

Suitability Study of Groundwater Sources for Rainbow Trout Farming in Sardasht County, using Geographic Information Systems (GIS) and Multi-criteria Decision Making (MCDM)

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Received: 2011/03/07

Accepted: 2011/07/21

Extended Abstract

Introduction

Rural development has various dimensions but it is particularly the development of the agricultural sector, which is widely believed to provide the main impetus not only for reducing poverty and hunger but also for ensuring food security for all. The various types of aquaculture form an important component within agricultural and farming systems development. Beside the important role of aquaculture in rural development, it also has an effective impact on exploitation of natural resources. Iran is an arid country, so aquaculture, can be an appropriate activity to use limited water resources. Sardasht County located in West-Azarbaijan is an area with rich water resources and has a good potential for aquaculture. Although this region includes rich water resources, but apart from that there are so many other factors which should be considered for locating the sites of aquaculture. Successful aquaculture activities are mostly depended on proper site locating specially in relation to the species which is intended to be cultured. The study area is a mountainous one which includes rich groundwater resources with low temperature that are suitable for rainbow trout farming. The present study attempts to assess the groundwater sources in study area for rainbow trout farming using Geographic Information Systems and Multi-criteria Decision Making. It is attempted to answer the questions such as the followings:

- 1) What are the main factors for suitable site-locating for rainbow trout farming raceways?
- 2) What is the importance of each factor for locating a site?
- 3) What is the capability of groundwater sources for rainbow trout farming and which of them are more suitable ones and therefore should be preferred in future planning for aquaculture development?

Methodology

This research has been done with the main goal of "Suitability study of groundwater sources for rainbow trout farming in Sardasht County". The method of this research is an applied one in terms of objectives, is a field-study in terms of variable control degrees, and a descriptive survey in terms of data-collecting method. The required data were collected using field methods such as questionnaires, observations, interviews, and secondary data banks like books, journals, and maps. Population included experts in cold water fish site selection. The samples of the Population (25 persons) were selected using Snowball method. Several methods were used to analyze the data consisting: financial analysis criteria included Net present value; multi-criteria decision methods included Analytic hierarchy process, remote sensing, and geographic information systems. Data analysis was done using several software including: Expert Choice 2000, ArcGis 9.2, PCI Geomatic, and Microstation. This study conducted in 4 phases: 1) the literature of the subject was reviewed and the main factors of locating suitable sites for rainbow trout farming were introduced. Then the weight of each factor was

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determined by Analytic hierarchy process. 2) The factors according to their suitability for aquaculture were categorized in four ranges: unsuitable, moderately suitable, suitable, and completely suitable. 3) All data were geo-referenced in ArcGis 9.2 and required information layers obtained. 4) Final weights of the factors multiplied in layers and the final capability of each groundwater resource for aquaculture was obtained.

Results

This study achieved an evaluation model for suitability study of water resources for rainbow trout farming. Based on this suitability assessment model, all of the effective factors in site selection and locating for rainbow trout farming are divided in 4 main criteria including: ecological, economical, social, and infrastructures. Each of these criteria is divided in some main sub-criteria and secondary sub-criteria. All criteria divided in 4 main criteria, 13 main sub-criteria, and 18 secondary sub-criteria as follows: (1) ecological: water (water discharge, type of water source, water temperature, PH), landform (slope, elevation), landuse, distance to disasters (such as flood, earthquake, etc.), (2) economical : distance to market, financial profitability, access to labor, (3) social: job making, type of ownership, population density, (4) infrastructure: distance to road, distance to electricity, distance to telephone. AHP was used to weight each the secondary sub-criterion. Then the range of each secondary sub-criterion was categorized in connection with the suitability for rainbow trout farming. So the evaluation model for suitability study of water sources for rainbow trout farming was achieved. This model classifies suitability in 4 categories: unsuitable (1-2), moderately suitable (2-3), suitable (3-4), and completely suitable (4-5). At the next step information layers created in secondary sub-criteria level of AHP hierarchy. Finally, the weights achieved from AHP were multiplied to created information layers and final capability for each site was achieved. The results showed that there were 208 groundwater sources in Sardasht which among them 141 sources (51 springs and 157 wells) has the capability for rainbow trout farming. Results after evaluation showed that none of the 141 groundwater selected sources, were classified as unsuitable, and completely suitable classes, 21% (29 sources including 3 springs and 26 wells) were classified as moderately suitable, and 79% (112 sources including 16 springs and 96 wells) as suitable ones. Besides, they showed that the main constraint factors for rainbow trout farming in the studied area were: (1) Distance to earthquake, which 88% of all sources were classified in unsuitable category with respect to this factor. (2) Distance to public telephone, which 30% of sources were classified in unsuitable category in relation to this factor. (3) High slope, which 30% of sources was classified in unsuitable category caused by locating in high slope sites.

Conclusion

Overall, the model which conducted in this study showed that there is a great potential for rainbow trout farming in Sardasht groundwater sources. This great potential should be considered in future rural development planning to take account rural aquaculture as suitable ecological, economical, social, and infrastructural activities for rural areas.

Keywords: Suitability study, Site-locating, Rainbow Trout, Multi-criteria Decision Making, Geographic Information Systems (GIS).

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