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Assessment of Seedling Survival and Associated Challenges under Community Mobilization Tree Planting Practice in Wadla Woreda, North East Ethiopia

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ABSTRACT

The main purpose of this study was to assess the level of seedling survival and associated problems under community mobilization tree planting practice in Wadla Woreda, North Wollo Zone, Ethiopia. A descriptive survey design with a mixed approach was used, which included both quantitative and qualitative data collected from households, leaders of kebeles, development agents, and forestry experts. Primary data was gathered through questionnaires. interviews, focus groups, and transect walks, while secondary data including reports and official records were also touched. Based on transect walk data, average seedling survival rate was 51.66% with a wide range of survival among the *kebeles*. Among sample *kebelles*, *Meley* recorded the highest (81.3%) survival. rate, and *Quana* was registered the lowest (31.86%) rate. Investigation of five-year trends (2018-2022) showed a variable performance in terms of survival, reaching its maximum in 2018 (89.4%), decreasing to 49.4% in 2020, and returning to 84.6% in 2022. The analysis of descriptive statistics and binary logistic regression proved that improper planting technique, inappropriate planting time, competition by weeds, predation by animals, lack of replacements and local instability were the major challenges that hinder seedling survival. in the study area. Therefore, to achieve a higher success rate in the afforestation programs and guarantee the success of community-based afforestation efforts, it is necessary to improve the survival rates by enhancing the local capacity, maintaining the timely replacement seedlings.

Keywords: Seedling survival, community mobilization, reforestation, challenges, Wadla Woreda

1. Introduction

Community mobilization is a planned and conceptualized project that seeks to mobilize communities towards bringing positive social transformation (UNEP, 2021). It is traditionally committed to either one of two paradigmatic frameworks: a top-down framework or a community-focused framework. The former tends to be professional in nature and focuses on the service delivery or the execution of programs that were developed by other parties. Although it can be effective in certain settings, this method is often lacking in the sensitivity to local conditions and local input, limiting its viability in the long term (World Bank, 2018). In Ethiopia, the top-down paradigm has been more successful in the conservation of natural resources, particularly tree-planting campaigns.

In Ethiopia, community mobilization has been found to be useful in the implementation of large-scale environmental restoration programmes including afforestation and soil conservation programs. The food-for-work schemes tend to support these initiatives and provide incentives to participate in them while at the same time alleviating the urgent food-security issues (Gashaw et al., 2018). Since the Derg rule up until now, hillside encroachments and reforestation programs have mostly been implemented within food-for-work models. They were paid using grain and oil under such programs to undertake activities such as planting seedlings, terrace construction, and building micro-dams (Admassie, 2020; Bekele, 2021). However, with all these attempts to correct forest degradation, success has often been unsuccessful compared to the labor and financial capital used to raise the success outcomes, thus leading to poor returns. The focus was usually on the number of seedlings planted with little regard to the survival of the planted trees, their management, and use (Bekele, 2021).

Large-scale tree-planting efforts have in the recent decades become one of the key environmental management approaches in Ethiopia, especially within the national Green Legacy Initiative (GLI). The GLI aims at reversing land degradation, enhancing the restoration of the ecosystem and reducing the negative effects of climate change by reforesting the community through community reforestation programmes. The Ethiopian government has implemented a continuum of afforestation and reforestation programs, including watershed control and tree-planting activities throughout the country. It was worth noting that over 350 million trees were planted on a single day in 2019, and then an accumulation of over 4 billion has been planted in the years since. It has

been reported that between 2019 and the summer of 2023, the Green Legacy program in Ethiopia had planted around 32.5 billion seedlings (WEF, 2019; ENA, 2023; All Africa, 2023). The Amhara region, and particularly Wadla Woreda, has been a proponent of these campaigns by engaging in massive community mobilization initiatives that preempt the conservation of soil and water, afforestation, and reclamation of the eroded landscape.

Even with these amazing mobilization activities, the success of such activities in the long term is still not known. The difficulty that faces numerous programs is related to poor maintenance, lack of community involvement, poor monitoring, and fascination with planting metrics more than post-planting survival. Although a number of studies have been done in Ethiopia on the aspects of tree planting in context, with respect to soil fertility, fuelwood use, and use of energy (Alemu, 1999; Gebreegziabher et al., 2010; Worku et al., 2017), limited research has been done to determine the survival rate as well as sustainability of seedlings planted with community mobilization. The subtle perception of these mechanisms should be a key to improving the effectiveness of reforestation and writing up policy reactions. Therefore, it is urgent to evaluate the rate of seedling survival and determine the obstacles related to the practice of community-mobilized tree-planting to increase the effectiveness and sustainability of future projects. This kind of knowledge will enable the policymakers and the local environmental offices, as well as communities, to optimize their approaches so that planting of trees will bring about genuine and sustainable vegetation recovery in Wadla Woreda.

Thus, the proposed research was to evaluate the survival of seedlings and challenges linked to community-mobilized tree-planting as a practice in Wadla Woreda in the Northeast of the Amhara region. The specific objectives are:

1. To determine the current survival rate of seedlings planted through community mobilization.
2. To identify the challenges that hinder tree seedling survival in the study area.

2. RESEARCH METHODOLOGY

Location of the Study Area

Wadla Woreda is located at $11^0$31’32’’ to$11^0$49’45’’ North latitudes, and $38^0$44’58” to $39^0$14’ 50” East longitudes. It is one of the 11 districts in North Wollo Zone, in Amhara Regional State, located at about 265 km east of the capital of the Region, Bahir Dar, 127km west of Woldiya which is the capital of North Wollo Zone and 648km from Adiss Ababa. It is bounded by: Delanta south east, Gazo woreda in the east, MeketWoreda in the north and Dawint Woreda in south west

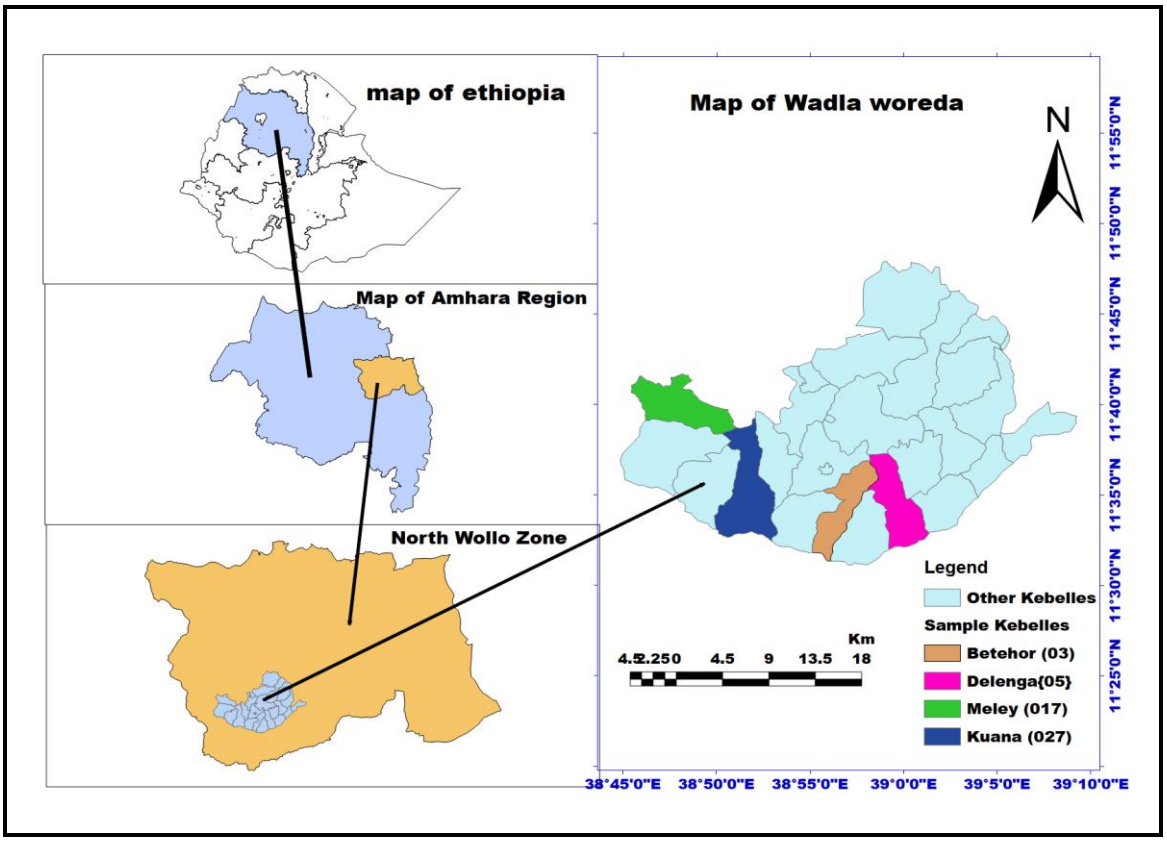


Figure1: Location map of the study area.

Research Design and Approach

In order to examine the level of seedling survival and its challenges, a descriptive survey type of research design was used. Because it is used to generate appropriate information from the households, local land administration committees, local/kebele administration, and kebele and woreda experts. In the process of data collection and generation, primary and secondary data were

used. To maximize the generation of reliable data for analysis and strengthen the data generation, collection, acquisition, and triangulation, the combination of methodologies, including qualitative and quantitative approaches, was applied.

Data Sources

Both primary and secondary data sources were employed in this study. Primary data were collected from households, Kebele leaders, the kebele land administration and use committees, and kebele administrative committees, as well as development agents. Various sources of secondary data were obtained, such as annual reports, technical manuals, official administrative records, and published and unpublished literature, to offer background information to the research area and also to explain current seedling planting practices.

Sampling Techniques and Determination of Sample Size

In order to select the desired samples that represent the Woreda, this study employed a two-stage sampling procedure. In the first stage, the district was categorized into different agroclimatic zones, and two *kebeles were selected* from each category purposely, which are largely community-mobilized seedling plantations performed in the district. At this stage, this study gives great attention to selected peasant associations, representing the Woreda in terms of socio-economic and physical characteristics adequately. Afterwards, residential heads of the sampled *kebeles* were stratified in terms of gender, and the respondents were selected through a systematic random sampling method. Beforehand, a complete list of every peasant household and demographic profile was made out of the respective *kebele* offices after a pre-survey interview was conducted. The individual respondents were then selected using proportionate allocation in each stratum. To arrive at the sample size, the formula suggested by Yamane (1967) was used:

$$n=\frac{N}{1+Ne^2} \quad , \qquad n=\frac{6517}{1+6517(0.05)^2}=377 \ldots\ldots\ldots\

Table 1. Sample households of the study area based on Agro climatic zone and sex

Agro climatic zone	PA /*Kebelle*	Male head House hold	sample house hold	Female head house Hold	Sample house hold
Dega	016(Kuana)	1329	(1329*377)/6517= 77	419	(419*377)/6517=24
	017(Meley)	1428	(1428*377)/6517= 83	423	(423*377)/6517=25
Woina Dega	03(Betehor)	938	(938*377)/6517=54	224	(224*377)/6517=13
	05(Delga)	1301	(1301*377)/6517=75	455	(455*377)/6517=26
Sub-Total	4	4996	(4969*377)/6517=289	1521	(1521*377)/6517= **88**
Total =289+88=377					

Source: Survey data 2024

Data Collection Instruments

Majorly, four types of data-gathering instruments were used for this study. These are questionnaires, key informant interviews, focus group discussions (FGDs), and transect walks. A combination of these tools presented all-purpose information to triangulate and increase the credibility of the study results.

Questionnaires

To collect the required data related to factors for tree seedling survival, both close-ended and open-ended questionnaires were employed. The close-ended questionnaires help the researcher to collect direct answers from the sample respondents. While the open-ended questions give high freedom to respondents to answer the questions by their own view. The questions are first translated into the Amharic language to be easily understood by farm households. Before conducting the survey, the researcher first made a pilot survey to see the details of the issue in the field and to check whether the objectives are addressed by the structured questionnaire or not. After the pre-taste of

the questionnaires was checked to prove their fitness, some aspects of the questionnaires were refined. The data were collected through trained assistants.

Key informant interview

To explore facts from the real ground, key informant interviews were conducted with a selected group of individuals (woreda forest sector experts and development agents) who are likely to provide needed information, ideas, and insights on seedling planting practices and the factors that affect their survival.

Focus group discussion

To supplement and confirm information that would be generated using questionnaire and interview, focus group discussions were conducted with the kebele land administration and use committees; and kebele administrative committees of the study area.

Transect Walks

To identify survived planted trees and damaged seedling as well as dead/dried/ seedling Transect walk was performed on the plantation site after identified straight line pattern of planted trees/ Planting Pits.

Data Interpretation and Analysis.

Quantitative and qualitative methods of analysis were used. Data coding was done for questions, and texts that were recorded during the interviews and the outcome of focus group discussion was condensed and compiled into short forms and finally categorized into different themes Statistical package for the Social Sciences(SPSS) version 22 was used to analyze quantitative data of questionnaires. Frequencies, percentages, means and standard deviations were calculated as descriptive statistics. The mean score for each item is to be calculated using the median line (3.0) as dividing line. Those items whose mean value is below 3.0 are assumed to have low effect on survival of seedling. In addition to descriptive statistics, Binary Logistic Regression was performed to identify the major challenges that hinders of seedling survival in the study area

In order to determine the survival rate of planted seedlings, the following formula was used after the data collection process was done using transect line survey on the mobilized plantation site.

Survival % A = $\frac{B+C}{B+C+D} * 100$…….(3.2)

Where:-

A = survived seedling percent

B = healthy seedling

C = damaged seedling

D = dead/dried/ seedling

Interpretation of qualitative data (interviews and FGDs) involved summarization, coding based on themes and triangulation of the results with quantitative analysis. Findings were presented through narrative explanations**,** tables and figures to clearly illustrate seedling survival rates and influencing factors.

Ethical concerns and considerations

The researcher carefully considered ethical standards throughout the study. All methods and procedure were carried out in accordance with relevant guidelines and regulations. Prior to beginning data collection, this study was approved by the Social Science and Humanity College Research and Community Service coordinator of Woldia University, and a confirmation letter acquired from this has been attached as supplementary material in this paper (Amharic to English translated version). This letter, issued through the respective academic institutions, was forwarded to the Wadla Administration Office and the concerned *kebeles*, with copies distributed to the researcher, data collectors, and supervisors. Its purpose was to ensure that governmental bodies were fully informed about the study's aims and to facilitate access to the necessary information and data.

Consent to Participate

After securing the necessary ethical approvals and preparing the data collection tools, the researcher and data collectors clearly explained the study's objectives to all participants, outlining its purpose and scope. They provided a transparent description of the data collection procedures, ensuring that participants understood what information would be collected, how confidentiality would be maintained, and how data would be anonymized and stored. They also clarified how

interviews, surveys, and other methods would be administered, as well as how the findings would be used and disseminated, thereby promoting openness and accountability in the research process.

The participants were then invited to complete the informed consent form. Although they agreed to participate, many chose not to sign the written consent document due to concerns about potential risks associated with attaching their signature or providing written proof of participation. Due to these concerns, written consent was not required. Instead, verbal consent was obtained after thoroughly explaining the research purpose, the value of the information being collected, and participants' rights, including the freedom to withdraw from the study at any time or to decline answering specific questions without providing justification. Moreover, the study did not involve individuals under the age of 18, who would require parental consent.

Interviews conducted during fieldwork were documented using handwritten notes. All data obtained from participants were handled with strict confidentiality. The researcher carefully safeguarded the names and any identifying information of key informants for reference and verification purposes until transcription and analysis were completed.

Data availability statement

Datasets generated or analyzed during the study are available upon reasonable request from the corresponding author.

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Declaration of interest statement

The authors report, there are no competing interests to declare.

Declaration of funding

This research was funded by Woldia University to support data collection. But, the funder had no role in the study design, analysis, interpretation and manuscript preparation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used AI and AI-assisted technologies in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

3. DATA ANALYSIS AND INTRPRETATION.

3.1 The Survival Level of Seedlings Planted by Community Mobilization

To evaluate the survival rate of the planted seedlings in the study area, data collection was done through a transect line survey on the mobilized plantation site. The transect line survey was done by taking samples of each study kebele individually. After that, ten (10) sample planting lines were selected in each of the study sections of the *Kebele,* and the number of healthy seedlings and damaged and dried seedlings was noted. Then, the survival rate was calculated using the above formula 3.2, and the finding is presented below (table 2).

Table 2. Survival rate of seedlings across sampled sites on study kebeles

Kebele	Healthy Seedlings	Damaged Seedlings	Dead/Dried Seedlings	Survival Rate (%)
Meley	369	27	91	81.30
Quana	82	19	216	31.86
Delenga	77	22	202	32.89
Betehor	108	29	174	44.00
Total	636	97	683	51.66

Source: Survey field report, 2024

Table 2 above indicates that there is variation in seedling survival rate across four kebeles. *Meley Kebele* had the highest survival percentage (81.3%), which means that it adhered to seedling management and good site conditions. However, *Quana* (31.86) and *Delenga* (32.89) had a

comparatively low survival rate, meaning that the number of seedlings that died in these locations was relatively more, which may have been caused by either poor methods of planting, poor climatic conditions, or lack of proper maintenance of the seedlings. *Betehor Kebele* had an average survival rate (44%), and the survival rate in the sampled kebeles was 51.66, which illustrated the necessity to improve the management practice to improve the seedling survival performance.

Table 3 below shows 5-year seedling survival between 2018 and 2022 at the woreda level. It shows the number of seedlings planted, planted area coverage in hectares, the number of survived seedlings, and the area of survived seedlings for each year.

Table 3. Five-Year Seedling Survival at Woreda level

Year	Number of Planted Seedlings	Planted Area (ha)	Number of Survived Seedlings	Area Survived (ha)
2018	18,652,894	1,663.42	16,683,636	1,486.34
2019	14,979,604	1,617.67	11,167,345	1,206.00
2020	18,184,626	3,119.00	8,986,497	1,562.00
2021	6,375,340	919.94	4,355,009	654.76
2022	12,280,000	1,355.79	10,383,000	1,150.90

Source: Wadla Woreda Agriculture Office, 2024.

In 2018, a total of 18,652,894 seedlings were planted across 1,663.42 hectares, with 16,683,636 (89.44%) surviving, covering 1,486.34 hectares. This indicates a high survival rate, with most of the planted area seeing successful growth. The following year, 2019, saw a decrease in both the number of seedlings planted and their survival. A total of 14,979,604 seedlings were planted over 1,617.67 hectares, but only 11,167,345 (74.55%) survived, covering 1,206 hectares. This drop in survival rate and area suggests that there were challenges in seedling survival during this period. In 2021, the number of seedlings planted increased to 18,184,626, spread across 3,119 hectares. However, only 8,986,497 (49.42%) seedlings survived, covering a reduced area of 1,562 hectares. Despite the larger planting area, both the survival rate and the area of successful growth were lower than in 2018. The following year, 2021, saw a significant reduction in both the number of seedlings planted and the surviving area. Only 6,375,340 seedlings were planted across 919.94 hectares, and just 4,355,009 (68.31%) survived, covering 654.76 hectares. This was the lowest number of

seedlings planted and the smallest surviving area, indicating significant challenges during this year.

By 2022, the number of seedlings planted increased again, with 12,280,000 planted over 1,355.79 hectares. Of these, 10,383,000 (84.55%) survived, covering 1,150.9 hectares. While survival rates improved compared to 2021, 2020, and 2019, they were still lower than in the earlier year (2018).

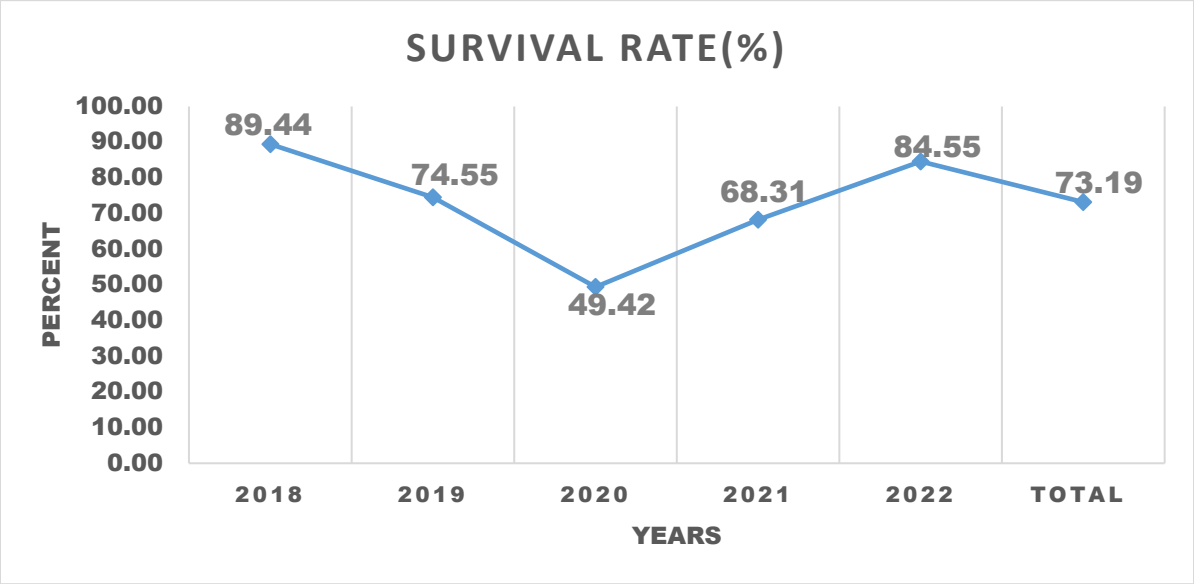


Fig 2: Trends of survival rate

Figure 2 above indicated the variation of survival patterns annually in the district. The highest survival rate (89.4) was recorded in the year 2018, and the lowest survival rate (49.4) was recorded in the year 2020. Downturns in 2019, 2020, and 2021 are presumably because of the COVID-19 upheaval and unrest caused by conflicts, as confirmed by the participants in the focused group discussion and interview. The 2022 rebound rate (84.6%) is an indication of better management and positive factors, but it highlights the necessity of regular monitoring and adaptive management. The total survival rate of the Woreda between 2018 and 2022 was 73.19. This trend analysis assists in assessing the performance and sustainability of reforestation procedures over a time cycle and also in identifying the changes in the survival rates, which could be associated with the different climatic, management, or community involvement criteria.

4.2 Challenges that Hinders Seedling Survival

Survival of the seedlings is one of the parameters that can dictate the success of community-based planting programs and reforestation. Seedling survival in Wadla Woreda is affected by numerous biophysical, socioeconomic, and management-related factors. To measure the barriers to seedling survival propagated by the community mobilization in the study area, respondents were requested to show their levels of agreement measured by the five choices at the right side of each item. The measures are 1 is Very Low, 2 is Low, 3 is Medium, 4 is High, and 5 is Very High. The answers of the household respondents on barriers to seedling survival are presented below (table 4).

Table 4. Challenges that hinders seedling survival

No.	Challenges	Responses	Rates					Mean	St.d
			1	2	3	4	5		
1	Deterioration in the condition of seedlings by mishandling during transporting & storage.	F	130	132	89	26		2.0292	0.926
		Percent	34.5	35	23.6	6.9			
2	Improper planting technique such as Shallow planting, inadequate firming of the soil around the roots, exposed or bend roots, etc	F	26	58	140	65	88	3.3475	1.191
		Percent	6.9	15.4	37.1	17	23.3		
3	Inappropriate planting time	F	26	27	126	160	38	3.4164	1.002
		Percent	6.9	7.2	33.4	42	10.1		
4	Occurrence of bad weather after planting like frost, very high temperature, drought, high rainfall and flood, etc.	F	64	234	72	7		2.0584	0.658
		Percent	17	62.1	19.1	1.9			
5	Attack by insect pests & diseases	F	9	297	44	27		2.2361	0.61
		Percent	2.4	78.8	11.7	7.2			
6	Weed competition	F	53	38	53	87	146	3.6233	1.435
		Percent	14.1	10.1	14.1	23	38.7		
7	Animal damage	F	2	38	59	84	194	4.1406	1.051
		Percent	0.5	10.1	15.6	22	51.5		
8	Absence of replacements	F	15	44	52	113	153	3.9151	1.168
		Percent	4	11.7	13.8	30	40.6		
9		F	305	72				1.19	0.394

	Miss match between seedlings and plantation sites	Percent	80.9	19.1					
10	Lack of quality seedlings	F	110	62	112	93		2.4987	1.153
		Percent	29.2	16.4	29.7	25			
11	Poor Preparation of planting pits	F	50	49	60	89	129	3.5252	1.412
		Percent	13.3	13	15.9	24	34.2		
12	Lack of peace and stability	F	28	53	137	64	95	3.3846	1.213
		Percent	7.4	14.1	36.3	17	25.2		

*Note: 1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High

As represented in the above (table 4), the 1st item of the questionnaire concerned the deterioration of seedlings by improper handling during transportation and storage. Household respondents were required to respond to whether this challenge hinders seedling survival in the study area or not. The data obtained showed that the highest number of respondents (69.5%) believed that deterioration in the condition of seedlings by mishandling during transportation and storage was not a problem that affected the survival of seedlings, but only a small percentage of the respondents (30.5%) agreed that it was a challenge in the study area (table 4). Moreover, the average mean score was 2.028, which is far below the median line (3.00) and is not the difficulty of seedling survival in the study area.

In view of inappropriate planting methods like planting too shallow and failure to firm the soil around the roots, exposure and bent roots, and other factors, the majority of the household respondents in the study area (77.4%) think that this problem is a hindrance to the survival of the seedlings in the area. On the other hand, 22.3% of the interviewees considered the impact of this challenge to be very low or low. The average of this challenge is 3.347, which is higher than the median.

With regard to inappropriate planting time, 85.5 percent of the respondents indicated that this challenge has a medium, high, or very high level impact, only 7.2 percent of the respondents rated the item low level, and 6.9 percent of the respondents rated it very low level. The mean score for this item is 3.41, which is above the median line. Therefore, inappropriate planting time is one of the major challenges in the study area.

In relation to the occurrence of bad weather after planting, such as frost, very high temperature, drought, high rainfall, flood, etc., none of the rated factors has very high influence on seedling survival. The percentage of respondents who responded that its effect was high and medium were only 1.9% and 19.1% of respondents, respectively, and most of the respondents, that is, 62.1% and 17%, rated the item as low and very low, respectively. The average mark of this item was 2.05, and it is much lower than the median line (3.0).

Regarding attacks by insect pests & diseases, which are damages caused by insect pests or diseases that affect tree seedlings' health and growth potential. No one rated the existence of this challenge at a very high status level. 306 (81.2%) of respondents agreed that this challenge has a low effect on seedling survival by rating this challenge as low and very low level. The remaining few (8.8%) of respondents agreed that it has a high effect on seedling survival in the study area. The mean score ($M = 2.33$; $SD = 0.894$) is no different from the frequency distribution of respondents, though it has medium variability among respondents (Table 4). This exposes the fact that the impact of this challenge on the survival of seedlings is not as acute in the study region.

For the effect of weed competition on seedling survival, 147 (39%), 92 (24.4%), and 63 (16.7%) of respondents were rated as very high, high, and medium level, respectively, but 32 (8.5%) and 43 (11.4%) of respondents agreed that this challenge has a low and very low effect on seedling survival (Table 4). The mean score was 3.7109 with 1.358 standard deviations. Thus, a higher mean score with greater standard deviation indicated the existence of this challenge in the study area with greater variability. However, weed competition is not a challenge in Meley kebele. This proved that 35 (9.3%) and 48 (12.7%) of respondents rated this challenge as low and very low level, respectively, and the mean score is 1.92 with a 1.091 standard deviation (Table 6). Furthermore, key informants of development agents and the focus group discussion with the kebele land administration and use committees and kebele administrative committees indicated that there is regular weeding activity on the mobilized plantation site. That is why this kebelle experienced a higher level of seedling survival than other kebelles.

Animals damaging tree seedlings is another significant challenge faced in achieving successful survival rates in all study area kebeles except Meley Kebele. The mean score and standard deviation for this challenge are 4.1406 and 1.0512, respectively. Again, the majority (278, or

55.7%) of respondents rated the impact of animal damage on seedling survival as high or very high. Unfortunately, respondents of all kebeles rated the effect of animal damage on seedling survival as above the medium level and have a far higher mean score from the median line (3.0) except for Meley kebeles. 34 (9.0%), 38 (10.1%), and 2 (0.5%) of Meley Kebele respondents rated the effect of this challenge on seedling survival as medium, low, and very low level, respectively. But the mean score for this kebelle is 3.0741 with 1.091 standard deviations, which is above the median line (see table 6). Again, the outcome of the focused group discussion and interview confirmed that free grazing is not allowed and it was not the major problem in Meley kebelle. Therefore, this particular problem seems quite severe based on its high mean value compared to other challenges mentioned earlier. The implication highlighted from this finding is the need for protective measures against animals, such as fencing or deterrents around seedlings' growing areas.

Concerning the absence of replacements for dead seedlings, 153 (40.6%), 113 (30%), and 52 (13.8%) of respondents agreed that the effect of this challenge is very high, high, and medium, respectively. But the remaining few (59, or 15.7%) respondents rated this challenge as low and very low level. The mean score for this challenge is 3.9151 with 1.168 standard deviations, which is far above the median line (3.0) with higher variability (table 4). Therefore, the above frequency distribution and mean score result forced us to conclude that the absence of replacements for dead seedlings by making frequent survival counts and follow-ups was very low and hindered the effectiveness of mobilized tree planting practice in the study area.

Mismatch between seedlings and plantation sites: This refers to a situation where an unsuitable species is planted in unfavorable environmental conditions, leading to a mismatch between the planted species and the site characteristics. 305 (80.9%) of respondents rated the effect of this challenge at a very low level. No one rated the mismatch between seedlings and plantation sites effect as above medium level in all kebelles (table 4). The mean score for this challenge is 1.19 with 0.394 standard deviations (with lower variability), indicating that it is not the challenge for seedling survival in the study area (table 4).

The respondents were further requested to provide the impact of the lack of quality seedlings on the survival of the seedlings within the study area (see Table 4). In this aspect, 50% of them, which is 205 (54.7 percent) of the respondents, felt the impact as medium and high level, whereas 172

(45.6 percent) of respondents perceived the item as low and very low. However, no one rated this challenge as very high on seedling survival in the study area. The average of this challenge was 2.49, which was bordering on average.

Regarding the poor preparation of planting pits, 24 and 34.2 percent of the respondents responded that it has a very high and high-level effect on seedling survival in the area, respectively. Unlike 15.9 percent of those who attended the study, who assume that poor preparation of planting pits moderately determines seedling survival, 13 percent and 13.3 percent of the participants consider poor preparation of planting pits as a low and a very low determining factor to seedling survival, respectively. The mean score (3.5252) of poor preparation of planting pits indicates that respondents generally view this challenge as somewhat serious.

The last point of table 4, point number 12, shows that 159 (42.2%) of respondents rated the item as high and very high, and 81 (21.5%) rated the item as low and very low. The rest, 137 (36.3), responded as moderate level. Once more, the average was 3.384, which is above the median (3.0), and lack of peace and instability is one of the challenges that prevent survival of seedlings in the study area.

Generally, the analysis of descriptive statistics (percentage, the mean score) displayed that the most urgent issues, which impeded the survival of the seedling, were presented by animal damage, the lack of replacements, the competition of weeds, improper preparation of planting pits, and improper time of planting. Poor handling, pests, and site-species mismatch, on the other hand, were considered less serious.

Besides descriptive statistics, binary logistic regression was conducted to identify the major challenges that hinder seedling survival in the study area, and the outcomes of the output are presented in table 5 below.

The binary logistic regression model fit well and demonstrated excellent explanatory power. The Omnibus Test of Model Coefficients revealed that the predictors significantly outperformed the null model ($\chi^2 = 165.899$, $p < 0.001$). Overall, the model fit well, according to the −2 Log Likelihood score (89.167). The model explained between 35.6% and 72.4% of the variation in the dependent variable, according to the Nagelkerke R^2 (0.724) and Cox and Snell R^2 (0.356). The

model's good fit to the data was also confirmed by the non-significant Hosmer-Lemeshow test (χ^2 = 0.98, df = 8, p = 0.998).

So, the model seems to provide a relatively good fit to the data, with the Nagelkerke R Square indicating that a substantial proportion of the variance in the outcome variable is explained. These results suggest that the predictors included in the model are effective in explaining the variation in the dependent variable, and the model has a strong predictive capability.

Table 5. Main Challenges Hindering Seedling Survival Identified by Binary Logistic Regression

Challenges	**B**	**S.E.**	**Wald**	**Sig.**	**Exp(B)**
Deterioration in the condition of seedlings by mishandling during transporting & storage	.000	.331	.000	1.000	1.000
Improper planting technique (shallow planting, inadequate firming, exposed or bent roots, etc.)	-0.591	0.268	4.865	0.027	0.554
Inappropriate planting time	-1.014	0.440	5.314	0.021	0.363
Occurrence of bad weather after planting (frost, drought, high temperature, rainfall, flood, etc.)	-0.271	0.540	0.252	0.616	0.763
Attack by insect pests & diseases	-0.485	0.498	0.948	0.330	0.616
Weed competition	-1.107	0.398	7.737	0.005	0.331
Animal damage	-1.026	0.333	9.482	0.002	0.359
Absence of replacements	-0.615	0.271	5.162	0.023	0.541
Mismatch between seedlings and plantation sites	1.055	0.851	1.537	0.215	2.871
Lack of quality seedlings	0.794	0.430	3.415	0.065	2.213
Poor preparation of planting pits	-0.438	0.328	1.781	0.182	0.645
Conflict or instability	-0.492	0.236	4.342	0.037	0.611
Constant	**10.432**	**2.319**	**20.244**	**0.000**	**33,924.364**

Notes: Omnibus tests of model coefficients (chi^2 = 165.899 and p = 0.00);-2Log likelihood =89.167; Pseudo R^2 (Cox and Snell R^2 = 0.356; Nagelkerke R^2 = 0.724; Hosmer and Lemeshow Test (chi^2 = 0.98, df = 8, p = 0.998)).

Source: Field Survey data 2024

The binary logistic regression analysis established a number of important factors that determined the survival of seedlings. In the variables that were tested, improper planting technique (p = 0.027), inappropriate planting time (p = 0.021), competition between the weeds (p = 0.005), animal damage (p = 0.002), and conflict or instability (p = 0.037) were identified to have a significant negative impact on seedling survival. These findings reveal that improper planting practice, improper timing of planting, uncontrolled weeds, animal grazing or browsing, and absence of replacement seedlings, as well as instability in the area, are very likely to decrease the chances of seedling survival.

On the contrary, the seedling/plantation site mismatch (p = 0.215) and lack of quality seedlings (p = 0.065) had positive coefficients, which meant that the outcomes of the two factors might be improved to increase the survival rates, but they were not statistically significant at the 5% level.

Moreover, the outcome of key informants and the focus group discussions did not contradict the above results. Participants of both key informants and the focus group discussions confirmed that weed competition (lack of cultivation); animal damage and absence of replacements for dead seedlings; lack of peace and stability; and the occurrences of COVID-19 disease were among the major challenges that negatively affect seedling survival in the study area. Since most plantation sites are degraded communal land and serve as rearing of livestock for the farmholds, animal damage is a serious challenge in the study area, as confirmed by the participants of key informant and focused group discussions. In addition, lack of peace and stability due to the northern Ethiopia war as well as the occurrence of COVID-19 disease significantly hinder survival of seedlings in the study as all stakeholders shift their attention towards these issues.

Again, the participants of both key informants and the focus group discussions also proved that deterioration in the condition of seedlings is caused by mishandling during transporting & storage; occurrence of bad weather after planting, like frost, very high temperature, drought, high rainfall,

and flood, etc.; Attacks by insect pests & diseases and mismatches between seedlings and plantation sites have low effects on seedling survival in the study area, which is similar to the finding of the survey. But, there was disagreement between qualitative and quantitative (survey) results on improper planting techniques, such as shallow planting, inadequate firming of the soil around the roots, and exposed or bent roots, as a challenge in the study area. The participants of both the key informants and the focus group discussions agreed that improper planting technique is not the challenge for seedling survival in the study area, which contradicts the survey result.

Discussion

The results of the study show that the community mobilization for mass tree planting in Wadla Woreda is usually high, particularly during campaigns of Green Legacy, although the long-term survival of the seedlings is average, with an average survival rate of 51.66. The conclusion of the present paper is fully concurring with the literature that was carried out by Berhe et al. (2024) that the mean survival of the tree seedlings was 53% in the dry land of Northern Ethiopia. Nevertheless, this result is in opposition to the national-level survival rates, which were 78.5% and 83.5% in 2019 and 2020, respectively (Abebe and Arega 2023). This is in part due to the high community engagement levels at the time of planting, especially in kebeles like Meley, which have a high survival rate (81.3%). We have, however, observed and interviewed that participation reduces steeply when seedlings are planted. Other tasks like watering, weeding, and guarding are intermittent and short-lived activities that wear out the gains of the initial mobilization. There are also issues with technical aspects of planting: a large number of seedlings are planted too shallow, and the soil is not hardened, and the planting pits are usually not prepared properly. Such bad planting practices have been confirmed by field observation and regression analysis, which have a significant association with low survival. In addition, frequent problems such as animals causing damage and weeds, as reported by community members and experts, are threatening, as there are no replacement seedlings and poor post-planting management. Survival is further compromised by other factors, including the wrong time to plant and the instability of the locality. These ideas are supported by the statistical model, with improper planting, untimely planting, weeds, grazing, absence of replacements, and the conflict playing a critical role against the chances of survival. These were the same findings reported in those studies done by Asmelash and Rannestad (2024); Berhe et al. (2024); Garedew et al. (2025); and Gebirehiwot et al. (2023).

Although such factors as seedling-site discrepancy or seedling quality were not that important, the environmental conditions (e.g., soil type, microclimate) also differ between kebeles and affect the results. Overall, the study highlights the fact that mass campaigns are effective in mobilizing the community to plant but fail to achieve long-term success. The reforestation process in Wadla Woreda will have to be transformed into a sustainable process that is less focused on planting but more on the continuity of the management process, development of skills and advancement of skills, organizing maintenance, and the support of the institution in the best way to ensure that the results will be better survival rates and stable benefits to the environment.

5. Conclusions and Recommendation

The analysis showed that the survival of the seedlings between community mobilization in Wadla Woreda was moderate (51.66%), and the survival of the seedlings varied significantly among kebeles. Meley had the highest survival (81.3 percent), and Quana and Delenga had the lowest survival (31-33 percent); this showed the local environmental conditions, planting practices, and community participation. The major problems that influenced survival were animal damage, competition from the weeds, lack of replacement seedlings, inadequate planting methods, improper pit preparation, and inappropriate time of planting. The analysis of logistic regression proved that improper planting, untimely planting, uncontrolled weeds, animal damage, lack of replacement, and local instability impacted considerably on seedling survival, whereas factors like seedling-site mismatch and seedling quality did not have much influence. The technical capacity and post-planting management practices need to be enhanced to enhance survival of the seedlings in Wadla Woreda. Seedling establishment can be improved by training the community members and development agents in proper planting and pit preparation and continued care. Institutionalization of regular maintenance procedures such as weeding, watering, and shielding against grazing animals or wildlife should be introduced. A dependable nursery system will be put in place so that there is a supply of quality seedlings and replacement of damaged or lost plants can be done in a timely manner. Besides, active participation in the community can be promoted by raising awareness, incentives, and shared responsibilities to develop local ownership and accountability. Environmental and social issues like animal damage, weed competition, and disturbed situations in the area, systematic monitoring, and adaptive management will allow the

maximization of the reforestation activities and guarantee the sustainable seedling survival throughout the district.

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Appendex

A. Data gathering Instruments

a. Questionnaire

I Background of the house hold respondent (personal characteristics)

1. Kebele----------Village name ----------
2. Sex: Male ------- Female---------
3. Age ----------
4. Marital status: Married------- Single----- Divorced----- Widowed
5. Level of education: A. illiterate B. read & write C. primary (1-8) D. Secondary (9-12)
6. Family size: Male Female

To evaluate the survival level of seedlings planted by community mobilization

7. Is there any seedling planting practice by community mobilization in your locality?
   A. yes B. No
8. Most tree seedlings planted by community mobilization are survived A. Yes B. No

Challenges for seedling survival in the study area.

Instruction: The death of seedling could result from one or some of the following causes. Please mark "X" on the following challenges that hinder **seedling survival**, based on the five options given at the right side of each item. **(1= Vey Low; 2= Low; 3= Medium; 4= High; 5= Very High)**

No.	Items	Rates				
		1	2	3	4	5
1	Deterioration in the condition of seedlings by mishandling during transporting & storage.					
2	Improper planting technique such as Shallow planting, inadequate firming of the soil around the roots, exposed or bend roots, etc.					
3	Occurrence of bad weather after planting like frost, very high temperature, drought, high rainfall and flood, etc.					
4	Attack by insect pests & diseases					

5	Weed competition					
6	Animal damage					
7	Absence of replacements					
8	Miss match between seedlings and plantation sites					
9	Lack of quality seedlings					
10	Inappropriate planting time					
11	Lack of peace and stability					

If any others please mention them.

b. key informant interview checklist

1. When the mass tree planting was started?
2. How do you see is the survival rate of trees planted by mass mobilization?
3. If the rate of survive is low what do you think the causes or reasons for this case?
4. What are the activities usually done to increase the survival rate?
5. Is there any challenges that hinder survival of tree seedlings planted by community mobilization ? What are these?

c. FGD checklist

1. How is the participation of the community in mobilized tree planting practices?
2. How do you evaluate the rate of survival of trees after plantation?
3. How is survival rate of mass mobilizing planting trees?
4. What are the activities of the community to raise the survival rate?
5. If the rate of survive is low what do you think the causes or reasons for this case?
6. What are the main factors affecting mass tree planting practice in you kebelle?

APPENDICES- B Tables on Data Analysis

Table 6. Challenges of seedling survival across *kebelles*

Items	Kebele	Frequency/%/	Rates					Mean	SD
			1	2	3	4	5		
Deterioration in the condition of seedlings by mishandling during transporting & storage.	betehor	F	21	20	25	1		2.0896	0.866
		Percent/% /	5.6	5.3	6.6	0			
	delenga	F	32	32	27	10		2.1485	0.984
		Percent/% /	8.5	8.5	7.2	3			
	Kuana	F	30	42	19	10		2.0891	0.939
		Percent/% /	8	11.1	5	3			
	Meley	F	47	38	18	5		1.8241	0.874
		Percent/% /	12.5	10.1	4.8	1			
	Total	F	130	132	89	26		2.0292	0.926
		Percent/% /	34.5	35	23.6	7			
Improper planting technique such as Shallow planting, inadequate firming of the soil around the roots, exposed or bend roots, etc	betehor	F	0	7	27	13	20	3.6866	1.018
		Percent/% /	0	1.9	7.2	3	5.3		
	delenga	F	0	10	40	21	30	3.703	1.005
		Percent/% /	0	2.7	10.6	6	8		
	Kuana	F	0	10	40	20	31	3.7129	1.013
		Percent/% /	0	2.7	10.6	5	8.2		
	Meley	F	26	31	33	11	7	2.463	1.155
		Percent/% /	6.9	8.2	8.8	3	1.9		
	Total	F	26	58	140	65	88	3.3475	1.191
		Percent/% /	6.9	15.4	37.1	17	23.3		
Inappropriate planting time	betehor	F	0	0	28	32	7	3.686	0.656
		Percent/% /	0	0	7.4	9	1.9		
	delenga	F	0	0	40	51	10	3.703	0.641
		Percent/% /	0	0	10.6	14	2.7		
	Kuana	F	0	0	24	57	20	3.96	0.662
		Percent/% /	0	0	6.4	15	5.3		
	Meley	F	26	27	34	20	1	2.4722	1.08
		Percent/% /	6.9	7.2	9	5	0.3		
	Total	F	26	27	126	##	38	3.416	1
		Percent/% /	6.9	7.2	33.4	42	10.1		
	betehor	F	7	47	13	0		2.0896	0.543

Occurrence of bad weather after planting like frost, very high temperature, drought, high rainfall and flood, etc.		Percent/% /	1.9	12.5	3.4	0			
	delenga	F	10	71	20	0		2.099	0.539
		Percent/% /	2.7	18.8	5.3	0			
	Kuana	F	7	57	30	7		2.3663	0.717
		Percent/% /	1.9	15.1	8	2			
	Meley	F	40	59	9	0		1.713	0.612
		Percent/% /	10.6	15.6	2.4	0			
	Total	F	64	234	72	7		2.0584	0.658
		Percent/% /	17	62.1	19.1	2			
Attack by insect pests & diseases	betehor	F	0	54	6	7		2.298	0.651
		Percent/% /	0	14.3	1.6	2			
	delenga	F	0	81	10	10		2.297	0.641
		Percent/% /	0	21.5	2.7	3			
	Kuana	F	4	75	18	4		2.2178	0.5762
		Percent/% /	1.1	19.9	4.8	1			
	Meley	F	5	87	10	6		2.157	0.582
		Percent/% /	1.3	23.1	2.7	2			
	Total	F	9	297	44	27		2.2361	0.6101
		Percent/% /	2.4	78.8	11.7	7			
Weed competition	betehor	F	0	0	14	20	33	4.2836	0.794
		Percent/% /	0	0	3.7	5	8.8		
	delenga	F	5	3	17	25	51	4.128	1.11
		Percent/% /	1.3	0.8	4.5	7	13.5		
	Kuana	F	0	0	7	37	57	4.495	0.626
		Percent/% /	0	0	1.9	10	15.1		
	Meley	F	48	35	15	5	5	1.925	1.091
		Percent/% /	12.7	9.3	4	1	1.3		
	Total	F	53	38	53	87	146	3.6233	1.4352
		Percent/% /	14.1	10.1	14.1	23	38.7		
Animal damage	betehor	F	0	0	7	21	39	4.4776	0.682
		Percent/% /	0	0	1.9	6	10.3		
	delenga	F	0	0	7	31	63	4.5545	0.624
		Percent/% /	0	0	1.9	8	16.7		
	Kuana	F	0	0	11	14	76	4.643	0.672
		Percent/% /	0	0	2.9	4	20.2		
	Meley	F	2	38	34	18	16	3.0741	1.091
		Percent/% /	0.5	10.1	9	5	4.2		

	Total	F	2	38	59	84	194	4.14	1.051
		Percent/% /	0.5	10.1	15.6	22	51.5		
Absence of replacements	betehor	F	0	0	7	27	33	4.3881	0.673
		Percent/% /	0	0	1.9	7	8.8		
	delenga	F	0	0	10	40	51	4.4059	0.666
		Percent/% /	0	0	2.7	11	13.5		
	Kuana	F	0	5	14	30	52	4.2772	0.885
		Percent/% /	0	1.3	3.7	8	13.8		
	Meley	F	15	39	21	16	17	2.8241	1.296
		Percent/% /	4	10.3	5.6	4	4.5		
	Total	F	15	44	52	##	153	3.9151	1.168
		Percent/% /	4	11.7	13.8	30	40.6		
Miss match between seedlings and plantation sites	betehor	F	51	16				1.2388	0.43
		Percent/% /	13.5	4.2					
	delenga	F	87	14				1.1386	0.347
		Percent/% /	23.1	3.7					
	Kuana	F	72	29				1.2871	0.455
		Percent/% /	19.1	7.7					
	Meley	F	95	13				1.1204	0.327
		Percent/% /	25.2	3.4					
	Total	F	305	72				1.191	0.393
		Percent/% /	80.9	19.1					
Lack of quality seedlings	Betehor	F	14	13	27	13		2.5821	1.032
		Percent/% /	3.7	3.4	7.2	3			
	Delenga	F	33	3	36	29		2.604	1.217
		Percent/% /	8.8	0.8	9.5	8			
	Kuana	F	25	20	19	37		2.6733	1.209
		Percent/% /	6.6	5.3	5	10			
	Meley	F	38	26	30	14		2.1852	1.06
		Percent/% /	10.1	6.9	8	4			
	Total	F	110	62	112	93		2.4987	1.153
		Percent/% /	29.2	16.4	29.7	25			
Poor Preparation of planting pits	Betehor	F	3	3	17	18	26	3.9104	1.111
		Percent/% /	0.8	0.8	4.5	5	6.9		
	Delenga	F	2	1	17	30	51	4.2574	0.913
		Percent/% /	0.5	0.3	4.5	8	13.5		
	Kuana	F	3	6	8	35	49	4.198	1.02

		Percent/% /	0.8	1.6	2.1	9	13		
	Meley	F	42	39	18	6	3	1.9722	1.018
		Percent/% /	11.1	10.3	4.8	2	0.8		
	Total	F	50	49	60	89	129	3.5252	1.412
		Percent/% /	13.3	13	15.9	24	34.2		
Lack of peace and stability	Betehor	F	2	9	26	14	16	3.4925	1.092
		Percent/% /	0.5	2.4	6.9	4	4.2		
	Delenga	F	0	10	39	21	31	3.7228	1.011
		Percent/% /	0	2.7	10.3	6	8.2		
	Kuana	F	4	3	43	20	31	3.703	1.063
		Percent/% /	1.1	0.8	11.4	5	8.2		
	Meley	F	22	31	29	9	17	2.7037	1.32
		Percent/% /	5.8	8.2	7.7	2	4.5		
	Total	F	28	53	137	64	95	3.3846	1.213

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