Irrigation Newsletter

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NEWS UPDATE

Irrigation Day 2067

Department of Irrigation celebrated the Irrigation Day on 4th August 2011 at its premises, Jawalakhel. Celebration started from the early morning with '*prabhat pheri*' (morning choir) participated by the staffs followed by blood donation program. Then after, the formal program was organized where Minister of Irrigation, Mr. Bharat Mohan Adhikari awarded best "WUA award of the fiscal year 2066/67" to WUA of Kerabari Bhogeteni Letang Naxalbari Irrigation System, Morang for its excellent management.

Likewise, best employees of the fiscial year 2066/67 were also felicitated inhis function. In addition, various sports activities and tournament were also organized on that day.

National Irrigation Seminar, 2068

National Irrigation Seminar - "Micro to Mega: Irrigation for Prosperous Nepal" was held on July 13-14, 2011 in Hotel Country Villa, Nagarkot. It was organized by Department of Irrigation with co-organizers INPIM-Nepal and IWMI-Nepal.

The seminar was inaugurated by Mr. Dal Bahadur Sunwar, Hon. State Minister, Ministry of Irrigation. Chief Guest of the opening session was Hon. State Minister and the Special Guests were Mr. Tana Gautam, Secretary, MoI and Er. Shital Babu Regmee, Secretary, WECS. The session was chaired by Er. Anil Kumar Pokharel, Director General, DoI. The seminar was attended by more than 90 experts and intellectuals from Ministry of Irrigation, Water and Energy Secretariat and other organizations related with water resources.

For the success/prolific outcome of the seminar 4 technical sessions were organized - 1st Strategic and policy issues 2nd Modernization of existing irrigation systems 3rd Climate change impact on water resources and challenges and opportunities in trans-boundary water transfer and 4th Enhancing water productivity with micro irrigation. In total 11 technical papers were presented in seminar on different sub-themes.

Orientation Training

Orientation Training for the newly appointed Engineers and Hydro-geologists in the Department of Irrigation was conducted in the department, Jawalakhel by System Management and Training Program from 29 th June to 8th July 2011. 31 Engineers and 3 Hydro-geologists participated in orientation training program. The training program was conducted to make them familiar with the working policies of the government, activities of Ministry of Irrigation, role and responsibilities of Department of Irrigation and Department of Water Induced Disasters Prevention. The organizational set up of Department of Irrigation and activities of different divisions and branches were briefed to the participants. Likewise, the participants were informed about the ongoing and proposed central level irrigation projects and the activities of Regional Irrigation Directorates and Irrigation Development Divisions and Sub-division offices.

The participants expressed that the orientation training program was very useful, it gave them an overall glimpses of the working procedures of the government and role and responisbility of Department of Irrigation.

Participation in International Workshop on Water Saving Irrigation and Food Security

A four days workshop on Water Saving Irrigation and Food Security was organized by Chinese National Committee on Irrigation and Drainage (CNCID) on 11-14 July 2011 in Beijing, China. All together 53 participants from China and other member countries of

Highlights of the Issue

Editorial

Micro to Mega Irrigation for Prosperous Nepal

Nepal has sufficient water resources for its needs. Optimum utilization of water for year round irrigation to its potential cultivable land is the country's need for increasing agricultural production for prosperous Nepal. Like any other natural resources water is not readily available for direct use when and where needed. It needs proper management of facilities and process it to deliver to users.

Conventional irrigation systems are mostly surface systems. The irrigation system is known as surface irrigation until the field is flooded by water. Surface system is the most common among the farmers for its simplicity irrespective of the significant losses of water incurring in the operation. So surface irrigation systems are considered unfeasible for very small water source and these systems have also limitation to the well prepared gently sloped land which is very difficult to achieve in hill and mountains.

Micro irrigation implies very small amount of available water applied efficiently to supplement the water requirement of crops. It is instrumental in avoiding the unfeasible situation for surface irrigation practice to poor soils and uneven land surface. Its application is more appreciated when cultivation is extended to larger area with effective distribution of limited water by modern appliances with better control. Use of micro irrigation appliances such as drippers, sprinklers is a meanse of achievement of such scope.

DOI is implementing nonconventional irrigation technology program (NITP) from the tenth five year plan. The program is focussing collection of water in reservoirs from very small sources to irrigate isolated pockets of cultivable land in hill and mountains which otherwise are not feasible under conventional system. The program encourages the use of modern water application techniques to optimize the limited water supply. These isolated pockets of cultivable land is mostly too small for feasibility criteria of conventional approach. These land is mostly owned by poor and excluded people. The program is runing as alternative development package for the marginalised and excluded people. However the program has the scope for enhancing the productivity within surface systems by intensifying cultivation in dry season as well as supplementing in wet seasons too.

Mega Irrigation implies to such large projects with very large infrastructures to supply water in large quantities to irrigate large areas of one or more distribution system. The efforts undertaken by the government to link one river basin to another by diversion structures to supplement the demand of irrigation in one water deficit basin from the other basin with surplus water for all its present as well as future demands. DOI is preparing to implement the Bheri Babai river diversion project in this fiscal year which would be a beginning of new dimension in development of irrigation facilities. Sikta Irrigation Project which is one of the largest project, is under construction and other river diversion schemes are under feasibility studies. In the past mega projects like Bagmati and Kamala have been developed.

Inspite of the capacities to divert large water volumes the supply of water dwindles down to quarter so as to shrink the cultivated area proportionately from the reported maximum irrigated area due to significant seasonal variation in runoff in the rivers. However the irrigated area is squeezed not only by supply constraints, rarely the reported irrigated area has met the target due to other genuine constraints like poor management capability, inaccessibility to the service to the scores of scattered and fragmented parcels of land. Inadequate distribution network is one major constraint to independent access for scattered and fragmented land holdings. Availability of ample groundwater in Terai plains has provided opportunity to supplement irrigation demand in deficit areas in dry season and isolated pockets in neighborhood of reported irrigated area. There is scope of conjunctive use to replenish the soil water storage adequate for evapotranspiration demand by combination of multiple technology.

International Commission on Irrigation and Drainage (ICID) including central office of ICID have participated and presented 18 papers on importance, experiences and utilization of water saving irrigation technology, from different member countries of Asia, Africa and Australia. The Deputy Director General Mr. Uttam Raj Timilsina participating from Nepal presented a paper; focusing on importance, and experiences of water saving irrigation technologies in Nepal.

The workshop was inaugurated by the Chief Guest, Mr. H.E. Jiao Yong Vice Minister, Ministry of Water Resources, People's Republic of China. The keynote speaker was Prof. Chandra Madramooto, president of ICID. The workshop was conducted at China Hall of Science and Technology, Beijing and was sponsored by Ministry of Water Resource, China and ICID Central Office New Delhi. The workshop highlighted the importance, work progress and experiences sharing on water saving irrigation technologies and its support to food production and food security in developing countries of different regions of the world.

Irrigation Management Transfer

Under the component B of Irrigation Water Resources Management Program (IWRMP), Irrigation Management of Block-8 of Narayani Irrigation System was transferred to Water User Association in a special program organized on 12 May, 2011 in Bara.

Irrigation Management Transfer (IMT) program was conducted under the chairmanship of Mr. Banka Bahadur Mahato, Chairman of Block-

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8 Water User Coordination Committee and the Chief Guest of the function was Er. Anil Kumar Pokharel, Director General, DoI. The other invitees were DoI staffs, participants from the local authorities and farmers. Er. Anil Kumar Pokharel representing Government of Nepal and Mr. Banka Bahadur Mahato representing Water User Coordination Committee of Block-8 signed the agreement paper on the irrigation management transfer.

Mr. Chetman Budthapa, Sociologist, IWRMP highlighted the details of agreement on the IMT whereas Mr. Imamudin Miya, Treasurer of Block-8, IMT specialist Dr. Prachanda Pradhan, SDE Basudev Lohanee expressed their views and encourage for the successful management of the system. Ms. Bandana Singh, member, NFIWUAN, Mr. Satyanarayan Mandal, IWRMP Coordinator, Department of Agriculture, IWRMP Coordinator Er. Niranjan Dev Pandey highlighted the need of IMT. Similarly, Senior Rural Development expert Dr. Purna Chhetri, World Bank, Er. Anil Kumar Phokarel, DG, DOI also expressed best wishes for the management of Block-8. One excavator, few cycles, computer were handed over to WUA on this program.

Regional Study Visit Program on "Irrigation System Management: Thailand and Vietnam"

Twenty government officers from National Planning Commission, Ministry of Irrigation and Department of Irrigation participated in Seminar and Regional Study Visit Program on "Irrigation System Management: Thailand and Vietnam" from 15th to 27th May 2011. The program was organized by Asian Institute of Engineering (AIT), Thailand in collaboration with Irrigation and Water Resources Management Project (IWRMP), DoI, Government of Nepal.

In Thailand, the "Input sessions" comprised of subjects as Integrated Water Resources Management, Participatory Irrigation Management and Irrigation System Management practiced in Thailand. And the "Exposure Visits" were focused on observation/study tours of various irrigation systems, O&M irrigation offices including Irrigation Development Institute (IDI), Royal Irrigation Department and Hydro and Agro Informatics Institute (HAII).

Similiarly, in Vietnam, "Input sessions" were on Overview on Water Resources Management, Irrigation System and Irrigation Policies in Vietnam while "Exposure Visits" concentrated on irrigation systems, irrigated agricultural cooperatives and their water users associations.

"International Training Course on Beyond Climate Change Impacts on Water Resources, Bio Diversity: Communication and the Role of Society"

International Training Course on Beyond Climate Change Impacts on Water Resources, Bio Diversity: Communication and the Role of Society jointly organized by Thailand International Development Cooperation Agency (TICA), Colombo Plan Secretariat and Faculty of Environment and Resource Studies, Mahidol University, Thailand held on 6-24 June 2011at Mahidol University, Thailand. The objective of the training program was to deliver the concept of climate change and bio-diversity and the highlight the activities that is undergoing in Thailand for the resilience climate adaptation. In total 12 participants from 10 countries participated in the training program. From Nepal.

Mr. Ashish Bhadra Khanal, Senior Divisional Engineer of Department of Irrigation participated in the program. Mr. Khanal presented the country paper on the impact of climate change due to global warming in the Himalayan region of Nepal. The climate change is the main factor behind the accelerated glacier retreat observed in the Himalayas. Further, he stated continued climate change is predicted to lead to major changes in freshwater flows with dramatic impacts on biodiversity, water resources, people and their livelihoods.

The training program was very useful it energized the participants on various aspects of climate changes taking place knowingly or unknowingly. The participants expressed that such trainings should be regularly conducted for the people at the grassroots level especially in developing countries.

WB approves $ 43m for Rani Jamara Kulariya Irrigation Irrigation

The World Bank approved and assistance package of $43 million for the implementation of Phase I of Modernization of Rani Jamara Kulariya Irrigation Project On July 7, 2011. The Project - located in Kailali District in the Far Western Tarai Region of Nepal- is one of the most prominent Farmer Managed Irrigation Schemes in the country, with a total command area of 14,300 hector. The bank's assistance package for the project will comprise a credit of $23.6 million from the International Development Association, the World Bank's concessionary lending arm, and an IDA grant of $ 19.4 million. The credit portion carries a 0.75 percent service charge, a 10 year grace period and a maturity of 40 years.

It constitutes three independent, traditional irrigation systems constructed operated, and managed by generations of farmers, mainly from the indigenous Tharu community. The oldest is the Rani system and it dates back to 1896.

In the first phase, the project will support the modernization of the irrigation system by substantially rehabilitating existing canal by providing control structures i.e. cross regulators in the main and head regulators at the off take of the branch, command area protection work, upgrading of village road within the command area, construction of feeder canal to feed Kulariya Jamara and Rani canal and by training Water Users Associations to improve their ability to manage the water and maintain the infrastructure. It will also carry out a series of agriculture production support activities in the project area through, demonstrations farmers' field schools, and other adaptive processes.

World Bank Country Director for Nepal Ms. Ellen Goldstein said "about 25,000 farming households comprising close to 160,000 people are expected to benefit directly from the project and the project will improve the reliability of water supply and help farmers better manage risks associated with droughts, floods and fluctuations in the availability of water during the agriculture seasons." Lead Irrigation Engineer at the World Bank Mr. Joop Stoutjesdijk told that Nepal has a long tradition of farmer managed irrigation with a strong sense of ownership and farmer organizations are typically strong and dedicated to rural development. Irrigation is only one input into agriculture and it is equally important of develop appropriate cropping pattern and identify high value crops for better returns.

TRAININGS/WORKSHOPS/SEMINARS

WUA Institutional Development Training

System Management and Training Program has conducted institutional development training for the WUAs of different irrigation schemes in Pyuthan, Rautahat, Sarlahi & Saptari districts during the month of June and July 2011. Three day training program on Water Management were conducted at different locations and was participated by the representatives from the respective irrigation water user's committees in groups of about 30 participants each.

Training on Gender Sensitization

On the occasion on "Year Against Gender Violence 2010" 1 day training program on gender sensitization was organized on 22 March 2011at Department of Irrigation with the objective to increase awareness about gender sensitivity in program planning and implementation. In total 40 participants including Director General, Deputy Director Generals, Program Coordinators, Directors of Regional Irrigation Directorates participated in the training. In the program Professor Ms. Mira Misra of Tribhuwan University highlighted on the "Conceptual Clarity on Sex and Gender" and Mr. Bodhraj Niraula, Joint Secretary Gender Responsive Budget Division, Finance Ministry and his technical advisor Ms. Nimja Tamrakar discussed on "Result Based Planning and Budgeting through Gender Responsive Budget Approach". Similiarly, Dr. Chandra Bhadra, Professor, Tribhuwan University discussed about "Planning, Programming, Monitoring and Evaluation from Gender Prospective" during the training.

FEATURE ARTICLES

A Case Study

Electricity Availability and its Effect on Shallow Tubewell Expansion:

Surendra Raj Shrestha

General Background

Terai region is abundant in groundwater resources. Studies have shown that potential for STW irrigation development is high in 726,000 ha land and in another 305,000 ha, it is marginal. Again, deep aquifers have good potential for irrigation development in 190,000 ha *(GDC, 1994)*. The total cultivated area is 1.39 million ha in Terai.

Rural electricity distribution network has, in general, improved recently, including in the Terai. Again, the government-set tariff rate for electricity use in irrigation is NRs. 3.60 per KWh, which is low compared to NRs 7.20/KWh in domestic use. As a result, many farmers were found to have replaced their diesel pumps with electric ones, because groundwater pumping with an electric pump is much cheaper compared to that with a diesel pump (Kansakar et al, 2006). Electric pumps are also available in a wide range of motor capacities that offered choices to the farmers according to their needs. Entry of Chinese electric pumps in the market has further made pumps prices more competitive and thus lowered their costs to the farmers.

The present study presents the impact of electricity infrastructure and cheaper electric pumps on intensification of STW irrigation development and access of small and marginal farmers on it in Nepal Terai.

Selection of the Study Area

A review of data from Nepal Electricity Authority indicated that Hirminiya Village Development Committee (VDC) area in Banke district has relatively better electricity and also road infrastructures. Some villages within this VDC area were known for vegetable production and shallow groundwater sources were known to be

used for irrigation. The Hirminiya Village Development Committee (VDC) lies in the southern part of the Banke district in Mid-western Development Region.

The VDC has a total area of about 1661 ha, out of which about 1365ha (82.17%) is cultivable. This area is constituted of alluvial soil, which is highly fertile and is suitable multiple and high value crops. Vegetable farming has been practiced in parts of VDC where farmers have access to irrigation.

In order to understand the impact of electricity infrastructure on STW irrigation development, two sites, namely Koreapurwa-Jangalipurwa (site 1) and the Bhanghotna-Baldipurwa (site 2) , were selected in the VDC for detailed study. The electricity distribution lines are better networked in the latter site, whereas it is sparse in the former site (Figure 1).

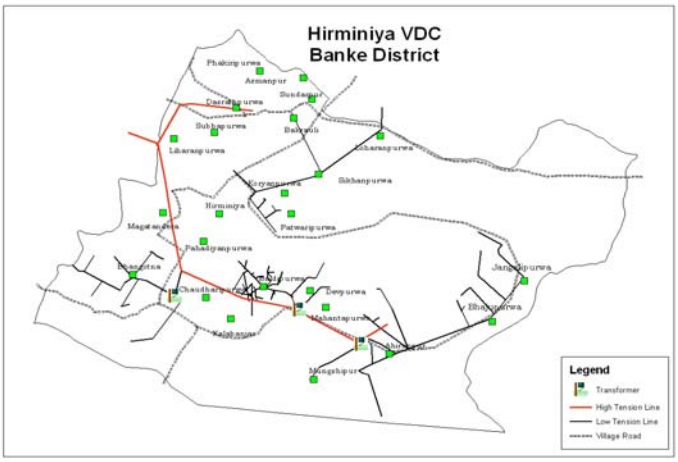


Figure no 1

The study site I lie at the central-eastern part of the Hirminiya VDC and include Sikhhanpurwa, Koreanpurwa, Patwaripurwa, Bhajjupurwa and Jangalipuwa villages. Its total area is about 553 hectares. The study site II is in the southwestern part of the Hirminiya VDC, and includes Bhangotna, Baldipurwa, Kalabanjar, and Chaudhripura village. It covers about 220 hectares area.

Evolution of Groundwater Irrigation in Hirminiya VDC

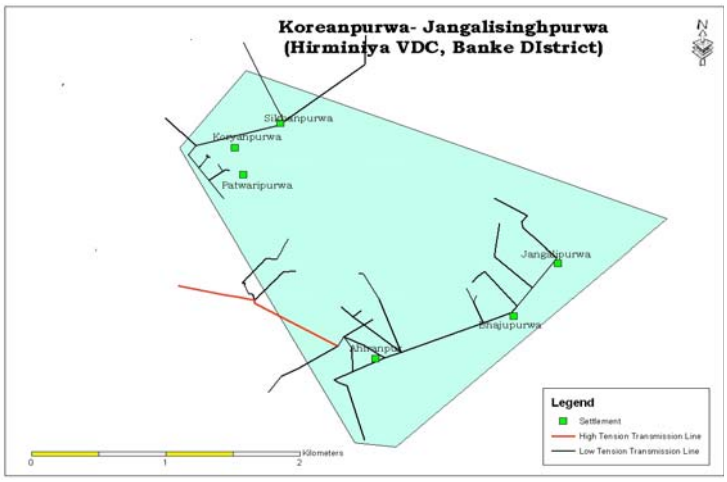
A lead farmer named Asif Ali Sekh was the first person to introduce shallow tubewell technology in this VDC, in the year B.S.2026 (1969) at ward no. 3 of the VDC. The diameter of well was 4" and 30 feet deep operated by diesel pump of 8 HP. After this construction of STW, many more farmers installed shallow tubewell and this was spread out to the entire VDC. From 1970 upto 1983 farmers had installed 4" diameter tubewell which was operated by 6.5-10 HP diesel pumps.

Government extended Electricity facility to Bhanghotana, Kalabanjar, Korianpurwa and Patawaripurwa of the Hirminiya VDC for the domestic use in 1983. At that time there were no single phase electric pumps available in Nepalese market that could be used for irrigation, but only the electric pumps operated under three-phase electricity line.

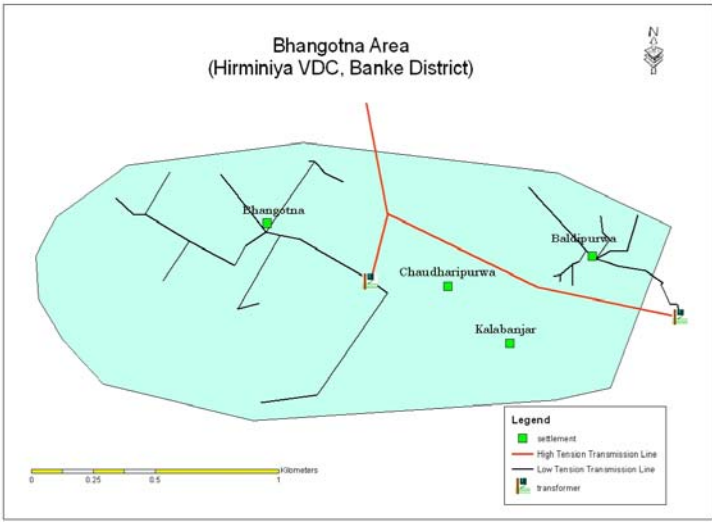
From 1989-1990 farmers started to use electric centrifugal pumps for irrigation operated by single-phase electricity line. The electricity line was also extended up to the farm field of the farmers. With the use of the electric pump, farmers had started to construct small STWs (mainly 2 inch, 2.5 inch and 3 inch diameter) because there was an electric pump of different capacity, different outlet diameter and of different price were available in the market. At first, there were only Indian electric centrifugal pumps available in the market, which was somewhat costlier than the Chinese electric centrifugal pumps now available in the market.

Electricity Infrastructure

Electricity network in site-I is shown in Figure 2. Here, the one general electricity distribution line that supplied electricity to the domestic users and a mill at Jangalipurwa are being used for distributing electricity to STW pumps also. Dedicated lines for STW pumps are available in a small area around Koreanpurwa village only, where electricity line comes from Udaypur VDC. The total length of low tension (440 V) line is 11.90 km within this site. The supply line from Ahirpur to the rice mill at Jangalipurwa is a single-phase line, but the same line has been used to distribute electricity to STW users along its alignment. As a result of this, there is voltage drop problem along the tail-end parts of the distribution area, especially when the rice mill is in operation. In the Koreanpurwa area there is no problem of low voltage.

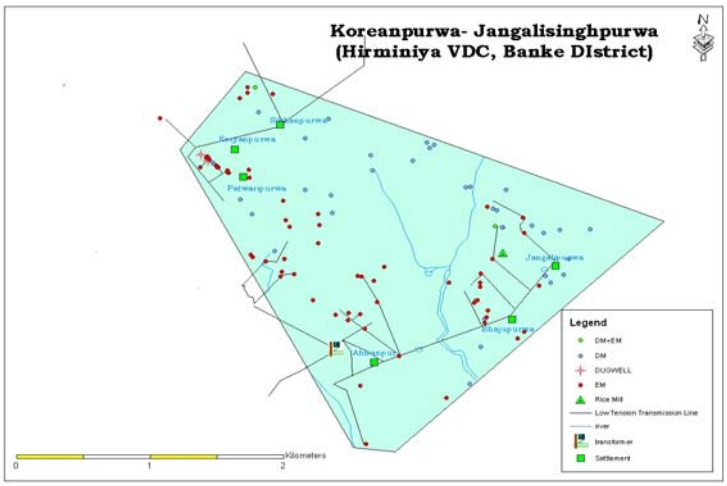


Electricity infrastructure is relatively better in the study site-II (Figure 3). There are two 11 KVA transformers within this area, one in Bhanghotna and the other in Mahantpur village. From these two transformers, distribution lines have been extended to the farm areas dedicated specifically for the purpose of STW pumps.

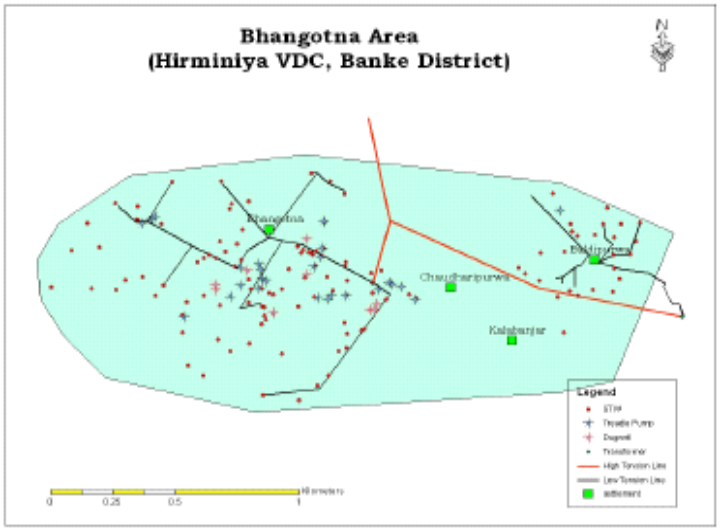


Shallow Tubewell Density

Present study has recorded 102 numbers of STWs within an area of 550 ha in study site-I. Locations of those wells are shown in Figures 4. Thus, in an average, there is one STW for every 5.5 ha land (0.18 STW/Ha) in this site.



On the other hand, 156 numbers of STWs were recorded in the study site-II, whose area is 220 Ha (Figure 5). Thus, in this area, there is a well for every 1.4 ha land, which is nearly four times higher than in the site-I. Tubewells are even denser in Baldipurwa village area, where there is one well for every 1.07 ha area. This suggests clearly that electricity distribution network can make tremendous impact on the intensity of STW installation by the farmers.

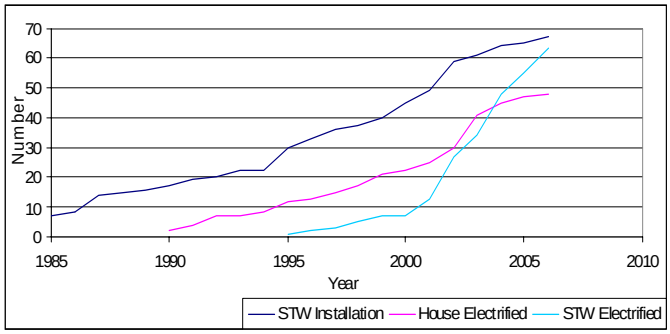


Electricity Infrastructures and STW Installation

Electricity supply was available for domestic consumers in study site-II since 1983, but the first electric pump was brought to use in this area in 1999 only, when the distribution line network was further expanded. In the study site-I, domestic supply lines were available since 1997, but the network has not been expanded as much as in site-I.

Chart 1 shows the trends in STW installation, STW electrification, with respect to household electrification. It shows that STW installation grew in numbers as electricity network was expanded for village electrification. Although rural electrification program of Nepal Electricity Authority was focused on domestic lighting use, the growth rate of STW irrigation consumers was much higher than the rate of growth of domestic consumers of electricity. The sharp rise in STW consumers of electricity took place after 2000 AD, when the government removed its capital subsidy for STW installation.

Chart 1: Yearly increase in STW installation, domestic electricity connection and STW electrification (cumulative figures)

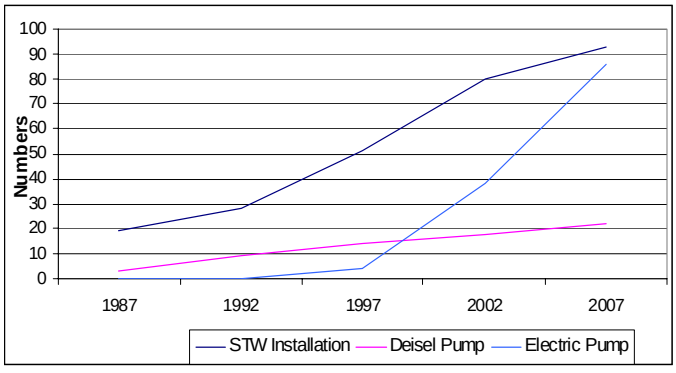


Source: Field Survey, 2008

The farmers rather than installing new tubewell, they are changing their water extraction motive from diesel operated to electric operated. The installation of electric operated pumps begun after 2000 although both the area was electrified in the same year i.e. 1983.

The expansion of STW was facilitated by the electrification. The study area was electrified during 1983. At the beginning the people did not electrified their tubewell as electric pumps were not easily available in the market. After 2000, farmers started electrifying STW too and at the same time the installation of STW has also gone up (Chart 2). After 2003, the installation of STW was not as much as between of 1991-1999. But the Installation of the electricity operated pumps had increased, indicating that the area of good electricity, the farmers installed STW almost in every area. After that, instead of installation of new STW, they are changing pumps from traditional diesel operated to electric operated.

Chart 2: Yearly increase in STW installation, Diesel Pump and Electric Pump (Cumulative figures)



Source: Field Survey, 2008

Conclusion

- From study of the area following conclusions can be drawn:
- The availability of the electricity is positively correlated to STW expansion.

- Small farmers' willingness to install STW is governed by electricity network with reliable supply and its proximity to the farm field.
- The expansion of STW is not only the function of electricity but also of cheaper construction and extraction technology and access to market.

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Water Saving Irrigation and Global Food Security

Uttam Raj Timilsina

Situation of population growth trends and global food security

It is estimated that the world's population of 6.7 billion is expected to reach to 9.2 billion by 2050 A.D. Much of this population increase will occur in urban areas of developing countries. The Food and Agriculture Organization (FAO) of United Nation estimates that to feed this population increase, food production must increase globally by 70%. and about one billion people are currently suffering from hunger and malnutrition. Most of 2.5 billion people expected to be added to the world's population between 2007 and 2050 are going to live in urban areas of developing countries. FAO also estimates that the total arable and permanent crop land used for crop production is about 1.5 billion ha which is about 11% of the global land surface area of 13.6 billion ha. It might be possible to cultivate another 2.7 billion ha but additional cultivation requires enormous costs and there will be destruction of environment, bio-diversity, wildlife, wetlands, forest lands, watersheds, and sensitive and fragile ecological habitats. Out of the 1.5 billion ha of cultivated land only 300 million ha are irrigated with over 70% being in Asia. This irrigated land (20% of total crop land) provides 40% of the world's food. It is also estimated that 62% of the total population in developing countries depends upon agriculture. The food availability per-capita per year is 0.16 MT in least developed countries, whereas at global level per capita food availability is 0.34MT/yr. A rough estimate shows that improving water productivity by 40% on rain-fed and irrigated lands could reduce the need for additional water for irrigation to minimum over next 25 years. During 1982 -1993 (10yrs) irrigated area increase rate was 1.5% per year, while between 1995-2020 (25yrs) it is expected to increase only by 0.6% per year. The potential of expansion of arable land is limited, so productivity of currently used land needs to be increased. Thus improvement in land and water management of existing agricultural area is a pre-requisite for expansion of current food production. In coming decades about 80-90% of required increase in food production be realized on existing cultivated land and about 10-20% on newly reclaimed land. The majority of the world's poor live in rural areas and depend on rain-fed agriculture for food, income and livelihood. Today about 45% of total food production comes from rain-fed agriculture which covers nearly 80% of the world's harvested cropland. There is a strong link between irrigation, poverty alleviation, food security and food right. Therefore it is realized that the scope for productivity improvement on the existing cultivated land is higher than agricultural area expansion.

The situation of irrigated Agriculture

In present context expansion of irrigated area and increasing irrigation water supplies are not that easy, because large proportion of land and water resources are already being used and transferred from food producing to non food producing areas. Further, expanding of irrigated areas requires relatively large investment to establish new infrastructures and might cause environmental deterioration. Hence capital cost for irrigation area expansion is higher in comparison to the cost required to improve productivity of the existing irrigated areas. Therefore it is also realized that productivity improvement in irrigated areas has better scope than irrigated area expansion. In south Asia, more than 50% of the cropped area is irrigated but productivity is relatively low, additional food demand can be met by improving water management, water use efficiency and water productivity of existing irrigated areas. Agriculture accounts for 70% of global fresh water withdrawls world wide. With rising water demand from non-agricultural sectors and the uncertainties in water supply brought about by climate change; the agricultural sector in developing countries will likely get less water in future. Together the increasing demand of water for food production and the limit of the availability of water resources suggest that agriculture must produce more food with less water.

Climate change is also projected to have a significant impact on water availability. It is generally agreed that climate variability and uneven frequency of rainfall has adverse effects on Agricultural farming. Reserves of water in mountain glaciers are declining, thus affecting river flows and water availability during crop growing seasons. By 2020 water use is expected to increase by 40% and more water will be required for food production to meet population needs. Irrigation sector has also suffered from a variety of problems, including poor irrigation practices, weak institutional management, irrigation system inefficiencies, failure to recover operational costs, failure to innovate and integrate new technologies into irrigation net work, lack of adequate operation and maintenance and rehabilitation of infrastructures due to the declining of investment in irrigation sector over the past 25 years.

Irrigation Technologies

There is a vast range of irrigation technologies available for improved operation, better management and efficient use of irrigation water ranging from simple siphon tubes for field water application to sophisticated canal automation and telemetry. Improved technologies play a significant role in achieving water saving, enhancing the operation and maintenance of irrigation and overall gains in irrigation performance and food production. The irrigation technologies can be categorized as off farm, on farm and soft tools for both, off farm and on farm. Off farm technologies being related to water conveyance from its source to the field head through canal network systems. The objective as well as function of the conveyance system being to deliver irrigation water from the source to fields at the required flow rate, at per-decided time and location in the command area with minimum losses. Technologies have been developed to achieve this objective through improved operation, regulation, control and in distribution of water over the command area, which include, canal lining, flow measuring and regulating device, use of telemetry, modern water delivery outlets etc.

Similarly On-farm technologies include the varieties of water application methods to the crops, such as gravity or surface flow, sprinkler and micro irrigation. Worldwide the surface flow is the most

dominant method adopted on 86% of total irrigated area. While sprinkler, and micro application covers 14% only. Beside the advances in the hard ware technologies at the off farm and on-farm scale, irrigation engineers and managers have been developing soft ware tools for improved operation, maintenance, monitoring and evaluation of irrigation systems. Satellite remote sensing and geographic information systems are being successfully used for assessment of irrigation potential, extent of water logging and soil salinity and assessment of crop productivity. Therefore the use of appropriate technologies for Water storage, conveyance, flow control and regulation, field application, irrigation scheduling, drainage of excess water, and maintenance of infrastructures greatly enhances the performance of irrigation schemes.

Stakeholder's participation in irrigation management

In order to create ownership, stakeholder's participation and management transfer of irrigation schemes to the stakeholder's is important. It has a positive impact on land and water productivity improvement. To enhance the stake holders participation more attention needs to be paid to scheme modernization, including necessary institutional reform,WUA strengthening and cost recovery aspects. The issue of cost recovery is more important for the sustainability of modernized systems. Business-oriented WUAs can handle comparatively more complex schemers than socially oriented WUA. In many developing countries there exists a social mode of WUAs with no provision for hiring professional staffs. Such WUA are institutionally weak and generally performing poorly.

Conclusion

From the view point of water saving and food security, the scope of productivity improvement on the existing cultivated land is higher than agricultural area expansion. Similarly productivity improvement in irrigated areas has better scope then irrigated area expansion. Selection of proportional or rotational water distribution highly depends on water availability and farmers capacity to operate the irrigation schemes. It is also realized that irrigation extension services, as well as awareness creation in adopting water saving irrigation technologies specially for rice irrigation such as alternate wetting and drying system for soil saturation culture instead of surface pounding culture might have positive influence to the water users towards better water utilization and water saving .Productivity increment in existing irrigation command areas depends on improvement of irrigation efficiency, water use efficiency ,water saving, modernization of existing irrigation schemes, stake-holder participation, realization of ownership feeling and improvement in operation and maintenance (O&M) cost recovery by irrigation service fee collection and local resources mobilization.

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FORTHCOMING EVENTS

The 1st EIT International Conference on Water Resources Engineering Cha Am, Thailand,18th August, 2011

Irrigation Australia Regional Conference & Exhibition, 22nd - 25th August 2011, Launceston, Australia

2nd Annual Urban drainage, sewerage & irrigation 2011, September 9 - 10, 2011, Abu Dhabi, United Arab Emirates

Management of Water in a Changing World: Lessons Learnt and Innovative Perspectives Dresden Germany,12th October,2011

The 6th China International Water Business Summit beijing China,13 th October,2011

21st International Congress on Irrigation and Drainage, 15-23 October 2011, Tehran, Iran.

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