIM reforms. It identifies the incremental and cumulative activities of various actors and the rules they apply to claim legitimacy and competency in exploiting the PIM reforms to (re)frame the water management problem in the village. Such exploitation, which facilitated an incremental increase in the irrigation command area without supplementing the existing water resources, has led to mismanagement of water resources and inadequate maintenance of the irrigation system. This allows the households from the village to frame a problem "inadequate availability of water in the irrigation command area", and therefore demand an additional irrigation scheme to supplement the existing water for growing agricultural crops.

Policies provide strategic directions for actors to adopt a particular course of action. These policies include paradigms,

☆ The paper is a tribute to Prof. Geoff T. McDonald and Dr. Basil von Horen.

* Tel.: +49 228 734918; fax: +49 228 731972.
E-mail address: s.saravanan@uni-bonn.de.

0378-3774/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.agwat.2009.12.003

public sentiments, programmes and frames (Campbell, 1998). They may be in the form of statutory statements written in constitutions, strategy papers, vision documents of public and private organizations, national and international organizations, water users' groups, religious groups, and other groups of individuals. They may also be in unwritten form, as values, principles and norms embedded in communities, caste, religions and/or even among individuals. To implement these policies, actors devise legislation, guidelines, institutional structure, strategies, incentives, customs, practice and other instruments in 'packages'. Actors in the paper are defined as groups of individuals functioning as a unit. They may be statutory public organisations, private companies, water user groups and even group of farmers. Sociologists regard these as structures consisting of rules and resources (Giddens, 1984). In a region, there are no single but multiple policies that integrate to shape and reshape water resources management. There is a growing body of literature that highlights the importance of policy integration[1] for sustainable development (e.g., Lafferty and Hovden, 2003; Lenschow, 2002). While most studies focus on the integration of strategies, structures and processes within governmental institutions, an attempt to examine the integration across public, private and socially embedded institutions is less common. More so is lack of literatures that combine qualitative narratives with quantitative analysis on the interlinkage between socio-cultural and ecological factors from an institutional perspective.

The paper examines the integration of statutory, private and community level actors and the rules they draw in framing an irrigation-related problem through a combination of qualitative and quantitative information analyzed through Bayesian network model. This tool visualizes the complex process of policy integration in the form of policies, where policies are negotiated in a number of complex interlinked arenas over space and time. The following section offers methodology to unravel the complex integration of policy networks to frame the irrigation-related problem. The third section empirically applies this methodology to the context of the Bikram Bagh Khul irrigation system in the Indian Himalayas. The fourth section analysis the policy networks identifies the role of actors and the rules they draw to exploit the historical and ecological factors, and estimates the probability of their relationship influencing an irrigation-related problem. The fifth section reveals the incremental and cumulative interplay of multiple governance arrangements in framing water management problems in a case study. The final section highlights the importance of integrative, adaptive and dynamic policy-making in multifaceted governance arrangements.

2. Methodology

An irrigation-related problem exists when there is a discrepancy between (1) technically achievable and desired social goals, and (2) actual outcomes (circumstances) that arise from current institutional arrangements (Livingston, 1987:287). The problem is dialectic, meaning it is perceived or framed differently by different actors depending on the strategic context. The paper aims to understand how the PIM programme that embeds on the existing socio-ecological and institutional settings helps to facilitate the framing of the irrigation-related problem as perceived by the communities in a Himalayan village. A combination of research methods was used. Semi-structured interviews, structured interviews, focus-group discussions, participatory resource mapping, participant observation, field notes and information derived from secondary documents (archives and published government records) were used during a yearlong field research programme in 2004. Structured interviews were conducted with 43 households (40% of the total households), semi-structured interviews with 32 officials (with government, non-government, politicians and academics), as well as focus-group discussions, participatory mapping exercises (resource mapping, transects and wealth ranking), and participant observation. This combination of research methods helped to contextualize information, and also to obtain both quantitative and qualitative information to understand the perception of different actors. The collected data was mapped as a network using the Bayesian network modelling tool to understand the probable relationship among the variables to frame the irrigation-related problem.

A Bayesian network is a modelling tool that quantifies the relationships among variables, even if the relationships involve uncertainty, unpredictability or imprecision. It is based on probability calculus following Bayes'[2] rules. A Bayesian network comprises three elements; firstly a set of variables that represent the factors relevant to a particular environmental system or problem, secondly the links between these variables, and finally the conditional probability values that are used to calculate the state of the variables (Bromley, 2005). Application of a Bayesian network (BN) has gained prominence as a decision support system (DSS) for integrated water resources management[3] (Batchelor and Cain, 1999; Cain, 2001; Bromley, 2005). Many studies have excluded the dynamic and complex nature of social-political and ecological processes involved in water management. This paper attempts to overcome some of these challenges by applying BN as an analytical tool, supplemented with narratives to understand the socio-political process of framing water management problems in the village.

The Bayesian network helps to integrate both qualitative and quantitative information, in addition to quantifying the probability of relationships amongst variables. In this network, the variable indicates the actors or the contextual factors, such as physiography, rainfall, historic settlements in the region. The linkages between these variables indicate the rule (or causal linkages) that governs their relationship, which is derived through chi-square (significance p value), using qualitative statements obtained from field research, and sometimes, through the logical reasoning of the researcher. Rules are patterned behaviour of a social group, evolved over a period (Mitchell, 1975; Ostrom, 1998) to govern human activity. They forbid, permit or require actions or outcomes to enable actors to derive benefit (or loss) from certain resources (Crawford and Ostrom, 1995). They are structures of power relations that actors draw in the socio-political process of exploiting PIM in the village. Rules are classified as statutory and socially embedded. Statutory rules are constitutionally and legally valid, openly shared and clearly structured arrangements enforced by either or both public and private actors. Socially embedded rules are formal, practiced widely amongst individuals and groups, but can also be concealed, unwritten and enforced by caste, village councils and religion. While there are a number of rules, following Ostrom et al. (1994) these rules are classified as boundary rules (specifying who the actors are), position rules (setting the position for actors to take), scope rules (setting the outcomes for their decisions), aggregation rules (specifying the outcome), information rules (providing channels for communica-

[1] The literatures also refer to this as policy process (e.g., Sabatier, 1999; Keeley and Scoones, 1999; Sutton, 1999; Mooij, 2003; IDS, 2006).

[2] Thomas Bayes was an 18th Century English clergyman, who is known for Bayesian probability theory.

[3] The approach in these studies marshals theoretically relevant variables (and their potential linkages) in order to understand the management problem. Second, they exclusively rely on the BN as the only tool for taking policy and management decisions, placing definite boundaries on spatial and temporal variables (Barton et al., 2008, also refer to Uusitalo, 2007). Finally, they believe that once the model is built it can remain stable (possibly updated), and can be decision-making tool.

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

tion), authority rules (setting the actions assigned to actors), and pay-off rules (prescribing the benefits and costs). The variables and their linkages (rules) are applied into a probability model of a BN using NETICA software (Norsys Software Corporation Canada). A panel of advisors (households, village leaders, bureaucrats, intellectual experts, non-government officials and politicians) validated the accuracy of the model in reflecting the reality of the situation it is used to understand.

3. The case of the Bikram Bagh Khul irrigation system

The Bikram Bagh Khul irrigation system witnessed the formation of the Bikram Bagh Khul Irrigation Society (BKIS) in 2001 by the Department of Irrigation and Public Health (DoIPH), Government of Himachal Pradesh. The BKIS was formed as a PIM initiative to maintain and manage one of the traditional Khul irrigation systems in the district, dating back to the 1880s. The Khul irrigation system is a gravity-based system that consists of a network of primary, secondary and tertiary lined or earthen channels. These irrigation systems are widely prevalent in the Himalayan regions. The Bikram Bagh Khul irrigation system (hereafter as the Khul) was built by the then ruler of Sirmaur, Shamsher Prakash in 1887 by diverting water from the river Markhanda to irrigate his Bikram Bagh (Bikram named after his son, and Bagh meaning orchard) (DoR, 1890). The main channel of the Khul is about 5–6 km long and irrigated about 304 acres of command area benefiting a population of about 1125 (about 188 households) from the Bikram Bagh Revenue Village (namely the hamlets Daduwala, Simbalwala, and Aakawala), and from the Pipalwala Revenue Village in the year 2004[4]. The households are from different castes. Officially they are classified as Scheduled Caste (Lohar, Jhimvers, Chamars, Pathan, Bhade), Scheduled Tribe (Gujjar, Bhanjar, Pinjer) and General Caste (Pandit, Rajputs). Of these about 76% are from the official category of the General Caste, 14% from the Scheduled Caste and 10% from the Scheduled Tribe.

The BKIS has a total membership of 179 members, representing the total households owning land in the irrigation command area, with 9 households being landless from the Pipalwala Revenue Village. The Society has 89 households/members from the Pipalwala Revenue Village holding 58 acres (average of 0.65 acres per household) in the irrigation command area, compared to 90 members holding 123 acres (average of 1.4 acres). The large area of 123 acres is the Bikram Bagh which is currently owned by the descendent of the ruler of the Sirmaur. The landholding pattern in the irrigation command area indicates predominance of marginal landholders. About 49% of the households own marginal lands (less than 1 acre), 35% hold small lands (between 1 and 2 acres) and 16% hold large lands (more than 2 acres of land). About 67% of the households in the Pipalwala Revenue Village are marginal landholders.

Water distribution in the irrigation command area is carried out through three network distributaries, where by each network distributary is managed by a hamlet. Each network receives water on a rotation-basis during normal rainy months (June-September) with Daduwala (in the head reach) being the first to receive the water, then Simbalwala (middle reach, which includes Bikram Bagh), finally by Pipalwala (tail-end). But during dry months (October–December), the timing of allocation varies and often leads to differences among the farmers, which is often negotiated by village elders or distributed based on the principle of 'might is right'. In each network, the water distribution is prescribed by the village leader appointed by the BKIS. For instance, in Daduwala the leader appointed does not have much difficulty, as the farmers are from a single caste and family lineage and he may thus distribute water based on his assessment of the demand for water. The situation is no different in the hamlet Simbalwala. But in the village Pipalwala, water distribution takes place on a 'first-come-first-serve' basis, wherein farmers intending to irrigate their field have to reach the diversion weir (from where the water will be diverted) by 5.00 pm in the evening. Water is distributed depending on who comes first and many times based on social bonds of preferential treatment by officials of the BKIS to a few members (a more elaborate discussion is carried out in the following section).

In general, the cropping pattern in the irrigation command area includes cultivation of paddy crop (excluding area under horticulture crops) from June to August, and wheat, maize and vegetables with supplemental irrigation (along with rainfall or through illegally lifting water from the nearby river Markhanda) from September to January. However, the cropping pattern varies depending on the location in the irrigation command area and also depending on the soil quality. Being red soil zone in the head and middle reaches, the households from Daduwala and Simbalwala, besides cultivating paddy, also cultivate banana, turmeric and sometimes sugarcane, and during dry months, wheat, vegetables and pulses. However, for the households in the tail-end village Pipalwala primarily characterised by salty loamy soil, the main crop is paddy during monsoonal months, while in the dry months, wheat, maize and fodder crops are cultivated, with a limited number of households cultivating vegetables.

Although the economic activities of the households revolve around agriculture, most of the households (about 80%) from Simbalwala, Daduwala, and Aakawala have at least one member of the family employed in the Defence service or in government departments. In contrast, households in Pipalwala largely depend on employment in industries or agriculture, in addition to farming their own land. In this hamlet, about 52% of households depend on labour employment and are also agriculturist, 33% of the households are employed in government departments and are agriculturist, about 10% are primarily agriculturist and receive pensions from their former employment in government department, and 5% are landless and largely depend on labour employment in nearby towns and in the village. Given this economic activity, it is not surprising that whereas about 17% of the population live below the poverty line[5], according to official records in Bikram Bagh Revenue Village, this figure is 26% in Pipalwala Revenue Village.

The formation of the BKIS, claimed a senior official in the DoIPH is, "one of the cost-effective interventions in reviewing traditional systems to address multi-caste conflicts and manage water resources". Further he argued, given the diverse economic activities in the region, the formation of the BKIS is expected to facilitate betterment in the economy, especially for the poor farmers in Pipalwala. In order to benefit the Pipalwala Revenue Village, the DoIPH appointed two of its village leaders as the President and Secretary of the BKIS, with a Treasurer from the Bikram Bagh Revenue Village. This simplistic presumption of the global discourse to promote democracy in managing the Bikram Bagh Khul by the DoIPH officials actively embeds with the historical multi-caste settlement, the functioning of the government agencies, interventions of the Land Reforms Act, market economy, and socio-cultural settings to frame the irrigation-related problem in the village. To understand how the households perceive the irrigation-related problem, the village Pipalwala was selected, given its tail-end location in the irrigation command area, larger marginal land owners, multi-caste character, and higher percentage of poor households.

[4] It must be noted that there are a few households who own land in this irrigation command area, but live outside the region. It is difficult to quantitatively ascertain the number of such households, but a guess estimate from the BKIS is that these comprise about 30 households.

[5] This figure was highly contested in the year 2004, which led the government of Himachal Pradesh to reconsider its criteria and also to carry out a re-survey of the below poverty line population.

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

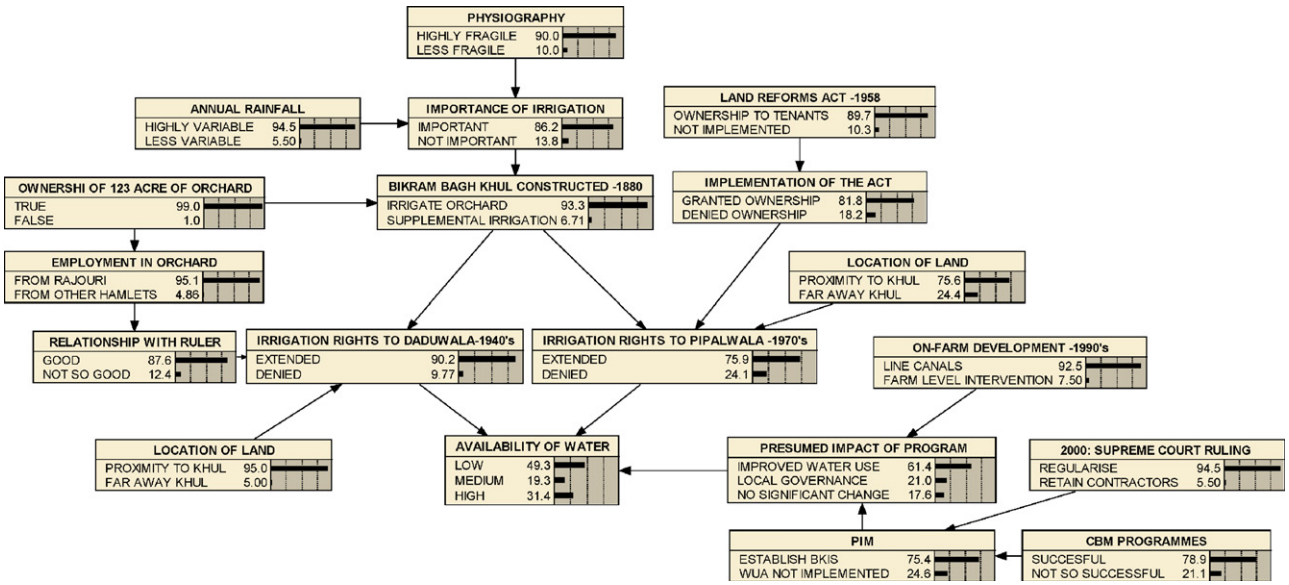

Fig. 1. Framing the problem in the Khul irrigation command area.

4. Framing the problem: incremental augmentation in the Khul irrigation command area

The Pipalwala Revenue Village is the lowest revenue division within the Indian administration system and is a downstream village in the Khul irrigation command area. The village is located in the low-hills sub-tropical Shiwalik zone in the state of Himachal Pradesh, and encompasses unconsolidated deposits, making the village land susceptible to soil and water erosion. The only river traversing the village is the river Markhanda, which dissects the region through a number of braided streams that flow from northeast to southwest. Settlement at this village's location dates back to the 17th Century (DoR, 1890), when the then ruler of Sirumar, the King Shamsher Singh (hereafter the Ruler), brought in different communities to work as tenant cultivators (in his orchards and his fields), to supply milk and its by-products, and for rearing horses and elephants for the royal requirements (DoR, 1890). Currently the village has a population of 430 households in two hamlets—Pipalwala and Bella. However, about 382 households (89%) reside in the hamlet Pipalwala. Most of these households (about 74%) are from the General Caste, 24% from the Scheduled Caste and the rest from the Scheduled Tribe (in 2002).

Since Independence in 1947, the village has witnessed various development initiatives including infrastructure developments, redistribution of unequal land ownership (Land Reforms Act), programmes to alleviate poverty, conserve water resources through on-farm management practices and introduction of democratic reforms (Indian Constitutional 73rd Amendment). These developments have significantly influenced the social and economic status of the households in the village. Currently households sell milk, seek employment in nearby towns as labourers, and in government and private companies, which contributes 38, 35 and 16% to their annual income, respectively. Agriculture contributes only 11% to the households' total annual income, but although comparatively this is less, it is significant for the households as it meets the subsistence requirements of the families. While food grains were the predominant crops in the past, in recent years these are supplemented with vegetables and fodder crops (with few horticulture crops). While official households below the poverty line in this village are estimated to number 111 households (about 26%), the primary survey conducted in the village by the researcher indicated about 51% of the households to be below the poverty line. This was based on a comprehensive index that considered land holding, sources of income and demographic structures in the households. The households living below the poverty line earned about 45,500 Indian Rupees per year, compared to an average earning of 70,400 Indian Rupees in the village. The villagers often complain that their inability to achieve a higher income is due to the 'inadequate availability of water to irrigate the Bikram Bagh Khul command area', for which the BKIS is actively pursuing the government agencies for an additional irrigation scheme to supplement their existing irrigation (for example a lift irrigation scheme).

There are multiple variables cutting across socio-ecological systems that incrementally and cumulatively facilitate the households' framing of the irrigation-related problem in the village (Fig. 1). The boundary variables influencing the perceived 'availability of water' in the Khul irrigation system were the contextual factors and the statutory public actors. The contextual factors included 'annual rainfall', 'physiography' and 'location of land'. The statutory public actors included 'Ruler ownership of 123 acres of orchards', 'on-farm development—1990', 'Land Reforms Act 1958', 'Supreme Court Ruling 2001' and 'participatory irrigation management (PIM)' programmes initiated by the World Bank and the Government of India (GoI). These boundary variables were exploited by statutory public actors and socially embedded actors through position variables—the 'importance of irrigation' to overcome variability in water, 'employment in orchards' for households in Dadawala, implementation of the Land Reforms Act, and through establishment of PIM in 2001. The socially embedded informal and statutory public actors exploited the above boundary and position variables using the following aggregation variables—'relationship with the Ruler', 'construction of 'Bikram Bagh Khul in 1887' and 'the presumed impact of programmes'. Interestingly, the socially embedded actors (the households of Daduwala and Pipalwala) exploited these rules to demand irrigation rights from the statutory public actors. The ruler of Sirmaur extended 'irrigation rights to (households from) Daduwala' in 1940s, later the DoIPH granted 'irrigation rights to (households from) Pipalwala' in 1960s as a result of the Land Reforms Act and recently the BKIS accommodated the interest of their 'dears-and-nears' by informally extending the irrigation rights. This has over a period of time increased the size of the irrigation command area without any supplemental irrigation or

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

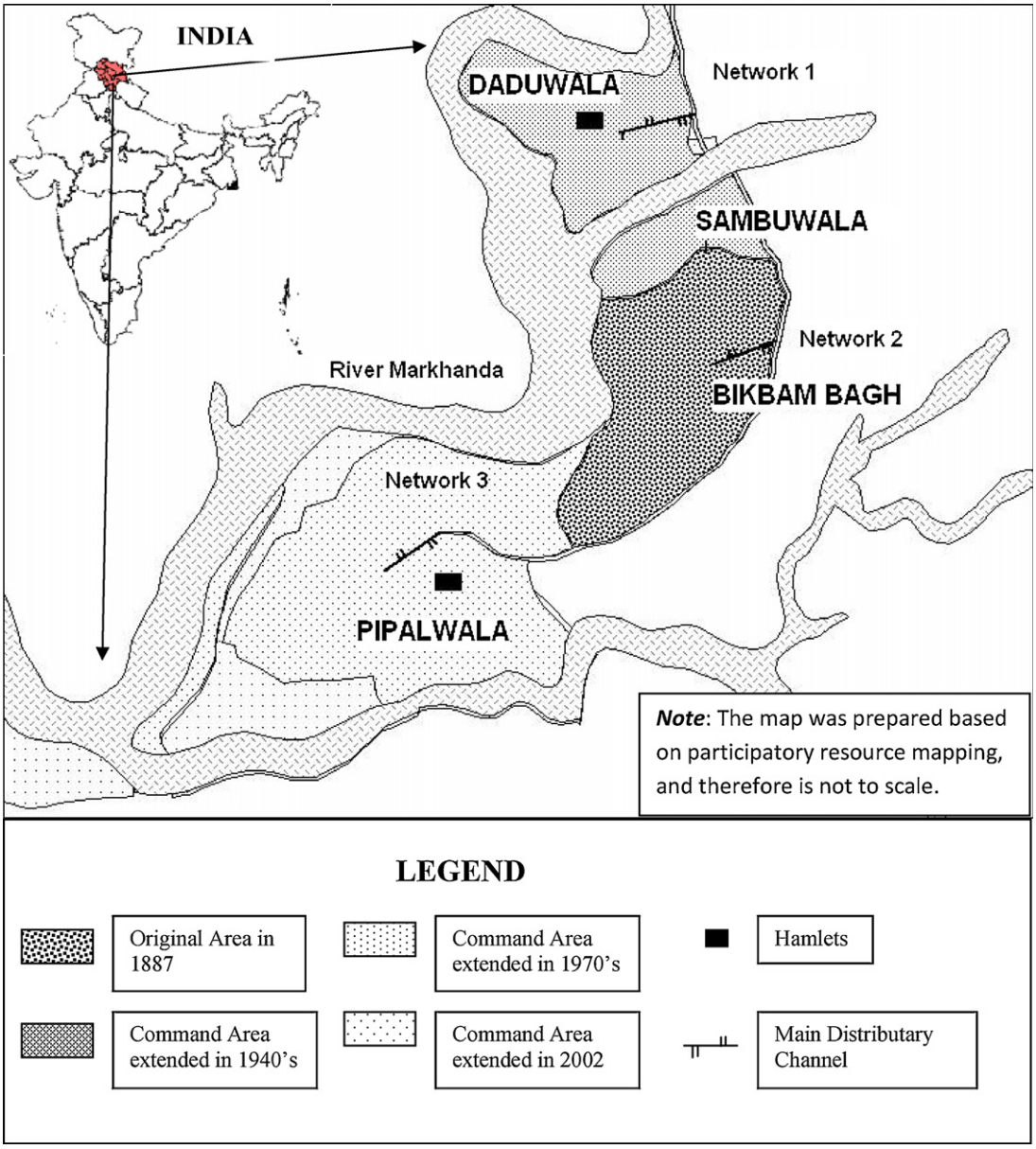

Fig. 2. Incremental expansion of Bikram Bagh Khul irrigation command area: 1887–2004.

demand management options (Fig. 2). This has influenced the pay-off variable—the 'availability of water', wherein the probability of the households to perceive 'low' availability of water was about 50% and 'medium' was about 20%. In managing the Khul over the past century, there were no variables that provided actors with the necessary information and scope for informed water-related interventions. As a result, actors adopted 'fire-fighting' approaches to further their own policies without a proper assessment of the existing water resources.

The physiography in the village is characterised by highly fragile land (prone to erosion and denuded landscape). All the 'official' classified reserve forests, *shamlat* (waste) land and grassland fall under the category of denuded landscape, which accounts for approximately 90% of the total area of the Khairi-Ka-Kala watershed. In this fragile landscape, variation in the annual average rainfall is high. Based on the reading from the nearest rainfall station, 95% variability in rainfall was reported since the 1980s when the first rainfall recording station was set up in Dualakhuan. It is difficult to verify if these variations were present during the 19th Century, when the Khul was constructed, but given the anecdotal evidence, the variations seem to be higher now than before. In these contextual settings, the Ruler's ownership of 123 acres of orchard land set the 'boundary' rules for water management in the hamlet. The Ruler exploited the 'boundary' rules by taking the 'position' to construct a Khul irrigation system to irrigate his 123 acres of orchard land in Pipalwala, and employed the households of the hamlet Daduwala (an upstream hamlet along the Khul channel) to maintain and meet the labour requirements (DoR, 1890). This wise decision, argued the descendent (great-grandson) of the Ruler, allowed households to provide security for the irrigation channels from water threats and also helped in managing the horticulture crops (Personal interview, 24 June 2004). Interestingly, the households of Dadawala 'aggregated' this position (employer–employee relationship) with another 'boundary' rule (the upstream 'location of land' that was close to the Khul) to demand irrigation rights. This was 'authorised' by the Ruler in the early 1940s to approximately 88% of the households of Dadawala, not due to an informed assessment of the water resources, but rather, as the great-grandson puts it, 'to protect the Khul system and in turn the horticulture crops, from

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

constant stealing of water by these households' (Personal Communication, 17 July 2004).

The increase in the Khul irrigation command area in the 1940s was augmented by additional interventions after India's Independence in 1947. The Land Reforms Act in 1958, the on-farm development activities in the 1990s to conserve water, and introduction of PIM in the 2001. The Land Reforms Act (1958) of the Indian government was implemented in the State of Himachal Pradesh as the Himachal Pradesh Transfer of Land (Regulation) Act 1968 and the Himachal Pradesh Tenancy and Land Reforms Act 1972 by the Department of Land Revenue (DoLR) to redistribute excess land from the landlords (here the Ruler) to the tenant cultivators (the households of the hamlet Pipalwala) in order to provide livelihood security. This Act set the 'boundary' rule for about 90% of the households, as the rest had prior landownership rights. However, only 80% of the households were able to take a 'position' – as landowners – as the rest of the households have their cases pending in judicial courts or were denied due to various reasons. These new landowners 'aggregated' their 'position' with the 'boundary' rule – the downstream 'location of land' close to the Khul – to legitimise their demand for irrigation rights.

Interestingly, the legitimacy of the households of Pipalwala to demand more irrigation rights was enhanced by other 'boundary' and 'position' rules from statutory public actors that affected the Khul's management. One of the boundary rules that enhanced the legitimacy was the on-farm development programmes that received priority under Five Year Plans in the State of Himachal Pradesh. Only 95% of the Khul was found lined in 2004, as one can witness breaches some of the channels that were lined destroyed in the rains or due to use of poor materials. While lining of the channels might increase the water availability under optimal geographical conditions, in a Shiwalik terrain that has loamy soil with high percolation rate and fragile landscape, the probability of loss is very high. However, this does not affect the official 'positions' of DoIPH, that "if Khuls are lined, irrigated area has to be increased to show the impact of the intervention", as was claimed by the senior official in the DoIPH, Nahan. This 'position' rule was strongly supported by the second 'boundary' rule—the Supreme Court of India's order. The order was a result of a case between Mohan R. Upadhayay vs. the State Government of Himachal Pradesh in 1994, which in the year 2000 directed the Himachal Pradesh Government with two orders (personal communication by a senior official at DoIPH). The first order was that any person working for more than 10 years in a government department had to be placed into a regular service, meaning they are given a regular monthly salary, with other social benefits (pension, housing allowances, provident funds and medical allowances). The second order was that any person who has served in the government departments for more than 240 days cannot be terminated. These orders were relevant to DoIPH which often employs labourers on daily wages to clean Khul and for other public related works (such as constructing bridges, roads and buildings). This order led to a three-fold increase (from 40,000 Indian Rupees per year in 1995 to 115,000 Indian Rupees in 2000 approximately) in the average cost of maintaining the Bikram Bagh Khul, creating a financial burden for the DoIPH. This led the DoIPH to take 'position' to form PIM implicitly as a means to reduce the financial burden, but explicitly to promote democratic forms of water management. This position was supported by the prevalence of many participatory-based resource management programmes funded by the World Bank (such as Integrated Watershed Development Programmes in the Kandy hills implemented by the Department of Forest (DoF)) and by the District Rural Development Agency (DRDA) (implementing integrated wasteland development programmes). Officials interviewed in government departments (such as DoIPH and DRDA) perceived a 78% probability that these programmes resulted in resource use efficiency and in promoting democratic forms of resource management. This assessment was based on the completion of the physical tasks of watershed management, maintenance of records and additional water availability (sometimes through transferring water from another watershed or through lift irrigation). This introduced a 'boundary' rule concluding that PIM is efficient, that it could reduce financial expenses, increase water availability and reduce water conflicts. The above two 'boundary' rules (provided by the Supreme Court of India and national and international agencies' experience in participatory resources management) provided an opportunity for the DoIPH to create a 'positions' rule—to establish the BKIS to overcome financial deficits and to promote democratic forms of irrigation management in 2001. These officials believed, as summarised by the Junior Engineer of the region, that 'people have experience (from the past), have knowledge on the water flow and therefore conserve water and resolve conflicts amicably' (Personal Communication, 22 June 2004). The probability that the BKIS was considered established by households (during primary survey) was only 75%. The rest were ignorant of such a formal user group, but believed that there is an informal committee albeit ineffective. The on-farm development and establishment of the BKIS was presumed to increase water availability for the government officials (with 85% probability perceived of these programmes increasing water availability).

Interestingly, the formation of the BKIS only accommodated the interests of some of the households who had close associations with the leaders (the President and the Secretary) of the BKIS, and who had cultivable lands adjacent to the Khul irrigation command area. This led to further increase in the command area. In 2004, the total irrigation command area was 306 acres, compared to 123 acres when it was constructed in 1887. There was no assessment concerning the availability of water prior to extending the irrigation rights in the Khul. This incremental increase in irrigation command area combined with inefficient distribution of water has caused the 50% probability of households to perceive the availability of water in the Khul as 'low' to increase. In the past, the water distribution in the irrigation command area was carried out under the order of the Ruler, given his ownership of the orchards. After Independence from the colonial rulers in 1947, the Government of India handed over all irrigation systems to the Public Works Department (PWD) of the respective states in 1958, which extended the irrigation rights to Daduwala, Simbalwala and Pipalwala at various periods. The PWD appointed a 'Water Distributor' who registers the command area farmers' demand for water and irrigates the fields based on a 'first-come-first-serve' basis in each network. This system of water distribution continued until the PWD handed over the irrigation management to the BKIS in 2001 and the BKIS appointed their own 'Water Distributor' from the members of the society for each of the three networks. Unfortunately, the BKIS appointed 'Water Distributor' in Pipalwala had to give up his responsibility due to social bonds of preferential treatment meted by the President and Secretary of the BKIS to a few members. This gave way to a new system of water distribution in Pipalwala alone, since 2002, wherein members reach the diversion weir (about 3 km from the settlement) a few hours prior to irrigating their land on the particular day of water distribution. Many households who have elderly members or children often have to depend on male adults or youths to attend this in order to irrigate their crops. Further complicating is any absence of crop planning at the level of the BKIS, each household planting their own crops depending on their own requirements. This often led to conflicts. For instance, in August 2004, a household planted fodder as their second crop, after paddy, on the assumption that water will be made available. But due to the delay in the onset of monsoon, farmers planting maize and wheat demanded first priority over

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

access to water, than households who had planted fodder crops. This resulted in the woman member in this household (whose husband was away at a nearby town) to sit on the distributor channel at night (at about 11.00 pm) thereby demanding water to her fields first. This enraged the male members who had planted maize and wheat crops, but they had to let the woman irrigate, given the fear that manhandling her in any way would lead to criminal charges brought against them. Such protests are common, along with water stealing and using force to take water, which is done especially by the disadvantaged or the rich households. This form of water distribution was aggravated by poor irrigation practices by the about 75% of the households flood-irrigating their crops. With no adequate knowledge of water distribution or training during the formation of the BKIS, disadvantaged household members often claim that 'water distribution in their village is based on the principle that 'might is right''.

The physiographic conditions, the then Ruler of the Sirmaur, the Land Reforms Act, on-farm development programmes, the Supreme Court ruling, introduction of PIM, and socio-cultural factors incrementally and cumulatively influence the perception of the households over the inadequacy of the water supply in the Khul irrigation command area, with about 50% of them perceiving 'low' availability of water in the Khul. The households' perception is actively supported by the BKIS which has taken up the matter with the DoIPH demanding an additional irrigation scheme to supplement the water supply to the existing irrigation area.

5. Implications for participatory irrigation management

Contemporary PIM programmes are premised to create a new lease of life in overcoming water problems, ignoring the complex and diverse socio-cultural, institutional and ecological environment. In the process they claim superiority of community-managed systems over state-centric and market-oriented governance. The paper reveals how the PIM initiative in the village Pipalwala was exploited by various actors who draw on diverse rules and contextual factors to frame the inadequacy of water supply in the existing irrigation system in order to demand a supplementary irrigation scheme. The contextual factors (climate, landholding size, etc.), social relations, judiciary, and national and international agencies set the boundary rules for actors to exploit PIM in the region. Statutory public actors (DoIPH, and the ruler of Sirmaur), and socially embedded actors (social relations in the village) use these rules to take positions to legitimise their demand for irrigation rights. However, the authority to frame the problem is collectively done by the statutory public actors (the DoIPH, the ruler of Sirmaur and the BKIS) who influence the perception of households regarding availability of water in the irrigation command area. In this integration process, a 'fire-fighting' approach is adopted by the actors depending on their own assessments of the situation. Rarely is any assessment of the existing water resources, the irrigation area, the cropping pattern and the practice of water distribution and management in the irrigation command area, conducted prior to the development and implementation of any new policies and programmes, like the PIM. The Land Reforms Acts in the 1960s and 1970s attempted to redistribute land, but they inherently legitimised the irrigation rights to the landlords. The on-farm development increased the size of the command area to meet the bureaucratic needs of the government agencies. Finally the cost factor due to Supreme Court ruling led to the formation of the BKIS. In the process, they incrementally and cumulatively facilitated increase in the irrigation command area and inefficient management of water in the irrigation system lead to low availability of water. The 'fire-fighting' approach is exploited by the households to frame a problem – 'inadequate availability of water in the Khul' – to demand an additional irrigation scheme to address water shortage.

The application of the Bayesian tool helped to map the interlinkages between the variables in a network form, which helped to understand the different roles played by the actors and the rules they apply. The contextual factors and statutory public actors played an important role in setting the boundary variables for the households in Pipalwala to demand an additional irrigation scheme. The statutory public actors and socially embedded actors (the households from the village) actively exploited these boundary variables to take positions. These position variables were aggregated and authorised by the statutory public actor (the DoIPH), which led to incremental increase in the irrigation command area. In the context of these diverse actors and their rules, the network identifies an absence of information that hampers actors in taking informed decisions on a particular course of action, and hence a 'fire-fighting' approach.

Contemporary participatory approaches to resource management (such as watershed and irrigation management) are programmed through 'blue print' policies. For instance, the widely known Parthasarathy Committee on Watershed Programs (GoI, 2006) claimed that their report was, "a detailed blueprint of a new course of watershed implementation in rainfed India" through multi-layered institutional structures (Shah, 2006:2982). The report, which was instrumental for the Ninth Common Guidelines (GoI, 2008) goes beyond to claim that such government reforms hold "the key to banishing poverty" and dry land development in India (Shah, 2006:2984). Often these statements are based on romantic notion of participation in the international discourse, disaggregated successes of non-governmental organizations that are deceptive in their presentation and remains a 'black-box' in the Indian democracy, are different from the way government manages resources, and fail to embed with the socio-cultural, institutional and ecological settings. This does not negate the importance of policies, but calls for policies to lay out broad principles (instead of 'blue-prints') that allow multiple actors to debate and share, taking their diverse needs into consideration. Facilitating the actors' debating and sharing of principles to enable an informed water management decision remains a challenge. The study in Pipalwala village reveals an absence of information rules that has hampered the actors in taking informed water management decisions. Public actors could strengthen the existing infrastructure facilities, such as roads, telecommunications, facilitate improvement in the market, access to mass media, and help-line centres for building the information rules that allow actors to interact and seek various options for desired outcomes; at the same time, public actors could raise awareness of issues related to resource management. Equally important for the government agencies is to regulate the distribution of water resources, build the capacity of strategic actors and facilitate agents of institutional change to enable comprehensive interventions in water resources management. This will make policy-making process integrative, adaptive and dynamic in multifaceted governance arrangement.

6. Conclusion

This paper demonstrates the exploitation of PIM by diverse actors and their rules to frame an irrigation-related problem in the village Pipalwala in Shiwalik in the Indian Himalayas. In framing the problem, the paper reveals that water is not managed by one form of governance (state-centric, market or community-based, such as PIM), nor is any one form of governance superior to the other. Rather, as the paper demonstrates, these forms of governance arrangements incrementally and cumulatively manage water, helping communities to frame the irrigation-related problem. In this multifaceted governance arrangement, applica-

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003

tion of diverse research methods and Bayesian network model reveals the complex process of policy integration, where the contemporary assumption of formulating a 'good' policy package is misplaced. Here, policies that come with a package of legislation and administrative structure are rarely implemented, but negotiated with other policies in shaping water resources management in the village. The network of policy negotiation reveals the decision to manage water is taken in a number of complex interlinked arenas over space and time. In this network integration represents a complex blend of statutory and socially embedded actors who exploit contextual factors and prevailing rules to negotiate their policies. Given the complex integration of policies, the paper calls for de-emphasizing the precondition of policy packages for resource management. Instead, emphasis should be placed on laying out broad principles in policy statements. This will allow multiple actors to integrate, adapt and remain dynamic in the policy-making processes by debating and sharing these principles for comprehensive assessment and its implementation. To facilitate this comprehensive assessment and implementation for an informed water management decisions the statutory public actors will need to build the capacity of actors, regulate water distribution, and offer diverse forums for actors to debate and share available information.

Acknowledgements

The author acknowledges University of Queensland for the International Postgraduate Research Scholarship and IWMI for Fellowships. The author is grateful to Prof. Geoff T. McDonald, Dr. Basil von Horen, Dr. David Ip, Prof. Maria R. Saleth, David Barton and John Bromley for their comments. The usual disclaimers remain.

References

Barton, D., Saloranta, T., Moe, S.J., Eggestad, H.O., Kuikka, S., 2008. Bayesian belief networks as a meta-modelling tool in integrated river basin management—pros and cons in evaluating nutrient abatement decisions under uncertainty in a Norwegian river basin. Ecol. Econ. 66, 91–104.

Batchelor, C., Cain, H.O., 1999. Application of belief networks to water management studies. Agric. Water Manage. 40, 51–57.

Bromley, J., 2005. Guidelines for the Use of Bayesian Networks as a Participatory Tool for Water Resource Management. Centre for Ecology and Hydrology, Wallingford, Oxford.

Cain, D.J., 2001. Planning Improvements in Natural Resources Management: Guidelines for Using Bayesian Networks to Support the Planning and Management of Development Programs in the Water Sector and Beyond. Centre for Ecology and Hydrology, Wallingford, Oxford.

Campbell, L.J., 1998. Institutional analysis and the role of ideas in political economy. Theory Soc. 27, 377–409.

Crawford, S.E.S., Ostrom, E., 1995. Grammar of Institutions. Am. Pol. Sci. Rev. 89, 582–600.

DoR, 1890. Misal Hakikat Bandopast—Bikram Bagh Panchayat. Department of Revenue, Government of Himachal Pradesh, Nahan.

GoI, 2006. From Hariyali to Neeranchal: Report of the Technical Committee on Watershed Programs in India. Department of Land Resources, Ministry of Rural Development, Government of India, New Delhi.

GoI, 2008. Common Guidelines for Watershed Development Projects. Report for Government of India New Delhi.

IDS, 2006. Understanding Policy Processes: A Review of IDS Research on the Environment. Report for Knowledge, Technology and Society Team, Institute of Development Studies, University of Sussex, Sussex.

Keeley, J., Scoones. I., 1999. Understanding environmental policy processes: a review. IDS Working Paper 89, Institute of Development Studies, University of Sussex, Sussex.

Lafferty, W., Hovden, E., 2003. Environmental policy integration: towards an analytical framework. Environ. Pol. 12 (3), 1–22.

Lenschow, A. (Ed.), 2002. Environmental Policy Integration: Greening Sectoral Policies in Europe. Earthscan, London.

Livingston, M.L., 1987. Evaluating the performance of environmental policy: contributions of neoclassical, public choice, and institutional models. J. Econ. Issues 21, 281–294.

Mitchell, B. (Ed.), 1975. Institutional Arrangements for Water Management: Canadian Experiences. Department of Geography, Faculty of Environmental Studies, University of Waterloo, Ontario.

Mollinga, P.P., Doraiswamy, R., Engbersen, K., 2000. Participatory irrigation management in Andhra Pradesh, India: policy implementation and transformation in the Tungabhadra Right Bank Low Level Canal. In: Paper presented at the 8th biennial conference of the International Association for the Study of Common Property (IASCP), Bloomington, Indiana, USA, 31 May–4 June.

Mooij, J., 2003. Smart governance? Politics in the policy process in Andhra Pradesh, India. Overseas Development Institute Working Paper 228, Overseas Development Institute, London.

Ostrom, E., 1998. The institutional analysis and development approach. In: Loehman, E.T., Kilgour, D.M. (Eds.), Designing Institutions for Environmental and Resource Management. Edward Edgar Publishing Limited, Massachusetts, pp. 68–90.

Ostrom, E., Gardner, R., Walker, J., 1994. Institutional Analysis and Common-Pool Resources. The University of Michigan Press, Ann Arbor.

Sabatier, P.A., 1999. Fostering the development of policy theory. In: Sabatier, P.A. (Ed.), Theories of Policy Process. Westview Press, Colorado, United States and Oxford, United Kingdom, pp. 261–275.

Shah, M., 2006. Towards reforms. Econ. Pol. Weekly 41 (26–27), 2981–2984.

Sutton, R., 1999. The policy process: an overview. Overseas Development Institute Working Paper 118, Overseas Development Institute, London.

Swain, M., Das, D.K., 2008. Participatory irrigation management in India: implementations and gaps. J. Dev. Sustain. Agric. 3, 28–39.

Uusitalo, L., 2007. Advantages and challenges of Bayesian networks in environmental modelling. Ecol. Mod. 203, 312–318.

Please cite this article in press as: Saravanan, V.S., Negotiating participatory irrigation management in the Indian Himalayas. Agric. Water Manage. (2010), doi:10.1016/j.agwat.2009.12.003