

WISWAM

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Select Article

**The role of a local committee in changing times
Irrigation management in the Himalayas
Nilhari Neupane and Gopal Datt Bhatta**

The Trans – Himalayan region of Nepal is often referred to as the country's desert. Water is a scarce resource that has traditionally been managed through local norms and institutions. The remoteness of the region has limited the role and influence of the central government. Although the locally managed irrigation system has been running for centuries, recent developments make people wonder if this approach is sustainable in the long run.

Mustang, in the Trans-Himalayan region of Nepal, is one of the country's Most remote districts. The upper part of the district, at altitudes that start at 3,800 meters above sea level looks like the Tibetan Plateau, with wind-eroded, rolling, yellow and grey hills. Rainfall is less than 200 mm per year, so even though farmer have sufficient land, they must keep part of it Fallow due to the shortage of water. The upper Mustang area used to be headed by a local king called Jigme palwar Bista. But since 2008 (when Nepal became a republic) his role is now chiefly ceremonial. Local people respect him. And he still plays a significant role in the distribution of water, as part of a system that builds on the local hierarchies and stratification which divides society into an upper ruling class and a lower working class.

Lomanthang is one of the many villages in this district. As in most villages, it has an irrigation committee which, in this case, consist of nine members. While the local king is its head, the committee is run by a chairman known as the Ghempo. There are two Mithue or secretaries (one of whom is appointed by the king and the other one by the Ghempo), and six Tshumies or messengers. After the king, the Ghempo is the person with the most influence, and he is the authority in issues related to irrigation and agriculture. All cases of conflicts, fights and robberies are brought to the Ghempo to adjudicate on, Ghempos are always members of the Bista family, and although they do not get a salary, they receive 25 percent of all the fines imposed .

The Mithue are next in the chain of command: only literate males are appointed to this position. Serving as secretaries to the Ghempo, the Mithue keep all the records related to the irrigation system. They also have the responsibility of managing the committee's finances. They do not get a salary for this work, but do not have to contribute any physical labour. The Ghempo also appoints a number of Tshumi who act as the supervisors of the irrigation system. And as such they have important

responsibilities. They have to stay close to the canals during irrigation (even during the night), and are responsible for reporting anyone caught stealing water to the Ghempo. Similarly, if they find livestock grazing in a field with

Culture and tradition:
For the local population water is both a utilitarian and a symbolic resource. Besides being used for drinking, cleaning and irrigation water is also seen as a divinity, and plays a central role in all villages rituals. Most villages have constructed a chorten near the source of water, on top of which they fly a flag. These chortens are small edifices made of stones and mud, and have different styles which reflect the local architecture. Villagers also plant various cold Tolerant species around the sources of water. These plants are considered to be sacred and are never cut. This is all done to ensure that the gods won't become angry and to avert drought.

The clearest example of how culture governs the management of water is seen during, the Sakaluka festival which is celebrated on the third day of the first Tibetan month (February/March), and represents an auspicious moment to begin the agricultural activities of the new year. During this day, all villagers go to the kin's fields. They plough the field, add manure, and start the agricultural season by sowing wheat seeds. Both the king and the queen take part in the festival. And then the new irrigation committee is formed and the coming year's water allocation schedules are hammered out. The whole village is ready for a new agricultural year.

Crops. Their owner is also taken to the Ghempo. They are also responsible for collecting all the fines, by going door to door. While they don't get any salary for their work they do receive part of the collected fines. Being part of the committee brings them prestige, as well as giving them priority in the irrigation rota.

Water allocation and local culture

An efficient allocation system is essential when rainfall is limited. In general, the most common method in the upper Mustang region is a lottery. The Ghempo throws the dice in the presence of the Mithue, Tshumi and all the local villagers to determine the sequence for distributing water. However, the Ghempo can give priority to a specific plot regardless of the results of the lottery. Members of the committee and other upper class farmers have priority over other villagers water allocation also depends on the type of crops cultivated. The first priority is given to wheat and naked barely, followed by peas, buckwheats, mustards and potato. All the villagers know that wheat and barley are highly sensitive to water stress, and that yields suffer if irrigation is delayed (showing that the water allocation patterns have a scientific basis). Another reason for giving priority to these crops is that they are the main staple foods in the region, and are also used for making chhyang, a popular drink.

But the committee's role extend beyond the allocation of water. One frequent concern is to ensures the maximum efficiency when watering

plots, diverting the water to the next plot as soon as possible. In addition, the committee members need to be permanently alert in taking care of

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the irrigation infrastructures. The sandy soils which predominate in the region mean that the canals frequently break, and the committee needs to respond to this immediately. If there is a small breakage, the Tshumins have the responsibility of repairing it. But if they cannot, then they ask each household to contribute with labour. Those who refuse to help have to pay a fine, or run the risks of being excluded from the system altogether.

Unequal relationships

Critics of this system point out that it is based on an unequal or asymmetric relationship between the upper class villagers, who run the system, and the lower class farmers. Others argue that this is justified as farmers depend on the upper classes for food in times of scarcity, and also for loans and land. The irrigation canals were built on the initiative of the upper classes and they still play a crucial role in the day to day management of the system, in terms of decision making and net working while farmers provide the manual labour, the upper classes provide the necessary cash and infrastructure.

This mutual interdependency has kept the system functioning as an efficient way of dealing with water scarcity. According to Narendra Lama, leader of the Annapuran a Conservation Area Project, the system is based on local knowledge, and because of this it works efficiently.

At the same time there are also many voices demanding that farmers get more water, that their income increases, or that roles and responsibilities within the village change, giving them a stronger voice. Irrigation projects and programmes in Mustange and in other parts of Nepal, have tried to improve the availability of water. Running with the support of the national government or of donor organizations, they all hope to benefit farmers. But they seldom recognize the existing, locally-sanctioned norms, so they run the risk of destroying the social capital that has developed over centuries. Many studies show the crucial role that such social capital plays in the governance of common resources. It takes a long time to develop accepted rules and norms of governance for these resources, but relatively little time to erase them. A frequently mentioned Example is the tank irrigation systems in southern India, which were based on social hierarchy and were the prevalent mode of irrigation before British colonial rule. When the British government implemented a new set of formal rules, it completely wiped out the existing social capital (based on the informal relationship between the ruling and working class), and the authorities were unable to replace it and keep the irrigation system

working. The challenge today is to develop more equitable formal rules that build on existing social capital.

Others recognize additional risks elsewhere. Amji Bista, the Ghempo in Lomanthang, has expressed his concerns about the future. Many young people are reluctant to follow the traditional regulations and norms and he sees increasingly frequent violations of the irrigation norms giving rise to

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conflicts. “ The irrigation system used to function properly in the past because of a strong internal cohesion and because the different groups of peoples understood each other very well.” There is a general feeling that, in the past, nobody dared to violate the rules, but that this is not so anymore. These changing attitudes are partly related to the interest of the younger generation in migrating to the cities and not wishing to continue farming. More difficulties may emerge as a result of the stronger presence of the government in the area, and the increasing presence of development projects.

A balancing act

The Lomanthang irrigation system has developed over hundreds of years and is rooted in a specific, political, social, cultural and economic environment. It has proved to be an efficient model for a semi-arid region. The social hierarchy and the informal rules and relationships ascribe different roles and responsibilities to different social groups. However, the changes occurring recently in Nepal are undermining the hierarchical organization and the social capital on which this system depends. A difficult balancing act must now ensure that private and public efforts succeed in improving the livelihoods of the population, while at the same time ensuring that water continues to be available, and that farmers are unable to irrigate their land.

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Source: LEISA INDIA . September 2010
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Recent Periodical Literature

Agriculture

004659

Author : sarode, Recent Periodical Literature

Pradeep P.

Title : Sheti ani udyog vikas (Marathi)

Source : Maharashtra sinchan vikas

Vol/Iss/Mth : 25(3),Apr-june Year : 2011 Pages : 27-28

004668

Author : Das, M.and others

Title : Evaluation and integration of soil salinity and water data for improved land use of underproductive coastal area in Orissa

Source : Irrigation and drainage

Vol/Iss/Mth : 59(5),Dec. Year : 2010 Pages : 621-627

Keywords : Soil salinity, Water lagoon, Farming Strategies, Soil moisture, Yeild,

Abstract : In this study the soil salt stress, availability and quality of underground aquifers at different sites were evaluated in the neighbourhood area of Chilika, the largest brakish water lagoon of Asia. Integrating soil salinity, soil moisture content, aquifer availability and quality, various farming strategies specific to different sites were developed. These could trigger 1.59 to 2 times more production from its present level in that area. Where there is a diverse occurrence of resources, a precise estimation of those resources' potentials thus provides keys to develop cost-effective options for improving production in an underproductive area.

004671

Author : Molle, F and others

Title : Villains or heroes? farmers' adjustments to water scarcity

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(4), Oct Year : 2010 Pages : 419-431

Keywords : Water Scarcity, Drought, Conjunctive Use, Coping Strategies,

Abstract : This paper examines how farmers have adapted to water scarcity in six different river basins of Asia and the middle east. It inventories the different types of adjustments observed and shows not only their effectiveness in offsetting the drop in supply but also their costs to farmers and to the environment and their contribution to basin closure. The conclusion calls for a better recognition of the efforts made by the irrigation sector to respond to water challenges and of its implications in terms of reduced scope for efficiency gains in their irrigation sector.

004677

Author : Van Rooijen, Daniel J. and others

Title : Urban growth,waste water production and use in irrigated agriculture:A comparative study of Accra,Addis,Ababa and hydra bad
Source : Irrigation and drainage systems
Vol/Iss/Mth : 24(1, 2),June Year : 2010 Pages : 53-64
Keywords : Waste water irrigation, Water scarcity, Urban water balance,

Engineering
004663

Author : Dubey, O.P. and others
Title : Remote sensing based stochastic model for estimating runoff from watersheds
Source : Water and Energy International
Vol/Iss/Mth : 68(4),Apr Year : 2011 Pages : 43-48
Keywords : Remote sensing,GIS,Runoff method,Flood frequency model,
Abstract : In this study, an attempt has been made to develop stochastic model for estimation of runoff from Himalayan watersheds. Model has been developed to predict the runoff using the most influential geomorphic parameters. The model efficiency was found to be more than 80 percent.

004675

Author : Keraita, Bernard and others
Title : Up and down the sanitation ladder :harmonising the treatment and multiple barrier perspectives on risk reduction in waste water irrigated agriculture
Source : Irrigation and drainage systems
Vol/Iss/Mth : 24(1,2),June Year : 2010 Pages : 23-35
Keywords : Waste water irrigation, Wastewater treatment,
Abstract : This paper discusses two prominent perspectives in the debate on risk reduction in waste water irrigation; reliance on conventional waste water treatment and the multiple barrier approach. The discussion shows that each perspectives has strengths and limitations.Rather than being apposing philosophies,they both support health risk reduction but in different ways depending on the level of the country in the sanitation ladder.Since each perspectives has limitations,the recommendation is to capitalize on their strengths and explore synergies to optimise their applications for optimum risk reduction.

004676

Author : Qadir, Manzoor and others
Title : Waste water production,treatment,and irrigation in middle east and North Africa
Source : Irrigation and drainage systems
Vol/Iss/Mth : 24(1, 2).June Year : 2010 Pages : 37-51
Keywords: Waste water production, Water reuse, Water quality, Water scarcity, Water reclamation,

004679

Author: Simmons, Robert Wand others
Title: Effect of long term untreated domestic waste water reuse on soil quality, Wheat grain and straw yields and attributes of fodder quality
Source: Irrigation and drainage systems
Vol/Iss/Mth: 24(1, 2), June Year: 2010 Pages: 95-112

Keywords: Soil quality, Waste water reuse, Fodder yields,

004680

Author : Erni, Marco and others

Title : Bad for the environment, good for the farmer? Urban sanitation and nutrient flows

Source : Irrigation and drainage systems

Vol/Iss/Mth : 24(1,2), June Year : 2010 Pages : 113-125

Keywords : Urban water balance, Water pollution, Waste water irrigation,

Abstract : Due to poor urban sanitation farmers in and around most cities in developing countries face highly polluted surface water. While the sanitation challenge has obvious implications for environmental pollution and food safety it can also provide 'free nutrients for irrigating farmers. To understand the related dimensions, a box flow model was used to identify the most important water and nutrient flows for the Ghanaian city of Kumasi. The analysis focused on Nitrogen and phosphorus and was supplemented by a farm based Nutrient balance assessment. Results show that the city constitutes a vast Nutrient sink that releases considerable Nutrients loads in its passing streams, contributing to the Eutrophication of downstream water.

Environment Ecology

004658

Author : Ranade, Vidyanand

Title : Manus ani paryavaran (Marathi)

Source : Maharashtra sinchan vikas

Vol/Iss/Mth : 25(3), Apr-June Year : 2011 Pages : 23-24, 26

Keywords : Global warming, Water pollution, Air pollution, Irrigated farming,

004674

Author : Zhai, L and others

Title : Comparison and modification of equations for calculating evapotranspiration (ET) with data from Gansu province, North West China.

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(4), Oct Year : 2010 Pages : 477-490

Keywords : Evapotranspiration, Empirical Method, Pan evaporation, Climatic Index,

004684

Author : Schutze, Niels; Schmitz, Gerd H.

Title : Occasion: New planning tool for optimal climate change adaptation strategies in irrigation

Source : Journal of irrigation and drainage Engineering

Vol/Iss/Mth : 136(12), Dec Year : 2010 Pages : 836-846

Keywords : Climate change, Irrigation scheduling, Deficit irrigation, Crop production,

General Law

004662

Author : Thomas, Sarasu E.

Title : Human rights law in India : Right to water and social justice

Source : Yojana

Vol/Iss/Mth : 55(4), Apr Year : 2011 Pages : 27-29

Keywords : Social Justice,Right to water,

Abstract : Water as a human right must be recognised at all levels beginning with its recognition in clear terms as a fundamental right under the constitution.If a citizen has a fundamental right to water ,the state should have a duty to provide that water.

Geology Earth sciences

004667

Author : Kumar, K.;Gupta, S.K.

Title : Decline of groundwater tables in the upper Yamuna basin: causes and management strategies

Source : Irrigation and drainage

Vol/Iss/Mth : 59(5),Dec. Year : 2010 Pages : 606-620

Keywords : Rainfall,Groundwater management,Yamuna Basin,Surface drainage,Water saving techniques,

Abstract : Amongst the three drainage basins in Haryana (India),the upper Yamuna and Upper Ghaggar basins are experiencing groundwater table declines in good quality aquifers. Rice wheat crop rotation widely adopted in this region is blamed for this situation. A number of groundwater maps were prepared to assess long term groundwater table behavior in these basins. The review through a desk study identified a number of management strategies that could help to save 15 cm. or even more water in the rice -wheat system. It is concluded that it should be possible to sustain groundwater irrigation even with rice-wheat cropping at the current level in these parts of the basins.

Geology Earth sciences

004657

Author : More, D.M.

Title : Maharashtraatil Bhujalachi vyatha (marathi)

Source : Maharashtra sinchan vikas

Vol/Iss/Mth : 25(3),Apr-June Year : 2011 Pages : 11-16

Keywords : Ground water development,Ground water recharge,

Hydraulic Engineering

004673

Author : Smith, R.J;Gillies, M.H.

Title : Head ditch hydraulics and the variability of inflows to irrigation furrows

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(4),Oct Year : 2010 Pages : 442-452

Keywords : Unsteady Flow,Furrow Irrigation,

Abstract : In this paper a steady spatially varied flow analysis is performed to predict the steady water surface profiles in a typical head ditch and the subsequent spatial variability of the furrow inflows, for both pipe of siphon and sill or bankless-type water application systems. The resulting patterns were very similar to those seen in the spatially varied pipe flow in gated pipe, with depths and outflows increasing towards the downstream end of the channel. It is shown that it is feasible to design head ditches to minimise the variability in outflows.An unsteady analysis of the same head ditch illustrated the variation of outflows with time caused by the time taken to fill the channel.

004681

Author : Jaafar, H.H.;Merkley, G.P.

Title : High resolution method for modeling hydraulic regime changes at canal gate structures.

Source : Journal of Irrigation and Drainage Engineering

Vol/Iss/Mth : 136(12), Dec Year : 2010 Pages : 795-808

Keywords : Canal Design,Gates,Hydraulic Modeling,

Abstract : A method for modeling flow regime changes at gate structures in canal reaches is presented. The methodology consists of using an approximate Riemann solver at the internal computational nodes, along with the simultaneous solution of the characteristic equations with a gate structure equation at the upstream and downstream boundaries of each reach. The conservative form of the unsteady shallow water equations is solved in the one dimensional form using an explicit second order weighted average flux upwind total variation diminishing (TVD)method and a Preissmann implicit scheme method. Four types of TVD limiters are integrated into the explicit solution of the governing hydraulic equations, and the results of the different schemes were compared.The complete method developed in this study was able to successfully resolve numerical instabilities due to intersecting shock waves.

004682

Author : Marcou, O and others

Title : Lattice boltzmann model for the simulation of flows in open channels with applications to flows in open channels with application to flows in a submerged sluice gate.

Source : Journal of Irrigation and Drainage Engineering

Vol/Iss/Mth : 136(12), Dec Year : 2010 Pages : 809-822

Keywords : Irrigation channels,Numerical simulation,Gates,

Abstract : Numerical simulations of free surface flows are important to provide a prediction tool for the optimal management of irrigation canals.Here consider an alternative to solving the shallow -water equations.It is proposed a free surface model in which the vertical component of the water current is fully resolved.It is believed that such a detailed description can be useful to model the flow around gates or in other situations where the vertical structure of the flow will be important such as in the case of sediment transport and deposition.Here approach is based on a two fluid lattice Boltzmann model.Author has compare the predictions obtained from numerical simulation and experiments performed on a laboratory micro canal facility.

Irrigation

004655

Author : Jade, B.D.

Title : Phalbag v kaddhanyasathi sukshma sinchan- kalachi garaj (marathi)

Source : Maharashtra sinchan vikas

Vol/Iss/Mth : 25(3),Apr-June Year : 2011 Pages : 1-8

Keywords : Horticulture,Micro irrigation,Drip irrigation,Water resources management,

004656

Author : Chavan, Asha and others
Title : Pani niyojan-vartman kalachi garaj (Marathi)
Source : Maharashtra sinchan vikas
Vol/Iss/Mth : 25(3),Apr-June
Year : 2011 Pages : 9-10,16
Keywords : Water availability,Irrigation planning,

004660
Author : Bhalge, Pradeep S.
Title : Anukarniya vaviharsh adivasi sahakari upasa
jalsinchan yojana (Marathi)
Source : Maharashtra sinchan vikas
Vol/Iss/Mth : 25(3),Apr-June Year : 2011 Pages : 29-30.34
Keywords : Lift Irrigation,Vavi harsh yojana,Water
distribution system,

004661
Author : Bharaswadkar, R.B.
Title : Sahabhangi sinchan vyavasthapanasathi pravrut
t karnyachi kriya,hisheb,kagadpatre,nondi ityadi (marathi)
Source : Maharashtra sinchan vikas
Vol/Iss/Mth : 25(3),Apr-June Year : 2011 Pages : 31-32
Keywords : Participatory irrigation management,

004664
Author : Wen shang Hou and others
Title : Using the behavior of seven amphibian species for
the design of banks of irrigation and drainage systems in
Taiwan
Source : Irrigation and Drainage
Vol/Iss/Mth : 59(5),Dec Year : 2010 Pages : 493-505
Keywords : Taiwan,Irrigation systems,Drainage,
Abstract : This study evaluated the amphibians' motility on
five different Bank slopes,and documented the relationship
between species' climbing abilities,the surface substrates
of banks,and seasonal variations in weather conditions.The
results showed that species in the same family or with
similar body size differ in their behavioral
performance.The experimental results of this study can aid
technicians in future engineering projects that involve
irrigation and drainage banks in Taiwan and around the
World.

004665
Author : Yhuang and others
Title : Airborne remote sensing for detection of irrigation
canal likage
Source : Irrigation and drainage
Vol/Iss/Mth : 59(5),Dec Year : 2010 Pages : 524-534
Keywords : Remote sensing,Canal likage,Irrigation
distribution network,
Abstract : In this study, a rapid, cost effective method
was developed for identifying Irrigation canal locations
likely to have leaks and/or seepage.The method involves the
use of a multispectral imager equipped with red, near
infrared, and thermal sensors, which is mounted on an
aircraft and flown at low altitude to collect the images. A
three step process, image acquisition, image processing,
and field reconnaissance, was developed for processing the

imagery and identification of locations likely to have leaks.

004666

Author : Albaji , M and others

Title : Comparison of different irrigation methods based on the parametric evaluation approach in the plain West of Shush, Iran.

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(5), Dec Year : 2010 Pages : 547-558

Keywords : Surface Irrigation, Drip Irrigation, Parametric Method, Land Evaluation, Land Units,

Abstract : The main objective of this research was to compare the suitability of land for surface and drip irrigation methods according to a parametric evaluation system in the plains west of the city of Shush, in South-West Iran. After analysing and evaluating soil property, suitability maps were generated for both methods by means of remote sensing (RS) and a geographic information system (GIS). The results indicated that a larger amount of the land can be classified as more suitable for drip than surface irrigation. Ultimately, the application of a drip irrigation system was suggested as the best method to be applied to the study area. The main limiting factors in using surface irrigation methods in this area were sandy soil texture and slope, moreover, for drip irrigation methods, the main limiting factor was soil calcium carbonate.

004669

Author : Khan, S and others

Title : Predicting water allocations and trading prices to assist water markets.

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(4), Oct Year : 2010 Pages : 288-403

Keywords : Water Allocations, Water Prices, Water Markets, Artificial Neural Networks, Water Table,

Abstract : This study shows that Neural network models can reasonably forecast seasonal allocations and trading prices in water markets. These models can complement other forecasting techniques such as regression analysis and time series models as the former can better capture the non-linear ties in the water trading system. Using a fifty percent probability risk factor for water variability, the water allocation model showed minor estimation error, however, in one instance the model underestimated the water allocation by 21 percent. Overall the models have good water allocation and price forecasting accuracy, and the determinants of water trading prices identified by the neural network models are those expected of the econometric models/economic theory.

004670

Author : Khan, S and others

Title : A decision support tool for irrigation infrastructure investments.

Source : Irrigation and Drainage

Vol/Iss/Mth : 59(4), Oct Year : 2010 Pages : 404-418

Keywords : Decision support tool,Water Management,Benefit cost analysis,Water Trading,Water Saving,Simulation,
Abstract : Increasing water scarcity, climate change and pressure to provide water for environmental flows urge irrigation to more efficient. In Australia, on going water reforms and most recently the national water security plan offer incentives to irrigators to adjust their farming practices by adopting water saving irrigation infrastructures to match soil, crop and climatic conditions. Water works is a decision support tool to facilitate irrigators to make long and short term irrigation infrastructure investment decisions at the farm level.

004672

Author : Moghadam, M.K.;Keshavarzi, A.R.
Title : An optimised water intake with the presence of submerged vanes in irrigation canals
Source : Irrigation and Drainage
Vol/Iss/Mth : 59(4), Oct Year : 2010 Pages : 432-441
Keywords : Water intake,Sedimentation,Sumerged Vanes,

004678

Author : Ensink, Jeroen H.and others
Title : Sewage disposal in the Musi-River,India:water quality remediation through irrigation infrastructure
Source : Irrigation and drainage systems
Vol/Iss/Mth : 24(1,2).June Year : 2010 Pages : 65-77
Keywords : Agriculture,Waste water treatment,Waste water use,Water quality,
Abstract : This paper presents a 14 months (Dec2003-Jan2005)water quality survey which aimed to quantify spatial and temporal changes in key water quality parameters along a 40 km stretch of the Musi River. The survey found that river water quality improved dramatically with distance from the city: from untreated sewage in the city to irrigation water safe for use in agriculture 40 km down stream of the city.

004683

Author : Alexander, G.Fernald
Title : River hydrograph retransmission functions of irrigated valley surface water-groundwater interactions
Source : Journal of Irrigation and drainage Engineering
Vol/Iss/Mth : 136(12),Dec. Year : 2010 Pages : 823-835
Keywords : Hydrology,Hydrologic models,Hydrogeology,Irrigation systems,Groundwater recharge,Surface water,
Abstract : Storage and release functions of western U.S.traditional river valley irrigation system may counteract early and rapid spring river runoff associated with climate variation.Along the Rio grand in Northern New Mexico,Author instrumented a 20 km long irrigated valley to measure water balance components from 2005-2007.Hydrologic processes of the system were incorporated in to a system dynamics model to test scenarios of changed water use.The modeled simulations showed that the coupled surface water irrigation system and shallow aquifer act together to store water underground and then release it to the

river, effectively retransmitting river flow until latter in the year.

004685

Author : Karamouz, Mohammad and others

Title : Optimisation of watershed control strategies for reservoir eutrophication management

Source : Journal of irrigation and drainage Engineering

Vol/Iss/Mth : 136(12), Dec Year : 2010 Pages : 847-861

Keywords : Watershed development, SWAT model, Simulation model,

Abstract : In this study the weather data for the next 10 years was generated using downscaled GCM data to simulate the watershed phosphorous load using the SWAT model .Then an optimal model for selection and placement of best management practices (BMP)at watershed scale is developed by linking the coupled watershed and reservoir models with a genetic algorithm.This model is able to identify the minimum present cost design of BMP structural alternatives.The objective of water quality is obtained using a system dynamic model for reservoir phosphorous concentration to determine a permissible phosphorous load as the main agent of eutrophication in a reservoir.

New Arrivals

Author	Title	Shelf mark
CSSRI	Annual Report 2009-2010	060.631.4/CSSRI
NBSSLUP	Annual Report 2009-2010	060.631.4/NBSSLUP
Bandyopadhyay Jayanta	Water Ecosystems And Society ; Confluence of disciplines	333.91/BAN
MERI Nashik	MERI Manual 2009	620/MERI
WALMI Aurangabad	Report of Farmers Participatory Action Research Programme (FPARP)	630.203/WALMI
Saravannan R (ED)	Agricultural Extension Worldwide Innovations	630.7/SAR
Peveerill K I ; Sparrow L A (ed)	Soil Analysis, An Interpretation Manual	631.4/PEV/SPA
Pawar R K	Organic Farming For Sustainable Horticulture	631.584/PAW
DIRD ; Maharashtra Govt.	Land Reclamation Guidelines 9001 ; 2000	631.6/DIRD/MAHA
Iyer Ramaswamy R	Water And The Laws In India	631.702/IYE
Iyer Ramaswamy R	Water Perspectives Issues Concerns	631.702/IYE
Joy K J ; Gujja B (ED)	Water Conflicts In India ; A Million Revolts In Making	631.7031/JOY/GUJ
Iyer Ramaswamy R	Towards Water Wisdom Limits Justice Harmony	631.7-31/IYE
Ghosh S P ; ICAR	Citrus fruits	634.3/GHO/ICAR
Pal B P ; ICAR	Rose In India	635.9/PAL/ICAR

सिंचाच्या व्यवस्थापात सहभागी होवू , आपल्या अडचणी आपण सोडवा घेऊ

Calendar Of Events

Date	Theme	Organization	Contact
2011	Msc programmes/PhD Programme On Line & Short Courses Tailor-Made Training	www.iitr.ernet.in .UNESCO-IHE	E-Mail-Info@unesco-ihe.org
<u>2011-2012</u>	Post Graduate Programmes in Water Resources Development And Irrigation Water Management	Indian Institute of Technology, Roorkee, Roorkee 247 667 (Uttarakhand) India, Source-Information Brochure-2011-2012	E-Mail-nayanfwt@gmail.com Web site_www.iitr.ernet.in
Aug 21-27, 2011	World Week in Stockholm, Responding to Global changes: water in an Urbanising World	World water Week In Stockholm	Website-www.worldwaterweek.org www.siwi.org
Feb-8-9-2012	National Symposium on Water Resources Management (WARMICF-2012)	Indian Association Of Hydrologists, National Institute of Hydrology, Roorkee-247667 (Uttarakhand)	E Mail-warmice2012@gmail.com

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