International Journal of Natural Resource Ecology and Management
2024; 9(1): 1-7
http://www.sciencepublishinggroup.com/j/ijnrem
doi: 10.11648/j.ijnrem.20240901.11
ISSN: 2575-3088 (Print); ISSN: 2575-3061 (Online)

Inventory of Seedlings Field Survival and Its Production Costin AdamiTulluand Dugda District of Central Rift Valley of Oromia, Ethiopia

Desta Negeyo

Oromia Agricultural Research Institute, AdamiTullu Agriculture Research Center, Adami Tulu, Batu, Ethiopia

Email address:
negeyo.desta@gmail.com

To cite this article:
Desta Negeyo. (2024). Inventory of Seedlings Field Survival and Its Production Costin AdamiTulluand Dugda District of Central Rift Valley of Oromia, Ethiopia.*International Journal of Natural Resource Ecology and Management*, *9*(1), 1-7.
https://doi.org/10.11648/j.ijnrem.20240901.11

Received: November 24, 2023; **Accepted**: December 14, 2023; **Published**: January 18, 2024

Abstract: Following production of large number of seedling each year; plantation campaign has conducted in large scale. The study was designed to assess the seedling production and its survival in East Shewa zone of Oromia region. From East ShewaAdami Tulu JidoKombolcha and Dugda Districts were selected. Survival count through transect on communal plantation sites wereused to obtain the primary data. Direct observation and the record of government nurseries seedling production and management data were obtained from the districts nursery during survey operation. As a result, even though there is a mass production of seedling and large scale plantation, there is poor nursery management and insignificant number of survival of planted seedlings on the field according to the data from survey result and actual count from selected plantation sites. Among the factors responsible for less seedling survival un accessible water sources and lack of overall management are the common factors at both districts. Therefore, it is important to take the revert action to save the undermined huge investment cost to the success of plantation. Post plantation management and budget allocation for transplanted plants also crucial for plantation success.

Keywords: Communal Sites, Seedling Production, Survival Rate, Private Holdings

1. Introduction

Tree plantation on degraded lands can play a key role in harmonizing long-term forest ecosystem rehabilitation or restoration goals. Forest plantations, using appropriate tree species can play an important role in the tropical ecosystem rehabilitation [3]. In such cases, planting of nursery raised seedlings may accelerate regeneration [15]. Successful seedling establishment and growth depends on the soil condition and the stored soil moisture to ensure survival into the next growing season [14]. Because, seedlings of some trees are sensitive to drought, and may be killed by even short dry spells [2].

Climate change affects a number of variables in plant growth and development. Several of the primary effects were seen in seedling mortality rates. Fluctuations in soil moisture content, light, or temperature influence seedling growth and development as forested ecosystems contribute to global hydrologic cycles. Seedling mortality and survival, especially when planted on public lands, was typically influenced by a number of factors including drought, poor planting practices or herbicide drift from nearby [12]. A lack of precipitation and belowground water resources leads to increased seedling mortality and extensive dieback in many species [13], while others are minimally affected [7].

Ethiopian government has a big dream: restoring 22 million hectares of degraded lands and forests by 2030. By doing so, the country aims not only to increase tree cover and restore degraded forests, but also to significantly enhance the forestry sector's contribution to agricultural production systems, water and energy; to improve food and nutritional security; and to create more opportunities for employment and household income (Ethiopia's new forestry law 2018).

In the dry and more degraded lands of central rift-valley of Ethiopia particularly AdamiTullu and Dugda District, have been planting many seedlings of different tree species year

after year but there is no plantation success on the field and number of seedling raised on the nursery and survived seedling on the field is completely contradictory. Therefore, the study was designed to assess the performance of seedling produced on nursery and field inventory on the plantation site for the last five years.

2. Research Methodology

2.1. Description of the Study Site

This study was conducted in Adami Tulu and Dugda districts in central rift-valley of Ethiopia. Adami Tulu district lies between 7° 9'N lat, 38° 7'E long; elevation 1650 m above sea level. The mean annual rainfall and temperature of the area is 760.9 mm and 19.8°C respectively. The pH of the soil is 7.88. The soil is fine sandy loam in texture with sand, clay and silt in proportion of 34, 48 and 18% respectively. The altitude ranges from 1500-2300 m.a.s.l. Adami Tulu JidoKombolchaWoreda has semi-arid and arid agro-climate zones. The Woreda receives an average annual rainfall of 760 mm. The mean monthly temperature varies from 18.5°C to 21.6°C with mean annual temperature of 20°C. Rainfall extends from February to September with a dry period in May to June, which separates the preceding short rains from the following long rains [1]. Three land use systems: croplands, controlled grazing lands with closed areas and communal open access grazing land exist in the study area [9]. The soil is fine sandy loam in texture with sand, clay and silt in proportion of 34, 48 and 18% respectively.

DugdaWoreda is located in East Shewa Zone of Oromia Regional State. Geographically the Woreda is located between 8^0 01'N to 8^0 10'North latitude and 38^0 31'E to 38^0 57'E longitude. The total area of the Woreda is 959.45 km^2. Altitude ranges from 1600 to 2020 meters above sea level The mean annual temperature was about 22.8°C, while mean annual rainfall was 750 mm (DugdaWoreda Agricultural Office, 2015). The land use of the Woreda consists of cultivated land (65.25%), forest (8.32%), pasture (3.55%), water bodies (12.54%), swampy and rocky mountain areas (0.31%) and 10.03% others and, the dominant types of crops are maize, wheat and teff. These soil types have light texture making them vulnerable to both wind and soil erosions. In addition, these soil types are saline and alkaline contents, though the degree of salinity is very low.

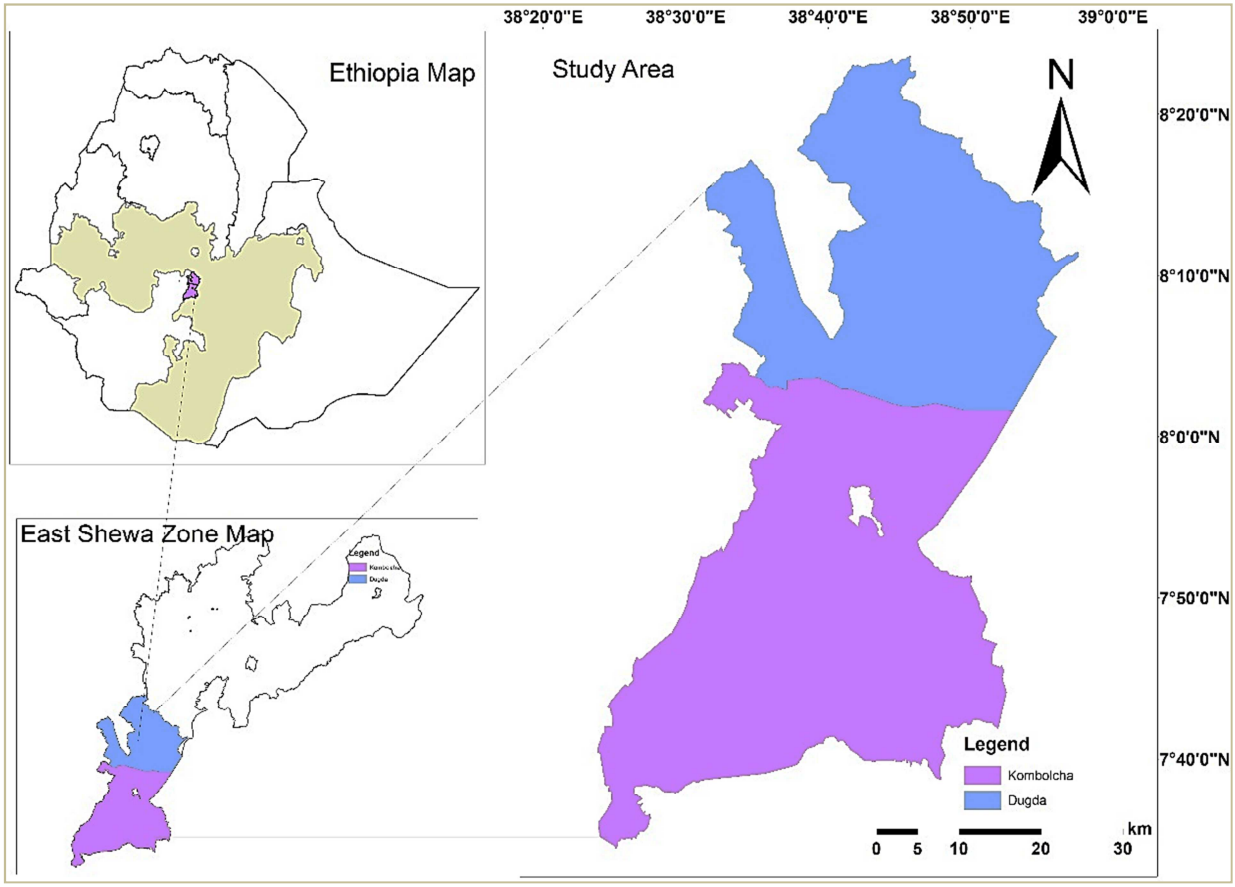

Figure 1. *Map of the study area.*

2.2. Sampling Procedure and Data Collection

Discussion with concerned development workers and local leaders was conducted mainly focused on strengths, weakness, opportunities and threats to forest development and facts about the failure of forest development in the study area. Five years back Data of seedling production and its

plantation success was assessed from District office and field observation at planted areas. From 2012 E. C. assessment was done for green legacy plantation status for the two consecutive years. Number of seedling raised on nursery by their species and number of seedling planted and survived was assessed. Field observation was also carried out at different times of the investigation year to have an idea where and how are seedlings performing on the field.

2.3. Statistical Analyses

Data from field observation was coded and entered in Statistical Package for Social Scientists (SPSS version 20) and converted to status for analysis.

Figure 2.*Seedling plantation during campaign.*

3. Results and Discussion

3.1. Government Nursery Seedling Production and Distribution

In the study area the sizes of the polythene tubes 8 cm, 10 cm and 12 cm were used to raise seedlings on nursery. The size of the polythene 12 cm is used to raise the seedlings of fruit trees while the left two sizes were used to raise the seedlings of other trees. From the nursery observation at AdamiTulluJidokombolcha district the soil which filled in the polythene is not well compacted and disintegrated during transportation to the site. This may be due to the soil type used and mixing ratio. In addition to soil compactness problem there is more than two seedlings per single polyethene tube and long nursery life time for some species. Due to the reason stated above seedling survival potential for long dry season may be affected in addition to other factor identified from field observation.

Despite its poor management and un availability of nursery calendar, there is massive number of seedling production and high cost investment specially post green legacy mobilization at both districts (Figure 1).

According to the data from the nursery management there is an increase of seedling production starting from green legacy initiative at both district (Figures 1 and 2). Every year there is distribution of more than half millions of seedlings for different kebeles and large scale plantation campaign. However it is distributed in mass there is low survival on the field according to the inventory result.

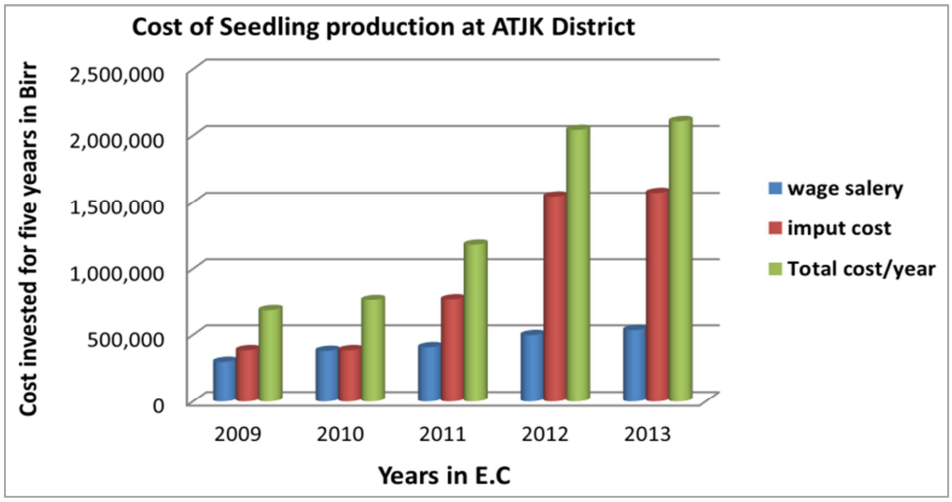

Figure 3. *Cost of seedling production at AdamiTulluJidoKombolcha District (2009 – 2013 E.C).*

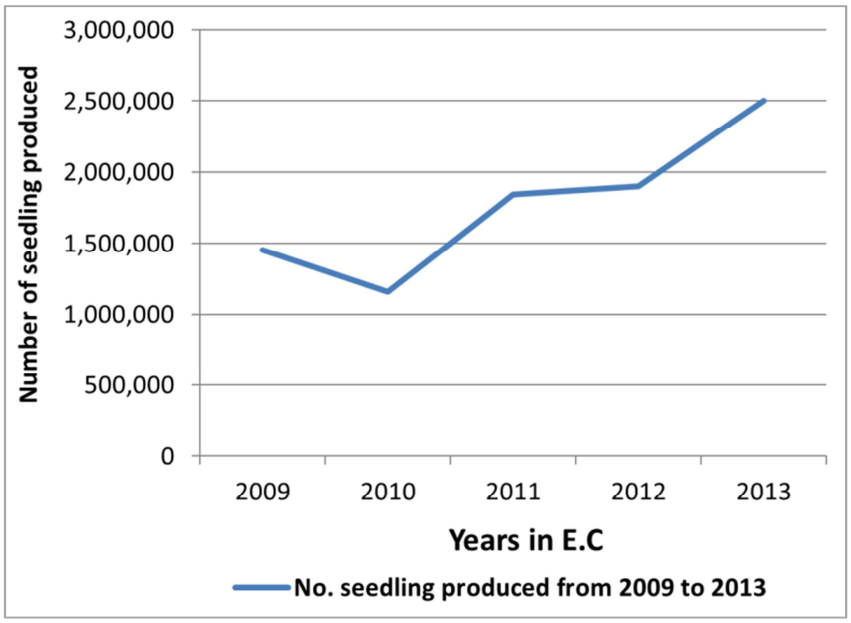

Figure 4. *Seedling produced at Adami Tullu Jido Kombolcha District (2009-2013 E.C).*

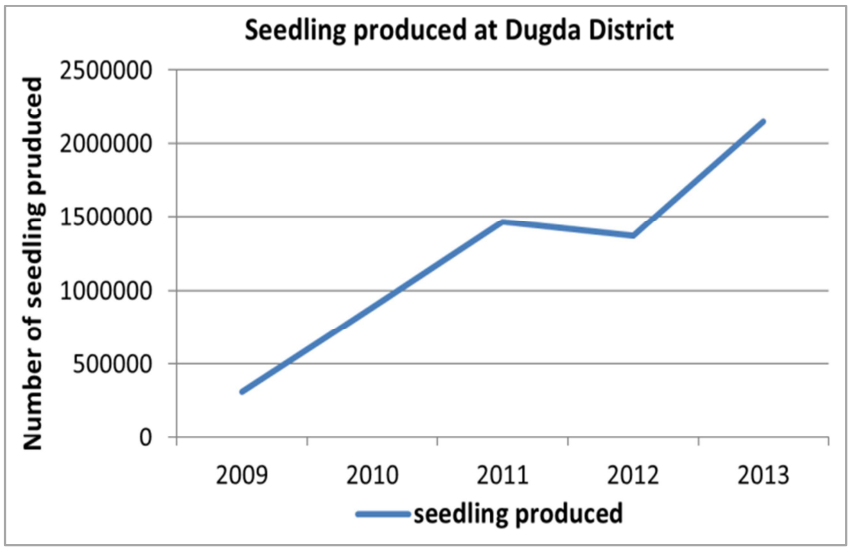

Figure 5. *Seedling produced at Dugda District (2009-2013 E.C).*

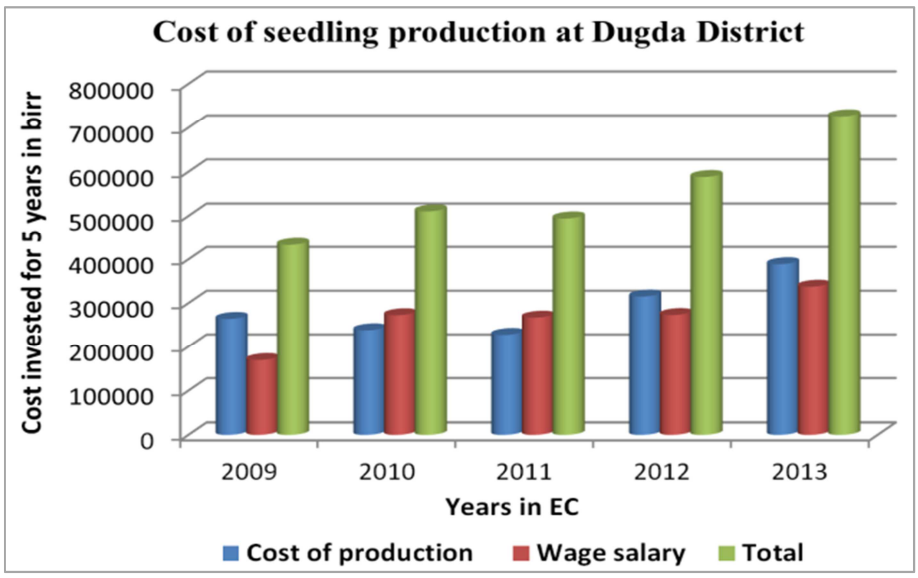

Figure 6. *Cost of seedling production at Dugda District (2009 – 2013 E.C).*

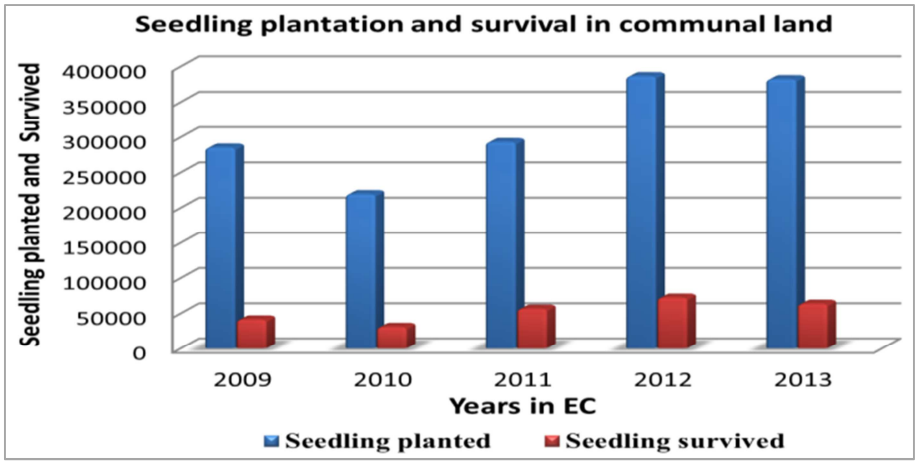

Figure 7. *Seedling plantation and survival in communal land at Dugda 2009-2013 EC.*

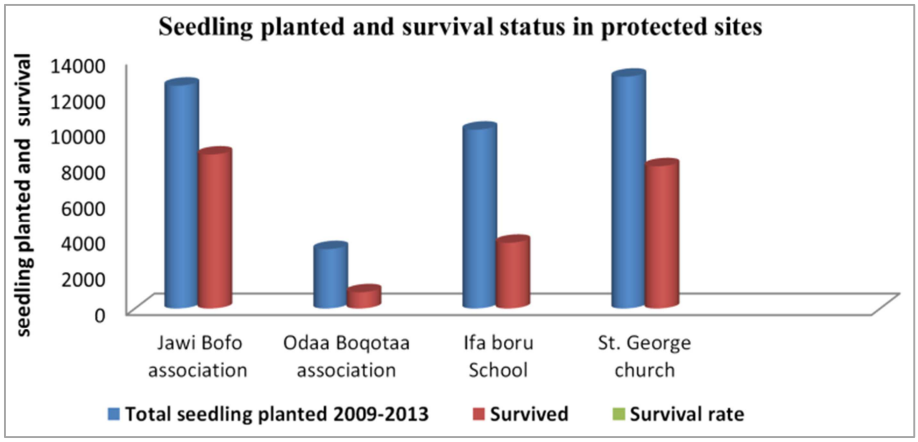

Figure 8. *Seedling planted and survived at protected site Dugda.*

3.2. Tree Seedlings Plantation and Survival

3.2.1. The Size of Planting Pit and Quality of Planting Technique

Planting technique is among factors for low survival of seedlings in the field. Among the observed problem during the campaign plantation, seedling was transported to the site before 1-2 days of campaign which may cause the shock of seedling especially in moisture stress areas like the study area. Again it is also observed that most of the pit preparation was

carried out during the day of planting which is not recommended. In addition the pit sizes were below the standard, i.e. the standard pit for seedling planting is 30*30 cm, for dry land areas even 40*40 cm is recommend. Reversely, the observed major average pit size was 15*10 cm as the sample picture was taken randomly during the field survey. The majority of the pits were prepared without soil and water conservation structures which may support the survival of the seedlings. The importance of the structures is on improving moisture supply to the seedlings and reducing overall moisture loss by controlling competing vegetation [5]. So, such planting pit structure is incapable of holding sufficient water and fertile soil for seedlings in the study area as it was observed during field inventory. Due to this the seedling performance after planting was weak and unable to resist long dry season. [10] also reported that the majority of planting was done without water harvesting structure in north eastern Amhara regional state.

Figure 9. *Field observation for green legacy plantation site.*

3.2.2. Seedling Plantation and Survival at the Communal Sites

The result of actual ground count from each kebeles of the Dugda district also confirmed that more than twenty thousands of seedlings were distributed for each kebeles every year. However large number of seedling was planted every year the survival rate was very low according to the data from the field (Figures 5 and 6). A number of factors could be stated for low survival rate of seedling on the field, but the major factor that affecting the plantation success on the field was watering and animal interference at Dugda district. The same factorslike poor seedling watering and animaldamage were affecting seedling survival at AdamiTulluJidoKombolcha District. Similar results have been reported by [6] that tree seedling death during drought can occur both as a direct result of water stress, or because drought can exacerbate the effects of non-drought factors such as pathogens, herbivores. In addition to the mentioned factor a seedling planting technique, planting seedling without soil and water conservation structure were another factor observed on the field. In line to this finding [4]. also reported that plantation approach has, been challenged because of the poor survival rates of seedling on the field particularly in dry-land areas and improving survival rate through supporting watering is required for their survival performance.

Seedling survival at protected area like schools and religious site was better than that of communal land. This is due to the factor that affecting seedling survival at the field may limited. Almost more than 48% of the seedling survived in average and increased survival rate at protected site was recorded during the inventory. This enhanced survival rate could be attributed to different factors such as good management (absence of animal trampling and browsing) and access to water. Seedling survival was better at protected site like church, school and different association area. At communal land seedling survival was lower compared to the protected area at both districts. The lower survival rate at communal land may be due to lack of management factors such as protection from animals and watering. The study of [11] also identified the problem of low survival rate of seedling due to high interference by local peoples.

4. Conclusion and Recommendations

Tree planting has the vital role in ecosystem productivity and enhance biological and chemical restoration of degraded land. Over all from what have been seen managements of the trees especially at the seedling stages is very crucial. Keeping the quality of the planting procedure followed by post seedling management after planted was the major problems in both areas. The study was identified some crucial factors that affecting seedling growth on nursery and its survival on the field. Among the challenge observed, lack of nursery calendar and inappropriate soil mixing ratio was observed at nursery level. It is common that if the pot not compacted well during soil filling, it is disintegrated during transportation and planting time which affects the root fiber of seedling. in addition seedlingmanaged for a long period oftime or beyond the colander of speciesmay die on nurseryand will be not success on the field. From field

inventory wrong pit size and plantation without soil and water conservation structure was identified. In arid environment it is important to prepare deep pit and supporting the seedling with soil and water conservation structure. Unless we improve the stated factor, unnecessary cost encore and time wasting on nursery may be useless.

However, the contribution of livestock grazing, and water stress impacts are main barriers for plantation success in the study area, the other factors that hindering tree seedling survival were, technique of planting, inappropriate site preparation were also obstacles for tree and shrub plantation development.

Therefore, as dry land areas commonly known by its moisture stress, integrating seedling plantation with soil and water conservation stricture to encourage water retention and soil fertility, and supplementing water in a hard season of the year (prolonged drought periods) is compulsory to enhance seedling survival rate. This means planning management the same as planning for production is a win-win solution on the failed survival and over all to our degrading environment. Also to enhance early growth and survival of planted seedlings; critical evaluation and selection of best nursery soil mixing ratio is important, protecting of planting site from animal interference are ideal toimprove seedling survival, and seedling transportation and planting techniques must be adjusted as suitable for dry land areas.

ORCID

https://orcid.org/0009-0002-6456-6559

Conflicts ofInterest

No conflicts of interest at all.

References

[1] Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J. R., Arico, S., Báldi, A. &Bartuska, A. (2015). The IPBES Conceptual Framework—connecting nature and people. Current Opinion in Environmental Sustainability, 14, pp. 1-16.

[2] Engelbrecht MJ, ComitaIS, Condit R, Kursar TA, Tyree MT, Turner BL and Hubbell SP (2007). Drought sensitivity shapes species distribution patterns in tropical forests. Nature, 447: 80-83.

[3] Founoune H, Duponnois R, Ba AM and El Bouami F (2002). Influence of the dual arbuscularendomycorrhizal/ectomycorrhizal symbiosis on the growth of Acacia holosericea (A. Cunn. Ex G. Don) in glasshouse conditions. Annals of Forest Sciences, 59: 93-98.

[4] GebrekidanAbrhaet. al 2020. Screening of tree seedling survival rate under field condition in TanquaAbergelle and Weri-LekeWereda's, Tigray, Ethiopia Abergelle Agricultural Research Center, Tigray Agricultural Research Institute (TARI), Ethiopia.

[5] Harrington JT, Loveall MW, Kirksey RE. 2004. Establishment and early growth of dryland plantings of Arizona cypress in New Mexico, USA. 2004: 183-192.

[6] Holl KD, Loik ME, Lin HV and Samuels IA (2000). Tropical montane forest restoration in Costa Rica: overcoming barriers to dispersal and establishment. Restoration Ecol. 8: 339-349.

[7] Klopcic M, Boncina A. 2012. Recruitment of tree species in mixed selection and irregular shelterwood forest stands. Ann ForSci, 69(8): 915–925.

[8] Mckay HM. (2006) A review of the effect of stresses between lifting and planting on nursery stock quality and performance.

[9] Mesku, D., Zeleke, A., Yasin, A., &Wole, K. (2008). FRG Project Completed Repass, EIAR, OARI and JAICA Cooperation, Adami Tulu Agricultural Research Center.

[10] MubarekEshetie*et. al. (*2020). Factors Hindering Seedling Survival in Sekota District, North Eastern Amhara, Ethiopia.

[11] Sorecha EM (2017). Growth and survival rate of endemic trees of Ethiopia: Oleaafricana and Hageniaabysinicca in Lake Haramaya Watershed, Eastern Ethiopia. Journal of Horticulture and Forestry 9(5): 33-39.

[12] Stanturf JA, Conner WH, Gardiner ES, Schweitzer CJ, Ezell AW. 2004. Recognizing and overcoming difficult site conditions for afforestation of bottomland hardwoods. EcolRestor, 22(3): 183–193.

[13] Valladares F, Niinemets U. 2008. Shade tolerance, a key plant feature of complex nature and consequences. Ann Rev EcolEvolSyst, 39: 237–257.

[14] Warren JM, Meinzer FC, Brooks JR and Domec JC (2005). Vertical stratification of soil water storage and release dynamics in Pacific Northwest coniferous forests. Agric. For. Meteorol. 130: 39-58.

[15] Yirdaw E and Luukkanen O (2003). Indigenous woody species diversity in Eucalyptus globules Labill. ssp globules plantations in the Ethiopian Highlands. Biodiversity and Conservation, 12: 567-582.

Biography

DestaNegeyo Komicha was born on June 21, 1986 in Bulbula East Shewa Zone, Oromia Regional State. He attended his elementary and Secondary School educations at the Bulbula Primary and Secondary school and Zuway (Batu) Secondary School, respectively. He joined the then Mekele University in July 2007 and graduated with BSc. Degree in Land resource Management and Environmental protection in July 2010. In December 2010, after his graduation, he was employed as Junior Researcher, at Yabello pastoral and Dryland Agricultural research center, in the department of Agroforestry. During this stay, he also served as EIAR Rangeland based water shad management coordinator. He joined the School Graduate Studies, Haramaya University, in October 2014 to pursue his M. Sc. study in Agroforestry. After that he working as senior researcher at AdamiTullu Agricultural research canter and conducting different research projects. Currently I am Agroforestry research team leader and focal parson of Tree aid project at Adami tulu agricultural research center, Oromia agricultural research institute.