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*Full Length Research Paper*

# Factors affecting farmer's decision to continue farm activity in marginal areas of Jordan

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**This paper aims at investigating the factors influencing family decisions to continue farm activities in marginal land of Jordan. For representing marginal lands; selective parts of Karak, Jarash and Mafraq regions were included in this study. Systematic random and spatial sampling techniques were used to collect data from 85 farm families in these regions. Descriptive analyses and binomial logistic regression were employed to determine the socio-economic and land management factors affecting farmers' decisions to continue farming activity. Socio-economic and land resource profile of farm family had important effect on their decision to continue farm activity. The profiles included factors of: age and education level of household head, farm income and family labour work at farmer, these socio-economic factors significantly influenced the farmer's decision to continue farming. Additionally, land management through adopting soil conservation and the institutional assistance in conservation had positively affected the decision to continue farming activity. These factors might be considered as a roadmap for structuring work plans to continue farm activity in marginal land. These work plans could be translated to services provided through extension and awareness campaign, technical and financial assistance in land conservation.**

**Key words:** Farmer's decision, farm activity, socio-economic factors, land resource.

## INTRODUCTION

With limited arable land of 5.4% of the total area (AOAD, 2006) the cultivatable land is under continuous pressure from population growth and expansion of municipal borders. Out of the total arable lands, a larger proportion is rainfed (57.7%); most of it located in marginal lands which are under the constant threat of drought (DOS, 2009).

A larger proportion of marginal land includes arid and semi-arid areas, where 21.5% of the population lives in rural areas and depend on agriculture for their livelihood (IFAD, 2009). Farmers struggle to cultivate crops and raise livestock despite irregular rainfall, intermittent drought and land degradation. Rangeland and livestock production systems are subjected to high stress causing low productivity and production, due to crop encroachment and livestock population growth.

The decisions concerning how to manage resources are determined at the family level as well as at village or higher levels. Families take the decision to settle on places of limited land resource, which lead to follow inadequate management practices causing lower farm productivity (Young, 1998). This situation is clearly reflected in the marginal land, the increasing pressure on marginal and degraded land would affect its sustainability and thus the farm-family income.

The economic sustainability of farming is considered in terms of production and the prospects for continued economic viability in the face of changing environmental, social and economic conditions (Smith and Mcdonald, 1998). Considering this situation in marginal land, it seems that farmers are not willing to continue farming operations in an area if they perceive that the operations will not remain economically viable (Zollinger and Krannich, 2002). The farm size is getting smaller due to urbanization into good quality agriculture land (Abu-sharar, 2006). Having smaller farm size means higher production costs and lower income (Jabarin and Epplin, 1994; Millington et al., 1999).

On marginal farms, sustainability is largely guaranteed

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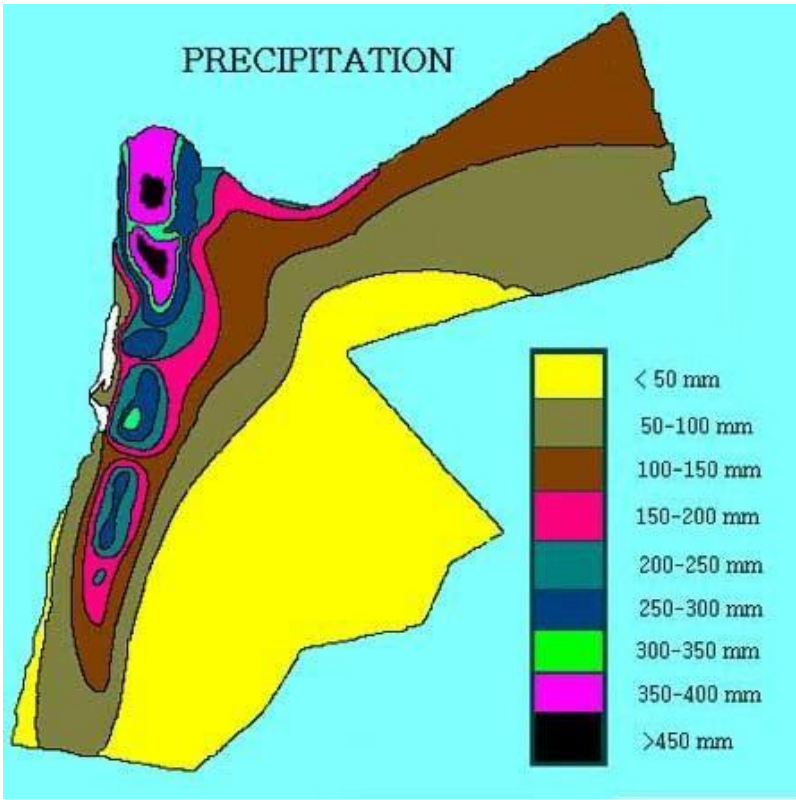


**Figure 1.** Map of Jordan showing area classification based on the amount of precipitation.

by a broad range of survival strategies, closely interlinked and embedded in the household structure of typical family farms (Meerta et al., 2005). The decisions are made on how to allocate and use family resources to achieve their objectives, for instance whether family labour or/and capital goes into farm or household or off-farm activities. These decisions depend on expectations and other alternatives and competing sectors of a family and the respective contributions to family objectives (Doppler, 1999).

The cost and availability of farming labour is considered a major problem that famers face in agriculture especially in marginal land, both Wiles et al. (2005), Zollinger and Krannich (2002) had explained the importance of family member participation in farm work to ensure deeper familiarity of farming work and thus taking the decision to continue farm activity in future. Farming family tends to involve more family labour in farming, as they may have deeper familiarity with the work of the farm. Thus it would influence the decision to continue farm activity as at least one of the family members is involved in farming (Wiley et al., 2005).

## Objectives of the study

The objective of this study is to determine factors affecting family's decision to continue farming, consequently to understand the socio-economic characteristics and land resources characteristic for such decision. Exploring these relations would structure in future work plans for farm family to ensure steady farm income for sustainable agriculture in marginal lands.

## MATERIALS AND METHODS

### Study area

The marginal land in Jordan is known for its long, dry and hot summer, and a short rainy winter expected from November till April. In the last years, the ratio of the low rainfall season to good season had increased to be 5:1, which had strongly affected agriculture especially the rainfed farming (MOA, 2005). The total area of Jordan is divided into the four ecosystem areas based on the amount of precipitation: marginal zone (200 to 300 mm rainfall), semi-arid (300 to 500 mm rainfall), semi-humid (500 to 800 mm rainfall), and the Jordan valley (300 to 500 mm rainfall). Marginal area or the steppe land is the strip situated between desert and fertile agricultural land that consists 6.3% of the total area of Jordan (Syouf and Duwayri, 1995) (Figure 1). The general characteristics of the marginal areas are (Maurer, 1999):

(i) Perception rate of 200 to 300 mm per year all long the strip.
(ii) Vegetation period varying between 75 to 120 days.
(iii) Very high variability of rainfall quantity and distribution especially in the southern part of these areas.

In the line of the objective of this research, three regions were selected to represent the marginal areas: parts of Karak, Jarash and Mafraq. The farming activities in these areas include crop cultivation and livestock breeding. In these areas farm families had started applying land and water conservation practices with the help of different governmental projects in the north and south of Jordan.

On average, Jordan only cultivates around 83% of the arable land; the same percentage applies in marginal land except in Jarash region where 40% of the arable land is cultivated. Jarash is a small region compared to other two regions, where residents are forced to use the good fertile land in urbanization (Alassaf, 2009).

**Sampling and the data collection**

After selecting the study regions to represent different farming activities in the marginal zone, the multi stage sampling was applied at the regions and village levels. Two different sampling methods were applied to select the families, the systematic and spatial random sampling methods. In the systematic random sampling method, the (n) units are selected by taking a unit at random from the first (kth) unit and then every kth unit thereafter and the sample is distributed evenly over the listed population (Weiss, 2008). This method is used to ensure sufficient coverage of all sub-populations, when the population are widely scattered geographically (Weiss, 2008). This method was applied in Karak and Jarash regions to collect data from 60 households that were involved in farm activity.

For selecting the Bedouin families in Mafraq region, spatial sampling method was applied. Sahoo et al. (2006) had explained the concept of spatial dependency which relies on the principles of proximity of locations to one another. Closer locations to one another are expected to have more similar values than those farther away, and in this will not provide efficient estimation of sample units. This method was used in this area to select 25 families, since all Bedouin families were coming from different parts from Mafraq region to this area during the dry season (April to September). A one kilometer distance was considered as gap between one Bedouin family to the next one to avoid family cluster from the same region and / or tribe. In total, 85 families were selected to represent families living in marginal areas of Jordan.

The survey of families was conducted using a standardized questionnaire. The questionnaire was designed to capture information about the family's characteristics such as family size, age, gender, composition and educational status, economic features such as income sources, resources used in farm and family, objectives and problems in the past and in the coming future. Before data collection, the questionnaire was pre-tested in the study areas and then adjusted to collect data appropriately.

**Logistic regression model**

The logistic regression model is one of the most common approaches used to study the decision between two alternatives (Field, 2005). This model predicts the probability that an individual with certain socio-economic characteristics and other determinants chooses one of the alternatives (Gujarati, 2003; Field, 2005). Other researchers had employed the logistic model to test farmer preference of different alternatives in resource management. The logistic model can be used to estimate the utility maximization where the farmer is assumed to have the preference among different alternatives to achieve higher benefits from involving in farming activities. This research focuses on the alternatives based on family decision to continue farming activity in marginal areas. Famer's take the decision based on the utility level perceived from farming activity, in other words; farmer's decided to continue farming activity as long as he or she perceives the maximum utility and benefits for better living standards from his or her point view.

Following Gujarati (2003), the logistic regression model form for binary choice problem could be introduced as following in Equation (1):

$$\ln \frac{Pi}{1-P_i} = \beta_0 + \sum_{j=1}^{k} \beta_j \quad X_{ij} \qquad (1)$$

Where; $P_i$ = Probability of the event occurring. $\beta_o$ = Constant term. $\beta_j$ = Coefficients. X = Independent variables. The coefficients demonstrate the effect of each explanatory variable on log of odds as follows in Equation (2):

$$\ln \frac{P_i}{1-P_i} = \text{log-odds ratio} \qquad (2)$$

The logistic model applies the maximum likelihood estimation after transforming the dependent into a logit variable. The empirical mathematical model for estimations is formulated as follows:

$$P_i = prob(Y_i = 1) = \frac{1}{1+e^{-(\beta_o + \beta_1 X_{1i} + \ldots \beta_k X_{ki})}} = \frac{e^{(\beta_o + \beta_1 X_{1i} + \ldots \beta_k X_{ki})}}{1+e^{(\beta_o + \beta_1 X_{1i} + \ldots \beta_k X_{ki})}} \qquad (3)$$

Based on the empirical model presented in Equation (3), the effect of explanatory variables on farmer's decision to continue farm activity could be expressed through the following linear relationship:

$$FDC = \beta_0 + \beta_1 GEN + \beta_2 AGE + \beta_3 EDU + \beta_4 FAZ + \beta_5 FIT + \beta_6 DER + \beta_7 FLW + \beta_8 TFZ + \beta_9 ASC + \beta_{10} HSC + \beta_{11} CIL + \beta_{12} RAN + \varepsilon$$

Where: FDC = farmer's decision to continue farming activity in marginal land. GEN = Gender of household head (dummy: 1 if male, 0 otherwise). AGE = Age of household head (years). EDU = Education level of Household head (Dummy: 1 if finished 10th grade, 0 otherwise). FAZ = Family size (person). FIT = Farm income/ total family income (percentage). DER = Dependency ratio[1]. FLW = Family labour work at farm (person). TFZ = Total farm size (ha). ASC = Do you apply soil conservation techniques? (Dummy: 1 if yes, 0 otherwise). HSC = Do you get any help for soil conservation measures? (Dummy: 1 if yes, 0 otherwise). CIL = Would you like to have more credit to improve your land? (Dummy: 1 if yes, 0 otherwise). RAN = Do you raise animals? (Dummy: 1 if yes, 0 otherwise). $\varepsilon$ = Disturbance term. $\beta_o$ is constant. $\beta_1, \beta_2, \ldots \beta_{12}$ are the coefficients of the independent variables.

For measuring the estimation fit of the estimated logistic regression model, Gujarati (2003), Field (2005) had presented three measures: -2 log of the likelihood value (-2LL), Cox and Snell $R^2$ and Nagelkerke $R^2$. The percentage of correct prediction will be explained to report the classification of farmer's decision to continue farming activity.

## RESULTS AND DISCUSSION

### Sample description

The sample description had considered the explanatory variables in the logistic model to discuss the basic

[1] The dependency ratio is defined as the ratio of family members under 14 and over 60 years to those members of working-age from 14 till 60 years (Al-baqaien, 1997).

**Table 1.** Sample description.

| Variable | Percentage frequency | Minimum | Maximum | Mean | Std.* deviation |
|---|---|---|---|---|---|
| Age of household head (year) | - | 26.0 | 68.0 | 50.88 | 11.75 |
| Farm income/ total family income (%) | - | 06.8 | 55.3 | 34.5 | 14.60 |
| Dependency ratio | - | 0.00 | 3.50 | 0.68 | 0.74 |
| Family labour work at farm (person) | - | 1.00 | 12.0 | 3.28 | 2.34 |
| Total farm size (ha) | - | 0.03 | 510.6 | 31.26 | 73.62 |
| Family size(person) | - | 2.00 | 19.0 | 7.470 | 3.65 |
| Gender of household head (male = 1, female = 0) | 94.1 | | | | |
| **Education level of household head **** | | | | | |
| Primary | 36.5 | | | | |
| Secondary | 23.5 | | | | |
| College | 10.6 | | | | |
| Illiterate | 29.4 | | | | |
| Do you apply soil conservation techniques? (Yes = 1) | 31.8 | | | | |
| Do you get any help for soil conservation measures? (Yes = 1) | 87.1 | | | | |
| Would you like to have more credit to improve your land? Yes = 1 | 15.3 | | | | |
| No | 84.7(72) | | | | |
| Do you raise animals? (Yes =1) | 49.4 | | | | |

*Std. = Standard deviation.**Education level: primary = 10 Grade. Secondary = 12 Grade. Collage = institute and university. Illiterate= basic skills in reading and writing.

features of the respondent farm family. Table 1 presents a summary of the sample characteristics of respondent farmer, which will be reported and discussed through classifying these characteristics in two categories: socio-economic profile and land resources profile.

**Socio-economic profile:** is presented by the dominant male farmer with an average age of 51 years; as in general most male farmers involved in farming after retirement as full time farmer. Around 37% of the famers had finished the primary level of education. By the law, it is compulsory for any Jordanian to finish the 10th grade of education.

As a constant source of income, farming families significantly depend on farm income as it consists 34% of the total family income in marginal areas. The average family size was found to be higher than the national average (5.4 person) (DOS, 2007). On average 3.4 family member is involved in farm work, they were mainly the household head, spouse and sons. Daughters are more involved in household work rather than farm work. In this study, the dependency ratio was found to be 0.68 people reflecting high number of member in unproductive age; each working member is responsible to support approximately one unproductive person. Livestock resource was considered as a part of the economic and wealth status of the family. Even though, only 49.4% of the interviewed families owned livestock that used for trading and/or for domestic consumption.

**Land resource's profile:** characteristics of land had an important role in describing the respondent farm family. In average, the farm family had 31.26 ha of land for farming. The availability of fertile land, in which conservation measures are applied, plays a crucial role in making decision whether to continue farming. Almost 32% of interviewed farmers adopted land conservation measures. The government projects have been motivating, technically and financially to the farmers to adopt conservation measures. The executed projects in this area are subject to certain restrictions to provide fund for land conservation. Many farmers face the problem of financing land conservation on their farm as farm income has decreased in the last years. The reduction in farm income is attributed to the rainfall variation from year to year, and the decrease in holdings size and its productivity, which has put additional pressure on financing land conservation thus their willingness to proceed on the farming activity.

## Logistic regression model

Econometric model results for the farmer's decision to

**Table 2.** Determinants of farmer's decision to continue farm activity in marginal lands.

| Variables | Coefficiennt | S.E | Sig. | Exp(B) |
|---|---|---|---|---|
| Intercept | -2.807 | 5.019 | 0.576 | 0.060 |
| Gender of household head | -16.79 | 5.800 | 0.004* | 0.001 |
| Age of household head | 0.061 | 0.530 | 0.252 | 1.063 |
| Education level of Household head | 2.921 | 1.624 | 0.720 | 18.55 |
| Family size | -0.140 | 0.196 | 0.475 | 0.869 |
| Farm income/ total family income | 2.752 | 0.946 | 0.004* | 15.676 |
| Dependency ratio | -3.206 | 1.180 | 0.007* | 0.410 |
| Family labour work at farm | 0.899 | 0.369 | 0.015* | 2.458 |
| Total farm size | -3.064 | 0.997 | 0.002* | 0.047 |
| Soil conservation | 2.677 | 1.535 | 0.810 | 0.410 |
| Do you get any help for soil conservation measures? | 5.121 | 2.374 | 0.310 | 167.49 |
| Would you like to have more credit to improve your land? | 1.819 | 1.276 | 0.154 | 6.164 |
| Do you raise animals? | -5.016 | 2.292 | 0.029* | 0.007 |

*Significant at 5% level. 2 Log likelihood = 38.160, Omnibus test of model coefficients($\chi^2$ , df, sig) = 78.713,12, 0.000 Cox and Snell $R^2$ = 0.602, Nagelkerke $R^2$ = 0.807. Percentage of correct predictions = 90.6%.

continue farming activity in marginal land are reported in Table 2 and shortly in the following linear equation:

$$FDC = \beta_0 + \beta_1 GEN + \beta_2 AGE + \beta_3 EDU + \beta_4 FAZ + \beta_5 FIT + \beta_6 DER + \beta_7 FLW + \beta_8 TFZ + \beta_9 ASC + \beta_{10} HSC + \beta_{11} CIL + \beta_{12} RAN + \varepsilon$$

As a whole, the model performed quite well ($p < 0.00$) as indicated by the high value of Omnibus test and the lower value of log likelihood. This goodness of fit test refers to the significant relationship between farmer decision to continue farming activity and the explanatory variables. The percentage of correct prediction is high at about 88.2% which refers to the power of the explanatory variables to explain 88.2% of the variation of classification for farmer decision to continue farming activity.

## Results evaluation

**Socio-economic profile:** The socio-economic factors were found strongly associated with the perception and the decision of farmers to continue farming activity. All the socio-economic variables incorporated in the model had an expected relation of direction. Age (0.061)[2] and education level of the household (2.921), share of farm income to the total income (2.752) and family labour working at farm (0.0899) have positive relationship with farmer decision to continue the farming activities as one of family's income activity, that is, it is a rational decision: as long farming activity provide work opportunities and higher income share to the family, the family would continue the farming activity. Higher education level in Jordan improves the chances to get off-farm opportunities; this explains the limited work chances for less educated people. More family labour involved in farming would affect farmer decision to continue farming due to the high cost of hired labour and its availability.

The factors of: gender (-16.79), family size (-0.14) and dependency ration (-3.206) were found negatively associated with the decision to continue farming. The male household head would not prefer to continue the farming activity especially the young ones, as they prefer other financially secured work. The family size (-0.14) had negative effect on the decision to continue the farming activity; family with high dependency ration prefer to depend on constant income source rather than farming income, as farm activity is associated with high risks.

**Land resource's profile:** Land resource's profile emphasized the importance of land resource in farming at the marginal lands. All explanatory variables included in logistic model had the expected direction of relationship. Except the farm size variable (-3.064), that had a negative effect on famer's decision to continue farming activity. This is more likely to be explained by the land quality used in farming. Land in marginal areas is characterized as degraded land in sever level. Improving land quality requires investments in land conservation and complementary irrigation, which means the need for financial and technical assistant to enhance farming activity in this land.

Land management has an important influence on farmer's decision to continue farm activity. The factors of: adoption of soil conservation (2.677) and farmer's willing-ness to have credit for land management (1.819) had positive effect on the decision to continue farming. This finding is consistence with the research results of Daba (2003), Pender et al. (2004); emphasizing the importance

[2] Figures in parentheses are the coefficients of explanatory variables

of credits used in land conservation for improving land quality and farming sustainability.

Getting help from different institution to apply soil conservation techniques made a significant influence on the decision (5.121). The help is provided through technical advice for farmers on how to manage and conserve their land, thus higher awareness level of land management is important to continue steady farm income for the family. Raising animal had a negative influence on the decision to continue farm activity (-5.016). Raising animal is considered a costly activity due to high fodder prices and low range land productivity, which had reduced the gross return from such on-farm production activity.

## Conclusion

Farm family in marginal areas takes the decision on how to use resources depending on its future objectives. Both socio-economic and land resource's profiles had explained the circumstances in which farmer decide to continue farm activity. The decision is based on receiving higher benefits from farming for better livelihood. Each explanatory variable in socio-economic and land resource's profiles had specific role in enhancing farming in marginal lands. Focusing on socio-economic stimulators and land management are considered a roadmap for structuring work plans to continue farming activity in marginal land. These work plans could be translated to services provided through extension and awareness campaign, technical and financial assistance in land conservation and finally through restructuring new rules in land tenure and the use of fertile land in urbanization.

### REFERENCES


Al-baqain R (1997). Socio-Economic Interactions between Low and High Potential Agro-Ecological Zones and Farming Systems in Jordan. In: w. Doppler and Bauer (Eds): Farming Systems and Resources Economics in the Tropics. Vol.28. Wissenschaftsverlag Vauk: Kiel.

Abu-sharar T (2006). The challenges of land and water resources degradation adoption in Jordan: diagnosis and solutions. In: Kepner G et al.: Desertification in the Mediterranean Region: a Security Issue, 201-206.

AOAD (Arab Organization for Agricultural Development) (2006). Arab Agricultural Statistics Year Book 26, 2006. Website http://www.aoad.org

Daba S (2003). An investigation of the physical and socioeconomic determinants of soil erosion in the Hararghe Highlands, Eastern Ethiopia. Land Degrad. Dev., 14: 69-81.

DOS (Department of Statistics) (2007). Jordan In Numbers for 2006. Amman, Jordan.

DOS (Department of Statistics) (2009). statistics agricultural production. Amman, Jordan.

Doppler W (1999). Setting the Frame: Environmental Perspectives in Farming and Rural Systems Analyses. In: W . Doppler; A. Koustouris (eds.) rural farming systems analyses: environmental perspective. Proceedings of the 3rd European Symposium of the Association of farming systems Research and Extension in Hohenheim, Stuttgart, Germany, March 1998.

Field A (2005). Discovering statistics using SPSS; London: Sage Publications.

Gujarati D (2003). Basic econometric. McGraw-Hill book company New York.

IFAD (International Fund for Agricultural Development) (2009). IFAD – country profile- Jordan Statistics. www.ruralpovertyportal.org

Jabarin A, Epplin F (1994). Impacts of Land Fragmentation on the Cost of Producing Wheat in the Rain-Fed Region of Northern Jordan. Agric. Econ., 11: 191-196.

Maurer M (1999). Dynamics and Potential of Farming Systems in the Marginal Areas of Jordan. In: W .DOPPLER.S. Bauer, (Eds): Farming Systems and Resources Economics in the Tropics, p. 32. Wissenschaftsverlag Vauk: Kiel.

Meerta H, Van Huylenmroeckc G, Vernimmenc T, Bourgeoisa M, Van Heckea E (2005). Farm household survival strategies and diversification on marginal farms. J. Rural Stud., 21: 81-97.

Millington A, Al-hussein S, Dutton R (1999). Population dynamics, socioeconomic change and land colonization in Northern Jordan, with special reference to the Badia Research and Development Project area. Appl. Geogr., 19: 363-384

MOA (Ministry of Agriculture) (2005). Report for Agricultural Sector for 2004. Amman, Jordan.

Pender J, Nkonya P, Jagger P, Ssrunkuumab D, Ssali H (2004). Strategies to increase agricultural productivity and reduce land degradation: evidence from Uganda. Agric. Econ., 31: 181-195.

Sahoo P, Singh R, Rai A (2006). Spatial Sampling Procedures for Agricultural Surveys using Geographical Information System. Indian Soc. Agric. Stat., 60(2): 134-143.

Smith C, Mcdonald G (1998). Assessing the sustainability of agriculture at the planning stage. J. Environ. Manage., 52: 15-37.

Syouf M, Duwayri M (1995). Jordan: Country report to the FAO: International technical conference on plant gen. res, Leipzig, Germany.

Weiss N (2008) Introductory statistics. Person Education. Eight edition. USA.

Wieley A, Bogg T, Ringo HM (2005). The influence of parental socialization factors on family farming plans of preadolescent children: An exploratory analysis. J. Res. Rural Educ., pp. 11-20

Young A (1998). Land resources: Now and for the future. Cambridge University press. United Kingdom.

Zollingrand B, Krannich R (2002). Factors Influencing Farmers' Expectations to Sell Agricultural Land for Non-Agricultural Uses. Rural Sociol., 67(3): 442-463.