

農業情報学会 2009 年度
オーガナイズセッション・個別発表 講演要旨集

テーマ：
「情報技術による農産物生産現場の革新」
(共催：日本農業工学会)

日時：2009 年 5 月 21 日 (木) 9 : 00 ~
会場：東京大学弥生講堂 (農学部内)
(東京都文京区)

主催：農業情報学会

農業情報学会 2009 年度研究発表会 プログラム

開催日時 2009 年 5 月 21 日 (木) 9 時開始
開催場所 東京大学弥生講堂 (東京大学農学部内)
(講演時間: 研究発表 13 分, 質疑 2 分)

＜オーガナイズセッション＞ (弥生講堂 一条ホール)

テーマ: 「情報技術による農産物生産現場の革新」 (主催: 農業情報学会 共催: 日本農業工学会)

開会 (09:00~09:05) 大会担当理事 中野和弘 (新潟大学大学院)
学会長挨拶

セッションA: 「農場リスク管理と情報通信技術ICT」

オーガナイザー 南石晃明 (九州大学大学院農学研究院)

9:05-09:10 オーガナイザー挨拶

- A 1 (09:10-9:25) 事例調査から見た適正農業規範GAP導入の阻害要因と今後の展望 1
河野 靖・渡辺 久 (愛媛県農林水産研究所)・南石晃明 (九州大学大学院)
- A 2 (09:25-9:40) 経営主体別にみた生産工程管理の現状と支援システムの有効性 3
前山 薫・松浦貞彦 (岩手県農業研究センター)・南石晃明 (九州大学大学院)
- A 3 (09:40-9:55) 生産資材適正使用のための GAP ナビゲーションシステムー試作システムの概要
と今後の課題ー 5
木村 浩 (特定非営利活動法人 農業ナビゲーション研究所)・南石晃明 (九州大学大学院)
- A 4 (09:55-10:10) 技術体系データベースを活用した農業経営ナビゲーションシステムー試作シ
ステムの概要と今後の課題ー 7
佐藤正衛 (中央農業総合研究センター)・南石晃明 (九州大学大学院)・本田茂広 (三菱スペース・
ソフトウェア)
- A 5 (10:10-10:25) ハイブリッド型農作業履歴情報自動収集システムの試作 9
南石晃明・吉越 恆 (九州大学大学院)・菅原幸治・深津時広 (中央農業総合研究センター)・
木室義彦・家永貴史・有田大作 (九州先端科学技術研究所)
- A 6 (10:25-10:40) 中国における適正農業規範GAP の動向と課題 11
徐 芸・南石晃明 (九州大学大学院)

討論 (10:40-10:50) 総合討論

セッションB: 「生産情報とユビキタス・マーケティング技術」

オーガナイザー 杉山純一 (農研機構 食品総合研究所)

10:55-11:00 オーガナイザー挨拶

- B 1 (11:00-11:15) 生産情報を伝える識別子の現状と新たな展開 15
河合幹裕 (食品総合研究所)・中嶋直美 (茨城県農業総合研究センター)・杉山純一 (食品
総合研究所)・高橋辰典 (静岡県西部農林事務所)
- B 2 (11:15-11:30) 外食における生産情報の活用システムの開発 17
杉山純一・河合幹裕 (食品総合研究所)・中嶋直美 (茨城県農業総合研究センター)
- B 3 (11:30-11:45) マーケティングに活かす情報コンテンツの評価 19
中嶋直美 (茨城県農業総合研究センター)・大浦裕二・山本淳子 (中央農業研究センター)・
河合幹裕・杉山純一 (食品総合研究所)

- 14:05-14:45 話題提供講演：「情報技術による農産物生産現場の革新」（弥生講堂 一条ホール）
1. 「知能的太陽光植物工場へのニーズと期待」（愛媛大学名誉教授 橋本 康）
 2. 「園芸生産物の高位安定生産のための諸問題」（千葉大学 古在 豊樹）
- 14:50-16:05 生産・経営情報部会，農業工学部会関連【座長：清水 庸（東京大学大学院）】
- 個12 (14:50-15:05) RFID・GPS・バーコードリーダを用いた即時データ転送可能な簡易農作業記録システムの開発
..... 71
櫻本直美・横山和成（中央農業研究センター）・和田静穂・増木啓言（(株)システムオペレーションズ）
- 個13 (15:05-15:20) スマートグリッドの灌漑への適用可能性 73
丹治 肇・桐 博英（農村工学研究所）
- 個14 (15:20-15:35) Development of an automatic control management system for a Greenhouse
—Automatic plant disease recognition— 75
Noe Velazquez Lopez, Yutaka Sasaki, Naoki Arakawa (Tokyo University of Agriculture)
and Kazuhiro Nakano (Niigata University)
- 個 15 (15:35-15:50) Development of Artificial Neural Network and Weighted Overlay models to
evaluate suitable area for Sugarcane using GIS 77
P. K. S. C. Jayasinghe (United Graduate School of Agricultural Science, Tokyo University
of Agricultural and Technology), Masao Yoshida (Ibaraki University), Takemi Machida
(Ibaraki University)
- 個 16 (15:50-16:05) GIS Based Sustainable Groundwater Management Approach for Irrigation
—Case Study: Nganjuk District, East Java, Indonesia— 79
Liyantono (United Graduate School of Agricultural Science, Tokyo University of
Agriculture and Technology), Tasuku Kato, Hisao Kuroda (Ibaraki University)
- 17:45~19:15 学会賞祝賀会・懇親パーティー（弥生講堂 会議室）

GIS Based Sustainable Groundwater Management Approach for Irrigation

-Case Study: Nganjuk District, East Java, Indonesia-

Liyanono*, 加藤亮**, 黒田久雄**

* *United Graduate School of Agricultural Science, Tokyo University of Agriculture and Technology*

** *Faculty of Agriculture, Ibaraki University*

Abstract

This research was conducted in Nganjuk district, East Java province, Indonesia. GIS and remote sensing were used to analysis land use, digital elevation model and hydrological data. Water balance analysis was conducted to estimate annual recharge and withdrawal of groundwater. The spatial database for distribution of wells was developed. The exploitation of groundwater for irrigation in dry season was analyzed. The estimation groundwater recharge showed the irrigated area has surplus recharge shallow groundwater. The irrigation well density analysis showed that irrigation wells were used in DS2. A water management plan for sustainable groundwater use was developed based on spatial distribution wells and water balance.

Keywords

groundwater, GIS, irrigation well density, water balance

1. Introduction

In Indonesia, rice production in dry season is still important for regional sustainable development. This research was conducted in Nganjuk district, East Java province, Indonesia. Objectives of the research are to develop spatial database for distribution wells, to analyze water balance and to propose a water management plan for sustainable groundwater use.

The Approach of this research was conducted in three steps. First step was to analyze annual recharge and withdrawal of groundwater by estimation of water balance. Second step was to develop a spatial database for distribution wells and to analyze groundwater exploitation for irrigation in dry season. Third step was to evaluate scenarios to propose a water management plan for sustainable groundwater use.

2. Study Area

The Nganjuk District lies in a climatic regime characterized by the annual progress of rainy and dry seasons, and receives roughly 80% of precipitation within the 5 to 6 months of the rainy season (December-May). Nganjuk area has flat area in central and eastern of Nganjuk with altitude ranging from 30 to 100 m above sea level. Mountains area is located at southern and northern area.

In Nganjuk area, there are 3 planting season, wet season (WS), first dry season (DS1), and second dry season (DS2). Paddy fields are cultivated in WS and DS1. Secondary crops (corn, soybean, onions, chilies, melons and vegetables) are cultivated in DS1 and DS2. Cropping intensity in Nganjuk district is high varied 2-4 crops yr⁻¹ with average 2.83 crops yr⁻¹ (BPS Nganjuk, 2007).

There are three main sub-basins in Nganjuk area, Widas, Kuncir, and Bodor sub-basins. Kedungsoko River is for Kuncir and Bodor sub-basins, Widas River is for Widas sub-basin and those rivers were merged into Brantas River. In Nganjuk area, there are two surface irrigation systems, Widas block and Mrican-Kiri block. The Widas block has irrigation command area in north western area of Nganjuk. The

Mrican-Kiri block has irrigation command area in south eastern area of Nganjuk. In Widas block a reservoir is constructed in west of Nganjuk, and in Mrican-Kiri block, irrigation water is uptake from Brantas River (Fig.1). The surface irrigation system in Nganjuk area can supply irrigation water in DS1, however, it is not enough to supply water in DS2. Therefore, groundwater is used for conjunction irrigation with surface irrigation in the DS2.

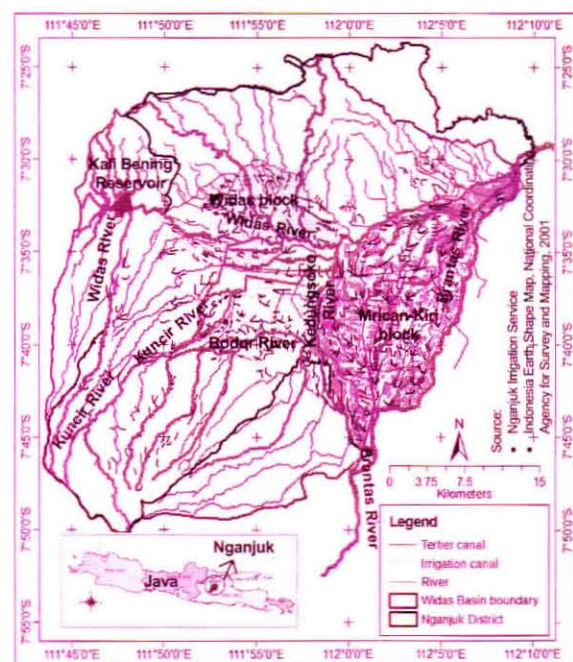


Fig.1. Nganjuk District and Widas Basin

3. Water Balance, GIS Database and Groundwater Management

In analysis of this research, GIS and remote sensing were used to analysis land use, digital elevation model (DEM) and hydrological data. And water balance analysis was used to analyze groundwater recharge and withdrawal.

First, water balance analysis was conducted in wet and dry seasons, respectively (Fig.2). Precipitation and irrigation data was supplied from local offices. Evapotranspiration was estimated using Penman Monteith method. Surface runoff was estimated using SCS-CN method. Subsurface flow and base flow were estimated from change of water storage (ΔS). $\Delta S'$ was replaced ΔS subtracted subsurface and base flows. Withdrawal was assumed same to $\Delta S'$.

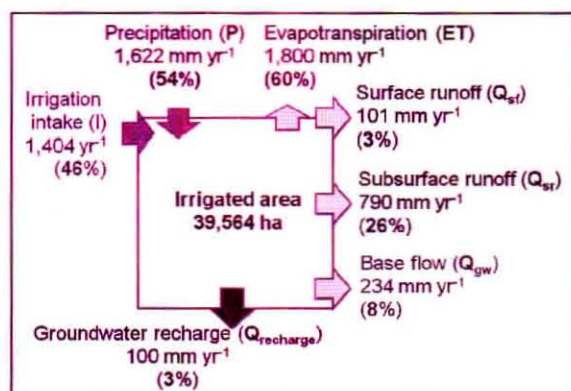


Fig.2. Flowchart of water balance in irrigated area

Second, irrigation well density (IWD) was estimated by cropping area and number of irrigation wells. The spatial distribution of groundwater withdrawal was analyzed using IWD. The IWD was varied 0-3 well ha⁻¹ in Nganjuk in 2006. High exploitation (IWD >0.5 well ha⁻¹) has conducted in 79 villages. These villages are located at south and central of Nganjuk area (Fig.3). Based on land-use/land-cover 2004 classification in DS2 and IWD map, irrigated area with crop and IWD >0.05 well ha⁻¹ has 82% of cultivated area.

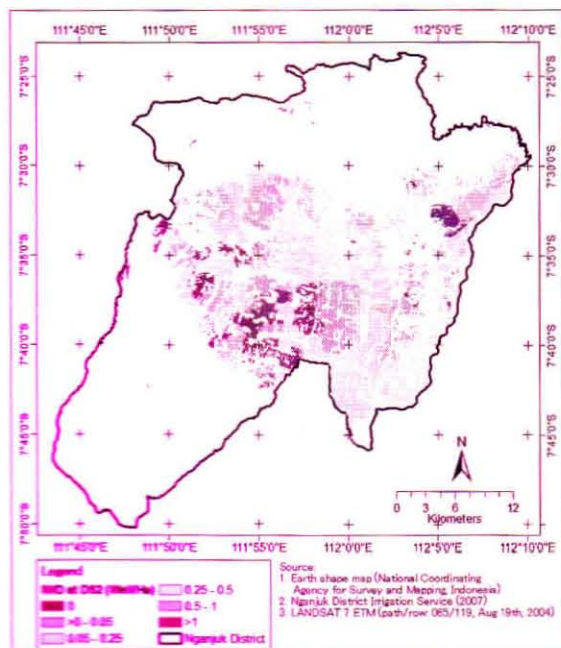


Fig.3. Irrigation well density at irrigated area with crop

Third, a water management plan was developed based on the spatial distribution of irrigation wells and water balance. Based on IWD and the estimation of groundwater withdrawal

in each area, a water management plan for sustainable groundwater use was proposed. The area with high IWD (>0.5 well ha⁻¹) should be managed with integrated management of wells and pumps to reduce the exploitation and interference of pumping.

The cropping intensity in the area with surplus groundwater recharge can be increased. Five scenarios of cropping pattern were made, i.e., corn, soybean, onion, melon, and mixed crops for increasing cropping intensity at the second dry season. Based on five scenarios, corn and soybean scenario more be feasible because these scenario still have surplus recharge of shallow groundwater and cropping intensity can be increased till 0.6-0.7 crop yr⁻¹.

4. Conclusion

The research showed as following. The estimation groundwater recharge showed the irrigated area has surplus recharge shallow groundwater. The spatial database for distribution of wells was developed. The IWD analysis showed that irrigation wells were used in DS2. A water management plan for sustainable groundwater use was developed based on spatial distribution wells and water balance.

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