REVIEW OF REMOTE SENSING -BASED IRRIGATION SYSTEM PERFORMANCE ASSESSMENT

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Abstract: *Land and water is one of the most important fundamentals natural resource for the existence of life agricultural industries are filly dependent on supply of water. Irrigation is they element for development of agricultural sector for food security. Limitation of irrigation scheduling on irrigated agricultures result water logging and Salinization .its evaluation is very much necessary for assessment of any irrigation system .Many researchers have tried to evaluate irrigation systems by different approaches worldwide; here an attempt is made to review some such researches done, with particular reference to remote sensing based irrigation performance assessment, different country***.**

Key words- *Remote sensing, performance evaluation, irrigation system, performance indicators.*

I. INTRODUCTION

water and land are natural finite resource but due to arbitrary and corrupt utilization, these resources are diminishing at an shocking rate .To feed the ever-increasing population of Ethiopia it is emphasized that agricultural production should be improved on sustainable basis by efficiently and judiciously utilizing the available recourse. Review of prevailing constraints and existing status of land and water resource gives an idea about availability and utilization pattern of these resource, difference between actual and potential output, and scope for improvement in the performance of system, which is represented by its measured levels of achievement in terms of one or several parameters that are chosen as indicators of the system "goals. Irrigation systems are hard to come to reality in today's

Complex socio -economy situations as more emphasis is placed on environment and other related aspects .At the same time population and food grain requirements are increasing at an alarming rate. These constrain lead to alternatives in the form of reallocations and efficiency improvements reuse of water, conservation of water .etc. within sustainability framework. These solutions are comparatively cost effective and less disruptive to ecosystems. Therefore, performance evaluation of an existing irrigation system is gaining attention of researchers, planners and managers in recent years. It is always wiser to know the performance of existing system on various aspects and take a corrective step for possible improvement to it. Performance indicators can be used as the basis for improving irrigation systems for better management .Several efforts have been made to identify universal comparative performance indicators to analyze and evaluate irrigation system

The study of various literatures suggests that evaluation of irrigation system has been done by various researches by following different approaches

a) Using various performance indices or indicators by using mathematical calculation.

b) Using advance techniques of remote sensing and GIS

c) Using hydrological models

d) Using decision support system like unclear logic

Amongst various researches work of burt, molden. Singh, droogers, style and marino used performance indicators or indices using mathematical calculation to evaluate irrigation system, however bastiaanssen and bos and ray used advance techniques of GIS and remote sensing combine with performance indicators .similarly mishra, droogers and bastiaanssen used GIS and remote sensing combine with hydrological model.

2. LITERTURE REVIEW

The accessibility of irrigation water management information on a detailed scale like agricultural fields or for entire river basins is not common. Data to quantity performance indicators are infrequently collected. Mohamed(1992)reported a filed multi-objective evaluation of performance of irrigation system is limited due to this inadequate understanding of field conditions causes and magnitudes of priority problems were not fully identified especially in less developed countries. Most studies and reports are either based on rapid appraisals or concentrating on one part of system .To makes a performance oriented approach effective, it is necessary to retreat new techniques and approaches to existing management practices. Satellite measurements can provide regular information on agricultural and hydrological conditions of the land surface.

Menenti (1990) vidal & sagardoy (1995)and bastiaanssen (1998) present earlier reviews on remote sensing applications for irrigations management.

Efficient operation and management of an irrigation system plays an important role in the sustainability of irrigated agriculture (Mishra et.,2001)for this reason ,irrigation project Performance studies are being used with increasing frequency to promote this objective. performance evaluations are being carried out for different purposes -to improve system operation ,to assess the general health of a system ,to assess impacts of intervention, to diagnose constraints, to better under stands determinists of performance, and to Compare the Performance of a system with other System or with the same system over time Performance Indicators , proposed by a number of researchers, are used in such studies (bos,1997,molden and gates,199,molden et al;1998.perry,1996,rao 1993 sakthivadial et al 1999).adequacy, efficiency, reliability and equity are performance objectives considered when evaluating irrigation water delivery or irrigation system performance. **Adequacy** can be defined as the ability of an irrigation system to meet the required amount of water**. Efficiency** embodies the ability to conserve water by matching water deliveries with water requirements. **Reliability** expresses the degree of variability in relative water delivery from point to point over the irrigated area (Molded and gates, 1990)

Burt et al(1997) emphasized to standardize the definitions and approaches to quantity various irrigation performance measures. The *ASCE* task committee on defining irrigation efficiency and uniformity provides a comprehensive examination of various performance indices such as irrigation efficiency, irrigation consumptive use coefficient, application efficiency, irrigation sagacity, distribution uniformity, adequacy and potential application efficiency. They proposed methods to assess the accuracy of numerical values of the performance indicators. {3}

Molden et al (1998) compared performance of eighteen irrigation system located in eleven different countries through various indicators .they presented nine indicators namely output per unit cropped area output per unit command, output per unit irrigation supply, output per unit water consumed, relative water supply ,relative irrigation supply water delivery capacity, gross return on investment, and financial self-sufficiency. Results showed large differences in performances among the systems.{15}

Singh (1998) highlighted the need for improvement in hydraulic performance of conveyance system ,equity, adequacy and efficacy of water supply suitable to crop production system .he also presented some performance evaluation parameters in order to a sestet function of (i)conveyance ,distribution and application systems:(ii) command system(iii) crop production system :an(iv) farmers origination network and its linkage with the state departments {17}

Regarding the assessment of irrigation system performance using remote sensing data and gis techniques, many authors have proposed indicator or to measures irrigation system performance (Bos et al..1994. Beryribey and Cakmak, 1996, Molden and Gate, 1990, rao1993 Molden et al1998).

The performance of the irrigation system for the different irrigation season was determined according to four indicators namely over all consumed ration, depleted fraction, Crop water deficit, and relative evapo transpiration. potential and actual evapo transpiraition parameter used in determining these indicators were estimated according to the surface energy balance algorithm for land (SEBAL) methods using satellite images (bastiaanssen1998).

Comprehensive reviews on remote sensing applications for irrigation system performance assessment are presented by Choudhury etal(1994) Vidal and sagardoy (1995), Rango and Shalaby (1998), Bastiaanssen (1998) and Stewart et al.(1999).

Bastiaaen and Bos (1999) after reviewing significant works suggested to use remote sensing determinants to evaluate irrigation performance indicators and suggested that it refines the spatial scale as compared to the classically collected flow measurement. Bastiaanssen et al (1999) and Sakthivadivel et al (1999) assessed performance of the bhakra irrigation system in haryana using remote sensing data and presented spatial variation of productivity in terms of land (kg/ha)and water (kg/m3). They found that differences in agricultural performance could be ascribed more to the hydrogical setting rather than to the water delivery performance [6].

Droogers et al (1999) used four performance indicators are used only at a local scale, a misleading picture can be give on the regional scale. This paves away for evaluating the management of all water resource in a river basin context.[11]

Mishra et al (2001) applied the MIKE 11 hydraulic model to the right bank canal system of the kangsabati project west Bengal India and computed a performance ratio (a ratio of the observed flow rate to the scheduled flow rate), which was used as an indicator for assessing the degree of uniformity in flow deliveries along length of the canal. A sharp decline was seen in the performance the performance ratio along the length of the canal because most of the distribution of the head and middle reaches have drawn more than their desired shares.[7]

Droogers and bastiaanssen (2002) reported that irrigation performance and accounting are useful tools to assess water use and related productivity. Remote sensing and a hydraulically modeln were applied to an irrigation project in western turkey to estimate the water balance to support water use and productivity analyses. Some common irrigation performance indicators such as the relative water supply, relative irrigation supply, depleted fraction and process fraction were quantified [16]

Ray et al (2002) computed multi -temporal remote sensing data based performance indices namely adequacy. equity and water use efficiency for the distributaries of the mahi righat bank canal command in gijarat, india the analysis showed that performance indicators could identify the problem distribution, an intensively managed and studied irrigation system the interaction of remote sensing data and GIS tools to regularly compute performance indices could provide irrigation mangers with the means for efficiently managing the irrigation system.[20]

N.bandara (2003) used NOAA satellite data to assess the performance of three large irrigation systems in srilank during the 1999 yala (dry season from April to July): polo nnaruwaa, kirindi oya and inkirindi oya the relative water supply was higher than in the other two system and irrigation efficiency was considerably lower he evaluated evapotransprition deficit (Etp-Eta), productivity of land, productivity water inflow, and productivity per unit etc [8]

3. CONCLUSION

A review has been undertaken into irrigation performance assessment through satellite and its impacts on the evaluation of performance indicators parameters. The potential effect of varying the irrigation performance indicators through satellite approach, satellite image processing in to evaluating the system performance was investigated using a literatures search of published information largely from Australia, India, and Ethiopia but also including relevant information from overseas. Some of the case studies shown in this paper reveal, however that irrigation performance list related to:

1. Internal and external performance
2. Hard ware and software performance
3. Irrigation and hydraulic and operation performance
4. Operation, strategic diagnostic comparative performance
5. Water allocation and water scheduling performance

Most of authors list of indicators being related to the performance of (i) the water delivery or irrigation system, (ii), the socio-economic and environment and (iii) the irrigation agricultural system. The framework of performance indicators thus included environment such as groundwater table changes. Different indictor's parameter related above performance category in The case of:

- ✓ Irrigation system (adequacy ,equity ,reliability and efficiency)
- ✓ Socio-economic and environmental (flexibility and sustainability).
- ✓ Irrigation agricultural system (productivity)

(Bos et al.1991).there is only a small group researches working on remote sensing interpretations for irrigations performance assessment. Their work is summarized in this paper to make a larger audience aware of their progress. The accuracy of measuring individual parameter from remote sensing data averagely value 85 %. Performance indicators are usually based on several parameters combined together and the accuracy is therefore approximately 75 to 80%. The current reduction in costs of raw satellite images, direct availability of NOAA image through commercial ground receiving stations cheaper computer-based processing software, and the availability of more strong interpretations algorithms, make application nowadays more attractive. Irrigation mangers, consultants and policy makers are usually not aware of the opportunities remote sensing can offer. This is partially due to the overselling of the possibilities satellites could offer at the onset of the remote sensing era in the seventies. Some of the case studies shown in this paper reveal, however, that irrigation performance indictors can be calculated for,

1. Diagnosing water management practices at small unit areas up to farm plot level and

2. Monitoring irrigation events at large scales in a regular fashion and

3. Revealing the overall water resources utilization.

This is an appropriate extension of using flow rates in the conveyance network. Aspects of adequacy, productivity, equity, reliability, efficiency and sustainability in irrigation management can be computed from remotely sensed data. Standardization of irrigation system performance indicators (adequacy, equity, reliability and efficiency), relates satellite data to evaluate (over all consumed ratio, crop water deficit, relative evapo-transparation or evaporative fraction and satellite measurements can help in surveying the conditions or irrigation land in a consists and objective manner (Hussein S 2016,Bandara 2006 , Bastiaassen 2001 and Bos and Nugteren 1990).

Over all this review concentrated on the irrigation performance assessment and its performance indicators an d so is intended to compliment the earlier review by (molden and gate,1990) and another on the role of remote sensing and GIS approach to evaluate irrigation system performance (molden et al 1998,bastiaanssen 1998). Some conclusions on the remote sensing have several advantages over field measurements. First measurements derived from remote sensing are objectives: they are not based on opinions. Second the information's is collected in a systematic way which allows time series and comparison between schemes. Third remote sensing covers a wide area such as whole river basins. Ground studies are often confined to small pilot area because of the expense and logistical constraints. Fourth, information can be aggregated to give a bulk representation or disaggregated to very fine scales to provide more detailed and explanatory information related to spatial uniformity. Fifth, information can be spatially represented through geographic information systems revealing information

that is often apparent when information is provided in tabular form. It is recommended to initiate more pilot studies and demonstration projects to show irrigation managers the possibilities of using satellite data: the demand should be driven because demand based project will not emerge if this group of end user is not aware of the possibilities. The interaction between research and the mangers responsible for water application on irrigated agricultural land, is a foundation for a further improvement of performance analyses

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