Natural Resource Conservation Practices of Resettlers in the New Resettlement Areas of Amhara Region, Ethiopia

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ABSTRACT

The objectives of this research were to: 1) assess the land-use changes and soil fertility management activities of resettlers in the new resettlement areas of Metema and Quara Woredas (Districts), 2) compare average working days spent by resettlers on private and communal land conservation practices before and after the resettlement, and 3) compare resettlers' level of participation in natural forest protection and tree planting in the two Woredas. The study was conducted in six resettlement Kebeles (villages) of Metema and Quara Woredas of Amhara region, Ethiopia. An interview schedule was employed to collect data from 337 resettlers, selected by simple random sampling technique. Data were analyzed by descriptive and inferential statistics to test hypotheses at the .05 significant level.

The findings revealed that above 76 percent of sampled resettlers in Metema and above 65 percent in Quara never practiced any type of soil fertility management practices in the new resettlement areas. Resettlers' total level of participation in natural forest protection and tree planting was found to be at low level in both of the Woredas.

Hypotheses testing using paired t-test revealed that average number of working days spent on private and communal land conservation before the resettlement were significantly higher than after the resettlement at $p < .001$. On the other hand, hypotheses testing using independent t-test revealed that total level of participation in natural forest protection and tree planting between the two Woredas did not show significant difference except for seedling preparation at $p < .01$. In general, natural resource degradation in the resettlement areas was moving at an alarming rate, while conservation practices were found at the low level. Hence, the local government should strive to raise the awareness of resettlers towards natural resource conservation activities; and the appropriate authorities need to intervene to integrate urgently needed development and conservation measures.

Keywords: resettlement, natural resource conservation, Metema, Quara, Ethiopia

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บทคัดย่อ

วัตถุประสงค์ของการวิจัยเรื่องนี้เพื่อ 1) ประเมินการเปลี่ยนแปลงการใช้ที่ดินและกิจกรรมการปรับปรุงบำรุงดินของผู้ตั้งถิ่นฐานใหม่ในเขตพื้นที่โครงการนิคมของผู้ตั้งถิ่นฐานใหม่อำเภอเมตตามา (Metema) และกัวอารา (Quara) 2) เปรียบเทียบจำนวนวันทำงานเฉลี่ยของผู้ตั้งถิ่นฐานใหม่สำหรับการอนุรักษ์ดินในพื้นที่ของตนเองและพื้นที่ชุมชนช่วงก่อนและหลังการตั้งถิ่นฐานใหม่ และ 3) เปรียบเทียบระดับการมีส่วนร่วมของผู้ตั้งถิ่นฐานใหม่ในการป้องกันป่าธรรมชาติและการปลูกต้นไม้ในสองอำเภอนี้ ทำการวิจัยใน 6 หมู่บ้านของอำเภอเมตตามาและกัวอารา เขตการปกครองอำฮารา (Amhara) ประเทศเอธิโอเปีย ใช้แบบสัมภาษณ์เก็บรวบรวมข้อมูลผู้ตั้งถิ่นฐานใหม่จำนวน 337 ราย ใช้วิธีการสุ่มตัวอย่างแบบ Simple random sampling การวิเคราะห์ข้อมูลใช้สถิติพรรณนาและสถิติอนุมานทดสอบสมมติฐานที่ระดับความมีนัยสำคัญ .05

ผลการวิจัยพบว่ามากกว่าร้อยละ 76 ของตัวอย่างผู้ตั้งถิ่นฐานใหม่ในเมตตามาและมากกว่าร้อยละ 65 ในกัวอารา ไม่เคยปฏิบัติการจัดการปรับปรุงบำรุงดินในเขตพื้นที่การตั้งถิ่นฐานใหม่ ระดับการมีส่วนร่วมของ ผู้ตั้งถิ่นฐานใหม่ในการป้องกันป่าธรรมชาติและการปลูกต้นไม้พบว่าอยู่ในระดับต่ำทั้งสองอำเภอ

การทดสอบสมมติฐานใช้ paired t-test พบว่าวันทำงานเฉลี่ยที่ใช้ไปกับการอนุรักษ์ที่ดินของตนเองและพื้นที่ชุมชนก่อนการตั้งถิ่นฐานใหม่ มีจำนวนวันมากกว่าภายหลังการตั้งถิ่นฐานใหม่อย่างมีนัยสำคัญ ที่ระดับ .001 ในทางกลับกันการทดสอบสมมติฐานใช้ independent t-test พบว่าระดับการมีส่วนร่วมในการป้องกันป่าธรรมชาติและปลูกต้นไม้ระหว่างสองอำเภอนี้ไม่พบความแตกต่าง ยกเว้นการเตรียมกล้าไม้ซึ่งพบความแตกต่างอย่างมีนัยสำคัญทางสถิติที่ระดับ .01 ในภาพรวมความเสื่อมโทรมของทรัพยากรธรรมชาติในเขตพื้นที่ตั้งถิ่นฐานใหม่กำลังเคลื่อนตัวไปสู่ระดับที่น่าวิตก ในขณะที่การปฏิบัติการเพื่อการอนุรักษ์อยู่ในระดับต่ำ ดังนั้นรัฐบาลท้องถิ่นควรพยายามอย่างมากในการสร้างความตื่นตัวให้แก่ผู้ตั้งถิ่นฐานใหม่ในการอนุรักษ์ทรัพยากรธรรมชาติและผู้มีอำนาจหน้าที่ควรเข้ามาเกี่ยวข้องเพื่อการพัฒนาและมีมาตรการอนุรักษ์อย่างเร่งด่วน

คำสำคัญ: การตั้งถิ่นฐานใหม่ การอนุรักษ์ทรัพยากรธรรมชาติ เมตตามา กัวอารา เอธิโอเปีย

INTRODUCTION

Over 85 percent of Ethiopia's population live in rural areas and depend on natural resources (land, water, forests and trees) for economic development, food security and other basic necessities (Alemneh, 2003). The country's economy is based on agriculture, which accounts for about 50 percent of Gross Domestic Product, 90 percent of exports, and 85 percent of total employment (Central Statistical Agency, 2000). Ethiopian agriculture is virtually small-scale, subsistence-oriented and crucially dependent on seasonal rainfall (Kassa, 2004). Despite its ancient history, Ethiopian agriculture has failed to adapt to more productive farming systems and is thus unable to feed the fast-growing population, which expands by 2.7 percent a year (Central Statistical Agency, 2007). The reasons behind the poverty in rural Ethiopia have mainly arisen from the neglect by successive governments, with the land being mined to feed an emerging population. Such pressures and interference have led to the collapse of the traditional land management systems in the protection of the environmental integrity in general and soil fertility in particular (Hailu and Edwards, 2006).

As part of its attempt to address the chronic food insecurity which is widespread in some parts of the country, the government of Ethiopia has initiated a program to resettle people from the agriculturally poor highlands to the more fertile lowlands. Accordingly, since 2003, the Amhara

National Regional State (ANRS) has resettled 166,204 people (82,196 household heads and 84,008 family members) in six Woredas of the region, namely Metema, Quara, Tegede, West Armachiho, Tach Armachiho and Jawi (Food Security and Disaster Prevention Office, 2009). The resettlement program was undertaken in areas where the soil and the vegetation are highly susceptible to human interference. Pankhurst (2004) indicated that in many of the lowland areas, where the resettlement was undertaken, the soils tend to be fragile and subject to erosion, and the concentration of large numbers of people leads to the clearing of land for cultivation and firewood which has resulted in considerable deforestation with potentially irreversible negative consequences. Mesfin (1988) also contended that the lowlands are more vulnerable to any types of land-use change than the highlands although this area covers about 60 percent of Ethiopia's land mass.

In further study, Rahmato (2003) reported that government sponsored resettlement programs carried out during 1984/85 involved considerable environmental damage by clearing large areas of vegetation to build homesteads, to acquire farmland and to construct access roads. He also indicated that the scheme failed to adapt farming practices to the agro-ecological conditions of the lowlands, and as a consequence the environmental damage involved was quite considerable. In his study of the Chewaka district in the Oromia National Regional State (ONRS), Berhanu (2007) indicated that the population pressures in the resettlement areas compounded by few conservation efforts jeopardized the sustainability of the woodland and life in the area in general. Ahmed (2005) reported that most of the host people complained of the abuse of forest by the resettlers. The latter have destroyed thousands of hectares of forest, which was tended to by host community for generations, to establish their homestead and farmlands. The host communities adhere to their own traditional practice to keep the forest but the resettlers cut the trees indiscriminately.

Despite the continual vegetation loss from the area, the conservation efforts undertaken so far are very minimal. Moreover, there are no or few studies conducted to have an in-depth analysis on the level of participation of resettlers in soil fertility management, land conservation, natural forest protection, and tree planting practices in their new environment. Three major research questions, thus, arise from this prevailing knowledge gap. These are: i) How is the level of involvement of resettlers in soil fertility management, land conservation, forest protection and tree planting activities? ii) What are the possible reasons that determine the involvement of resettlers in natural resource management in the new environment? iii) What intervention strategies or recommendations are required to sustain natural resource productivity in the resettlement areas? The outcome of this study is to provide an indication to the local governments to envisage appropriate policy measures that potentially curb the negative impacts of the resettlement scheme on the environment while at the same time meet the goal of the resettlement program per se. The objectives of the present study were, therefore, to: 1) assess the land-use changes and soil fertility management activities of resettlers in the new resettlement areas of Metema and Quara Woredas, 2) compare average working days spent by resettlers on private and communal land conservation practices before and after the resettlement, and 3) compare resettlers' level of participation in natural forest protection and tree planting in the two Woredas.

RESEARCH METHODOLOGY

Data collection and analysis

Sampled household survey was the principal means of generating data from primary sources. The household survey was focused on the resettlers' involvement in land conservation, natural forest protection, tree planting and traditional soil fertility management practices. In this study, two Woredas and six kebeles (three from each Woreda) were selected purposively for their potential number of

resettlers for comparison purposes. Out of the total population of the six Kebeles (2,696 people) only 337 (168 from Metema and 169 from Quara) were determined as sampled resettlers on the basis of Jaegers' (1997) formula, allowing 5 percent error margin. Each sampled respondent was selected using simple random sampling technique.

The interview questionnaire was pre-tested with 40 resettlers before the study and minor changes were made in interview schedules. Data were collected during October and December 2009 by going to each sampled households' homestead. Data were analyzed using frequency, percentages and arithmetic means. Paired and independent sample t-tests were employed to test the hypotheses at the .05 significant level.

In this study, natural resource conservation refers to natural forest protection, tree planting, soil fertility management (composting, use of manure, crop rotation) and private and communal land conservation. On the other hand, private land conservation refers to any conservation measures such as terracing, mulching, strip cropping, pitting and the like undertaken on private farmlands, while communal land conservation refers to conservation measures like hillside terracing, gully treatment, controlled grazing, communal plantation and etc. undertaken on communal lands.

RESULTS AND DISCUSSION

Land use changes

For the purpose of the government-led resettlement, the scares forest lands were used. As a result, large area of woodland is converted into cultivation bringing a major shift in the land use change in the affected areas.

Prior to the 2003 resettlement program, the total cultivated land area in Metema and Quara Woredas was estimated to be 60,650 and 236,497 hectares, respectively. Besides, the woodland coverage in the respective Woredas was 232,001 ha and 535,537 ha. After the resettlement program was implemented, however, the total area of cultivated land for Metema and Quara Woredas increased to 95,105 (10.8% increment) and 264,104 hectares (3.2% increment), respectively. On the other hand, the woodland area was decreased to 201,906 ha in Metema (9.5 % decrease) and 493,969 ha in Quara (4.9% decrease) (Table 1). The annual decrease of

Table 1 Land use changes before and after the resettlement in Metema and Quara Woredas

Land use types	Before		After		Changes in
	Area, ha	%	Area, ha	%	percent
Metema Woreda					
Forest land	232,001	72.8	201,906	63.3	-9.5
Scattered tree and grassland	25,599	8.0	20,002	6.3	-1.7
Cultivated land	60,650	19.0	95,105	29.8	+10.8
Other land	664	0.2	1,901	0.6	+0.4
Total	318,914	100.0	318,914	100.0	-
Quara Woreda					
Forest land	535,537	62.4	493,969	57.5	-4.9
Scattered tree and grassland	85,289	9.9	97,870	11.4	+1.5
Cultivated land	236,497	27.6	264,104	30.8	+3.2
Other land*	1,263	0.1	2,643	0.3	+0.2
Total	858,586	100.0	858,586	100.0	-

*Other land refers to land occupied by water body, huts, construction and etc.

Source: Woreda Office of Agriculture and Rural Development (2009).

the woodland in Metema and Quara was 4,299 and 5,938 hectares, respectively. These dramatic land use changes occurred over a period of less than a decade. The findings of this study, thus, indicate that resettlement is one of the major causes for the depletion of natural forests in the study area. Ahmed (2005) similarly argued that the recent resettlement program has resulted in large damage to the natural forest as well as the killings and fleeing of wild animals. In their study in the refugees settlements of the Senegal River Valley, Richard and Mohamed (1996) have described the decrease in woodland from 28 percent to just 9 percent over the 11 year period, whilst the area classified as forest virtually disappeared. Similarly, Messay (2009) reported that because of alarming increase in population size following the 2003 and 2004 resettlement program in Jiru Gamachu in Central Ethiopia, the dense grasslands and woodland vegetation has been entirely converted to villages, grazing and farming lands.

Soil fertility management practices

The soils in the lowlands tend to be fragile and easily lose their fertility because of erosion, unless they are sustainably maintained by means of either traditional or improved soil fertility management practices. However, the resettlers in the lowland area studied practice a traditional form of agriculture known as shifting cultivation whereby they rotate fields rather than crops. Because of this practice, the resettlers intensively exercise deforestation which leaves farmlands and grazing lands exposed to continuous erosion which results in massive land degradation. The resettlers use animal dung as fuel, and crop residues as animal feed. These traditional practices, although not void of their own merits, also preclude the use of natural waste as organic fertilizers. These traditional practices, in turn, lead to breaches in the cycling of soil nutrients, in particular nitrogen and phosphorous, resultant in the decline of soil fertility and thus a decrease in crop yields (Amhara Forestry Action Program, 2002).

The survey result revealed that only 16.7, 23.2 and 21.4 percent of respondents in Metema and 14.8, 34.3 and 16.0 percent in Quara practice composting, manure application and crop rotation, respectively in the new resettlement areas (Table 2). The remainder of the resettlers never practices any type of soil fertility management technologies since their arrival to the new area. Both a lack of awareness and a sense of ownership to invest in the land, insufficient extension service on appropriate technologies, use of dung for fuel and environmental conditions unfavorable to rotate crops used by the resettlers were incriminated to be the reasons for the non-implementation of soil fertility management practices by the resettlers. Due to these factors, which are further exacerbated by other dynamics, the soil fertility in the resettlement areas has been in a constantly decline. The overwhelming majority of sampled respondents believe their farm plots to be less fertile at present than the first three consecutive years of agricultural activity.

Table 2 Proportion of resettler households practicing and not practicing traditional soil fertility management technologies in Metema and Quara Woredas

Traditional soil fertility management technologies	Number and percentages of households per Woreda			
	Metema (n=168)		Quara (n=169)	
	Practicing households n (%)	Not practicing households n (%)	Practicing households n (%)	Not practicing households n (%)
Compost	28 (16.7)	140 (83.3)	25 (14.8)	144 (85.2)
Manure	39 (23.2)	129 (76.8)	58 (34.3)	111 (65.7)
Crop rotation	36 (21.4)	132 (78.6)	27 (16.0)	142 (84.0)

Private and communal land conservation activities

Land is one of the major economic factors for rural farmers. In the resettlement areas, all the households surveyed possess land for farming and residence. Therefore, the inhabitants are responsible for conservation measures on private and communal lands to secure a sustainable income and enhance environmental-friendly agriculture practices in the lowland areas. According to the regional soil and water conservation guideline, every farmer should spend at least sixty days per year on private and communal land conservation activities (Bureau of Agriculture, 1995).

As shown in Table 3, 95.8 percent of respondents in Metema and 92.3 percent in Quara never engaged on private land conservation practices after the resettlement program. Similarly, 53.5 and 52.1 percent in Metema and Quara, respectively never participated on communal land conservation practices in their new resettlement areas. Before the resettlement program, 13.7 and 30.2 percent in Metema and Quara, respectively did not engaged on private land conservation practices, while only 5.4 percent in Metema and 4.7 percent in Quara never participated on communal land conservation practices. The average number of working days spent per year on private land conservation before the resettlement was 17.4 in Metema and 15.1 in Quara, whereas on communal land conservation, the average number of working days spent per year was found to be 19.8 and 19.2 in Metema and Quara, respectively. However, after the resettlement program, these averages decreased to 0.27 in Metema and 0.73 in Quara on private land conservation, while on communal land conservation it decreased to 2.7 and 3.4 in Metema and Quara, respectively. This shows that resettlers used to spend more time for land conservation practices at their original places in the highland as opposed in their new resettlement areas in the lowlands. Three main factors could be cited in support of the fact that land conservation practices are considerably better in resettlers' original habitats. These are: i) the resettlers are prevented from expansion of their farmland and hence obliged to maintain what is at their disposal; ii) local government

Table 3 Average number of annual working days spent by the resettlers on private and communal lands conservation practices prior to (while still in the highlands) and after the resettlement in Metema and Quara

Number of working days spent per year	Number and percentages of households per Woreda							
	Metema (n=168)				Quara (n=169)			
	Before		After		Before		After	
	Number	%	Number	%	Number	%	Number	%
On private land								
0	23	13.7	161	95.8	51	30.2	156	92.3
1-10	8	4.7	7	4.2	12	7.1	10	5.9
11-20	124	73.8	0	0.0	87	51.5	2	1.2
Above 20	13	7.8	0	0.0	19	11.2	1	0.6
Mean	17.4		0.27		15.1		0.73	
On communal land								
0	9	5.4	90	53.5	8	4.7	88	52.1
1-10	51	30.3	68	40.5	29	17.2	69	40.8
11-20	56	33.4	10	6.0	85	50.3	11	6.5
Above 20	52	30.9	0	0.0	47	27.8	1	0.6
Mean	19.8		2.7		19.2		3.4	

officials and extension workers are mainly evaluated on the basis of their performance on land conservation activities; and iii) provision of incentives like training, hand tools and grain in some labor-intensive activities.

As indicated in Table 4, average working days in a year on private land conservation before the resettlement were significantly higher than after the resettlement at $p < .01$ in Metema and at $p < .001$ in Quara Woredas. Similarly, average working days in a year on communal land conservation before the resettlement were significantly higher than after the resettlement at $p < .001$ in both of the Woredas.

According to the respondents, the absence of well planned annual programs for the promotion of conservation activities, the lack of compatible conservation technologies for the lowland areas, the deficiency of known incentives to the resettlers while in their original habitats, the inadequacy of agricultural extension services at village level, the lack of a sense of ownership to stimulate investments on land, and a low level of community awareness were the major factors responsible for the low performance of conservation activities on private and communal lands after the completion of the resettlement program. These findings are in agreement with the observations of Berhanu (2007) who indicated that resettlers were not involved in soil conservation activities in their new environments. He stipulated that out of the total sampled resettlers, 99.29 percent were not involved in any soil conservation practices. He also pointed out that the reason for weak involvement may be caused by the absence of cognition of soil fertility exhaustion by the resettlers; conversely, the flat terrain, which does not necessitate the construction of terraces and the education thereof, prevents the creation of awareness among the resettlers of the importance of conservation measures.

Resettlers' level of participation in natural forest protection and tree planting

Regardless of the future of the resettlements, improvements of livelihoods of the resettlers in the Ethiopian lowlands remain elusive in the absence of a proper management of the natural forests. Aside economic considerations, forests are important due to their buffering function between arid areas and the highland plateau. Moreover, the vegetation of these settlement areas is known to act as a "Green guard" due to its function as a protective of not only the area studied, but also for Ethiopia at large against desertification which threatens from the direction of the neighboring Sudan and the Sahel region (Parks Development and Protection Authority, 2001). Accordingly, proactive participation of the resettlers in natural forest protection is indispensable beyond doubt.

The survey results show that the total level of the resettlers' participation in natural forest

Table 4 Comparison of average working days in a year spent by resettlers on private farmland and communal land conservation practices before and after the resettlement in Metema and Quara Woredas

Type of land	Metema (n=168)			Quara (n=169)		
	Mean	SD	t	Mean	SD	t
Private farmland			6.29**			6.35***
Before	19.7	5.7		21.2	8.5	
After	6.6	2.4		9.5	7.4	
Communal land			8.55***			11.65***
Before	21.5	16.9		18.5	7.9	
After	5.8	4.2		7.1	5.2	

**significant at $p < .01$ ***significant at $p < .001$

protection is low in both districts examined. The low level of participation is manifest in all natural forest protection related activities such as the prevention of deforestation, production of charcoal, farmland expansion and the control of illegal forest and forest produce traders, and forest fire protection (Table 5).

The means of total level of participation in natural forest protection and tree planting were 2.36 and 2.16 for Metema and 2.37 and 2.25 for Quara, respectively while the means of overall level of participation in natural forest protection and tree planting were 2.26 and 2.31 in Metema and Quara, respectively. Between the two Woredas there was no significant difference in the respondents' level of participation in natural forest protection and tree planting at $p < .05$, whereas only seedling preparation showed a significant difference between the two woredas at $p < .01$ (Table 6).

From the respondents, it is understood that four major reasons are causes for the resettlers' low level of participation in natural forest protection and tree planting: i) the lack of a sense of ownership along a desire to maximize exploitation of the available land in absence of any consideration of the consequences associated with such a practice of agriculture; ii) the quantitative inadequacy of the officially allocated farm land (1.02 ha in Quara and 0.91 ha in Metema (Food Security and Disaster Prevention Office, 2009)) to families of an average size of 4.8 people; iii) limited existence of off-farm activities which could generate additional income in the resettlement areas, and iv) low level of support from the local administration and extension agents at great distances from the resettlement areas.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study showed that in the past seven years of resettlement, area of woodland in Metema and Quara decreased nearly by 9.5 and 4.9 percent,

Table 5 Respondents' level of participation in natural forest protection and tree planting in Metema and Quara Woredas after resettlement

Activities	Metema (n=168)			Quara (n=169)		
	Mean	S.D	Level	Mean	S.D	Level
Natural forest protection						
Prevention of tree cutting	2.33	0.85	Low	2.39	0.64	Low
Prevention of charcoal making	2.42	0.79	Low	2.41	0.65	Low
Prevention of farmland expansion	2.32	0.71	Low	2.32	0.65	Low
Control illegal forest traders	2.39	0.74	Low	2.34	0.66	Low
Forest fire protection	2.36	0.82	Low	2.39	0.69	Low
Total	2.36	0.64	Low	2.37	0.57	Low
Tree planting						
Problem identification/appreciation	2.33	0.73	Low	2.40	0.65	Low
Land allocation for tree planting	2.15	0.71	Low	2.27	0.80	Low
Seedling preparation	1.91	0.61	Low	2.10	0.62	Low
Plantation	2.20	0.72	Low	2.21	0.62	Low
Taking care of planted seedlings	2.20	0.71	Low	2.25	0.69	Low
Total	2.16	0.56	Low	2.25	0.53	Low
Overall	2.26	0.47	Low	2.31	0.45	Low

Interpretation of mean score: 4.21-5.00 = very high, 3.41-4.20 = high, 2.61-3.40 = moderate, 1.81-2.60 = low and 1.00-1.80 = very low level of participation.

respectively. Conversely, cultivated land increased by 34,455 ha (10.8%) in Metema and by 27,607 ha (3.2%) in Quara Woreda. This increment of cultivated land in the resettlement areas has not only affected the acacia woodland, but also the most economically important tree species like incense and gum. The study also indicated that the overwhelming majority of resettlers in two sampled Woredas have never practiced any type of soil fertility management practices after their arrival to the new resettlement areas. At the same time, the study revealed that the resettlers used to spend more time for land conservation practices at their original places in the highland as opposed to the case in their new resettlement areas in the lowlands. Total level of participation in natural forest protection and tree planting was found to be at the low level in both of the Woredas.

Table 6 Comparison of respondents' level of participation in natural forest protection and tree planting in Metema and Quara Woredas (n=168 Metema and 169 Quara)

Activities	Woreda	Mean	SD	t
Natural forest protection				
Prevention of tree cutting	Metema	2.33	0.85	.774 (ns)
	Quara	2.39	0.64	
Prevention of charcoal making	Metema	2.42	0.79	-.107 (ns)
	Quara	2.41	0.65	
Prevention of farmland expansion	Metema	2.32	0.71	-.026 (ns)
	Quara	2.32	0.65	
Control illegal forest traders	Metema	2.39	0.74	-.729 (ns)
	Quara	2.34	0.66	
Forest fire protection	Metema	2.36	0.82	.448 (ns)
	Quara	2.39	0.69	
Total	Metema	2.36	0.64	.148 (ns)
	Quara	2.37	0.57	
Tree planting				
Problem identification/appreciation	Metema	2.33	0.73	.917 (ns)
	Quara	2.40	0.65	
Land allocation for tree planting	Metema	2.15	0.71	1.64 (ns)
	Quara	2.27	0.80	
Seedling preparation	Metema	1.91	0.61	2.83**
	Quara	2.10	0.62	
Plantation	Metema	2.20	0.72	.145 (ns)
	Quara	2.21	0.62	
Taking care & follow-up	Metema	2.20	0.71	.604 (ns)
	Quara	2.25	0.69	
Total	Metema	2.16	0.56	1.454 (ns)
	Quara	2.25	0.53	
Overall	Metema	2.26	0.47	.961 (ns)
	Quara	2.31	0.45	

ns= not significant; **significant at p<.01

Hypotheses testing using paired t-test revealed that average number of working days spent on private and communal land conservation before the resettlement were significantly higher than after the resettlement. On the other hand, hypotheses testing using independent t-test revealed that total level of participation in natural forest protection and tree planting between the two Woredas did not show significant difference. In general, natural resource degradation in the resettlement areas is moving at an alarming rate, while conservation practices are found at the low level.

Recommendations

Successful natural resource conservation initiatives require greater participation and involvement of the local communities. Therefore, concerned public authorities need to create a suitable platform to enhance community awareness of the fact that natural resource conservation is to their own benefit. In addition, it requires the provision of appropriate and compatible technologies with the agro-climatic zone of the area. Similarly, it is vital to design and implement participatory forest management practices with active involvement of the resettlers to increase their sense of ownership towards forest resource conservation and at the same time, to strengthen the law enforcement against illegal land invaders in the resettlement areas. As a long term solution, a general land use plan for the region and a legally binding land use plan at village level could contribute in limitation of the illegal expansion of farmlands. In line with this, the local government should reconsider the guideline for farmland allocation in the resettlement areas, as insufficient agricultural land is one of the reasons for forest land encroachment. The regional government should also strive to strengthen the agricultural extension services and build the capacity of local government institutions at the village level to efficiently support the resettlers to diversify their off-farm income and minimize their dependency on forest and forest produces. Furthermore, different incentive mechanisms are needed as to motivate resettlers for a better performance in natural resource conservation and to empower communities to establish a system for the conservation of the environment.

Finally, although the resettlement program has brought some economic changes in the households, its adverse environmental effect was overlooked. Moreover, the issue of natural resource management is not taken into consideration. Therefore, there is a need to work in a holistic manner and to incorporate the potential risks of resettlement on the environment and possible reduction mechanisms prior the commencement of such a program. To this end, when population resettlement is an unavoidable means of securing food self sufficiency, it should be minimized by investigation of all viable project options. On the other hand, further detail studies should be performed on the development of alternative policy strategies for the efficient use of land and other natural resources under adverse ecological conditions and high population pressure.

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