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Investigation of survival rate of trees planted in agroforestry and forest plantations in HuyeDistrict from 2007 to 2011 and underlying factors

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Abstract

This study was conducted in Huye District from December 2011 to June 2012, with aiming to investigate the survival rate of trees planted on private and public land from 2007-2011 and underlying factors. Low survival rate of trees planted during annual planting campaigns is often reported in many parts of the country and there is need to understand why and propose adequate solutions to improve survival rate of trees in plantation. The study was conducted in three sectors of Huye District namely Mukura, Tumba and Ngoma sectors. Data were collected through a structured questionnaire that was administered to 51 sample farmers as well as through actual counts conducted both on private and public trees and forest plantations. The collected data were analysed and presented using SPSS and Microsoft Excel softwares. The results of the study revealed that, in the study area, the majority of trees fail to survive after the tree planting season generally due to lack or poor post-planting care. Thirty nine percent of respondents reported to have not provided any post-planting care to their trees. Nevertheless, 35% of respondents reported to have weeded their trees during the studied period. In addition, the results indicate that private trees survive better than public ones. The mean survival rate computed on a sample of agroforestry private trees was 51% while on public trees it was 30%. In woodlots and forest plantations, private trees survived at 65% while the public ones survived at 40%. This study should be carried out in other parts of the country in order to identify underlying factors behind low survival rate of trees after each tree planting season.

Keywords*: Deforestation, reforestation, tree survival rate, tree planting seasoning, physical count of trees.*

1. Introduction

Deforestation has been going on in Rwanda since long time as forests were cleared in favour of agriculture. However, during the last fifty years, deforestation and forest degradation accelerated due to various factors. Between 1960 and 2002, the area of natural forests of Rwanda underwent a decrease of about 65% (Twagiramungu, 2006). The search for arable lands, extensive farming, illegal felling of forests for firewood, production of wood for charcoal and poles for building in urban areas, as well as a land mismanagement have drastically contributed to this reduction of natural forest coverage. Currently the remaining natural forests are all protected and practically almost all forest products needs are met through harvesting planted trees and forests (ROR, 2010).

Nowadays, forest restoration is being addressed at the national and international levels to restore previously depleted forests through forest plantation establishment projects (Maginnis and Jackson, 2003; Evans and Turnball, 2004). In Rwanda, every year, the government with the support of various NGOs and development project donors, spends a huge budget in forest restoration and rehabilitation through production and distribution of tree seedlings throughout the country (Nduwamungu, 2011). However, despite the great efforts invested in mobilizing human and financial resources for tree planting during the annual tree planting week and beyond, low survival rate of newly planted trees and forests has been reported throughout the country (ROR, 2010).Low survival rate of trees planted during community works is common in many parts of the country and there is need to understand why and propose adequate solutions to improve survival rate of trees in reforested areas.

Huye District is one of the districts in which the issue of poor establishment of newly planted trees has been widely observed as indicated by the dominance of old forest plantations throughout the District in comparison with the number of tree seedlings produced and planted each year (HDESA, 2011). Thus, the objective of this study was to investigate possible factors behind low survival rate of trees after each tree planting season in Huye District and propose how to

ensure optimum establishment of man-made forests and agroforestry trees.

2. Materials and Methods

This study was conducted within three sample sectors of Huye District namely,Tumba, Ngoma and Mukura. In each sample sector, seventeen respondents were randomly selected provided that they have planted some trees between 2007 and 2011. A structured questionnaire consisting of both open-ended and closed-ended questions was prepared for data collection and was administered directly to 51 respondents while collecting also data on private trees and forests. During interview, the questions asked focussed on total number of trees planted by the respondent from 2007 to 2011(the species planted, the type and source of planting materials, number that survived) and on information about underlying factors that could influence the rate of survival of newly planted trees such as tree planting method, tree planting season, types and quality of seedlings used while planting, aftercare activities done, seedling transportation method and handling, control and monitoring of the planted trees.In addition, actual physical count of surviving trees was carried out in randomly selected private and public sites in the study area.

The physical count enabled estimation of the actual number of surviving trees out of many planted either on private or public sites. Through this count, each tree (s) reported to have been planted at any site by each respondent was physically checked in order to ascertain that the said trees were really planted and thereby being able to record the reliable survival rate of trees on that site. Physical count also helped identify the real species of the planted trees since some respondents were not aware of tree species that were planted. Per each site, only five transects were randomly selected for physical count, and per each selected transect, both the number of empty holes and the number of surviving trees were recorded. These records helped in calculating the survival rate of trees per that site given that the total number of planted trees was known. Figure1 is a sketch of how physical count was carried out in the field. The Statistical Package for Social Sciences (SPSS) and Microsoft Excel were used to process the data.

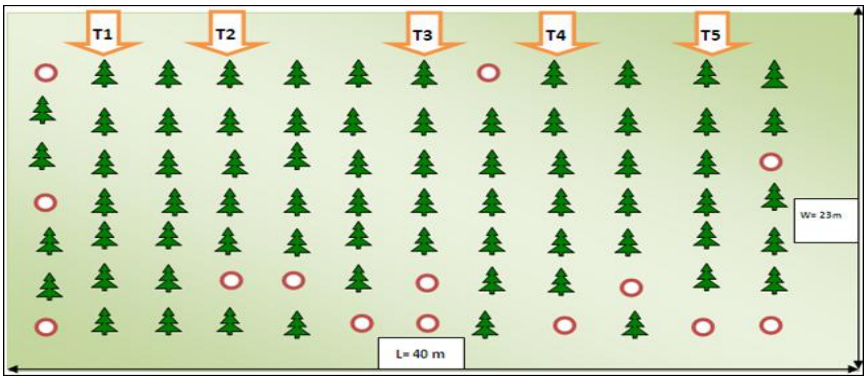

Figure1: Graphical illustration of how physical count was carried out in the field

Where: **L**is length of the site,**W** is width of the site, O isempty hole; is surviving tree and **T1**, **T2**,…. **T5**are Transect numbers.

3. Results and Discussion

Source of tree planting stocks

All respondents reported that they use seedlings as the main tree planting material. About 82% of respondents (Table 1) confirmed that they use tree seedlings sourced from tree nurseries of administrative Cells ("*Pepiniyeriz'utugari*"), suggesting that within Huye District, seedlings distribution to the farmers generally occurs at the cell level.

Table 1: Source of tree planting stock

Source of planting stock	Frequency	(%)
Cell nursery	42	82.4
Sector nursery	4	7.8
Private nursery	3	6.0
Own nursery	1	2.0
Wildings	1	2.0

Tree planting period and techniques

About 82% of respondents reported that they planted their trees in November which is the normal tree planting season. The greatest proportion reported to dig planting pits one week before planting (Table 2).Unless the pits are not deep enough this period is normally

about the right time to plant trees(the best being two weeks before planting) (Nduwamungu, 2011). Nevertheless, it was reported that seedlings are often transported by hands on open environment without taking into account of potential sun heat damage which can increase water loss by seedlings especially root desiccation (Landis and Haase, 2008) and later reduce survival rate of planted trees.

Table 2: Time of digging planting pits (N=51)

Time of digging	Frequency	Percentage (%)
The same day at the planting period	**10**	**19.6**
A day before planting	**4**	**7.8**
Two days before planting	**6**	**11.8**
A week before planting	**17**	**33.3**
Two weeks before planting	**8**	**15.7**
More than two weeks before planting	**6**	**11.8**

Post planting care conducted on newly planted trees

The majority of respondents (39%) reported that they do no post-planting care to their trees. The trees are left on their own. Even though 35% of farmers said that they carried out weeding, this percentage is still at the lower end because weeding activity for tender trees is known to be the most important post-planting care for successful establishment of newly planted trees (Elefritz*et al*., 1998).In fact, about 94% of respondents complained that after planting there is no follow up of private trees and woodlots by forestry professionals in the district. The care is all left to the farmer who is not even instructed on proper tending techniques of young tree plantations. This is a great challenge that should really be addressed if higher survival rate and performance are to be achieved. Table 3summarises responses on the follow up care provided to tender trees just after they are planted out.

Table 3: Post planting care conducted (N=51)

Type of care	Frequency	Percentage (%)
Nothing	**20**	**39.2**
Weeding	**18**	**35.3**
Watering during drought season	**6**	**11.8**
Fencing/sheltering	**2**	**3.9**
Low pruning	**3**	**5.9**
Mulching	**1**	**2.0**
Beating up	**1**	**2.0**

Annual survival rate of trees from 2007 to 2011

The results of this study indicated that there is still a great amount of trees which fail to establish just after they are planted out. This is proved by the relatively low survival rates of many trees planted either on private land or on public land (Figures 2, 3, 4 &5). Nevertheless, comparing the survival rates on private and public lands, it was noted that trees on private lands survive better than those planted on public lands. In fact, basing the actual physical count in sample agroforestry and forest plantation sites randomly selected in the study area, the mean survival rate during the last five years (2007-2011) in agroforestry on private lands was 51% while on public lands it was 30%. In woodlots and forest plantations, trees on private lands survived at 65% while those on public lands survived at 40% (Figures 4 &5).

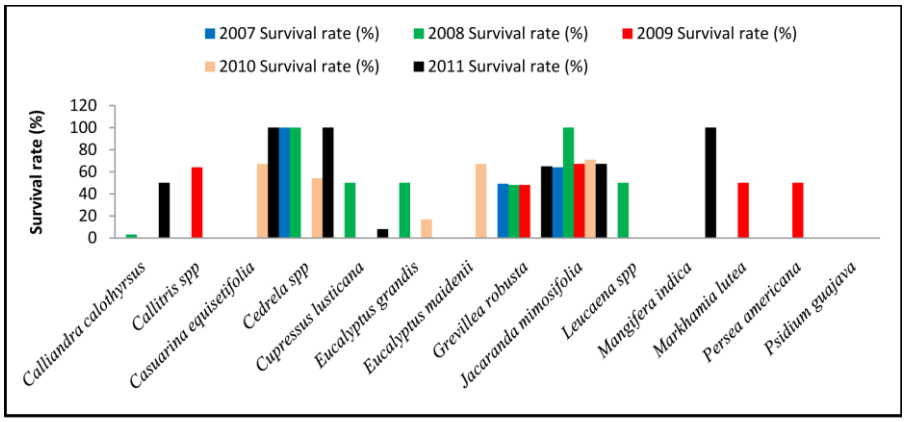

Figure 2: Survival rates of trees planted on private farmlands (agroforestry) represented by tree species

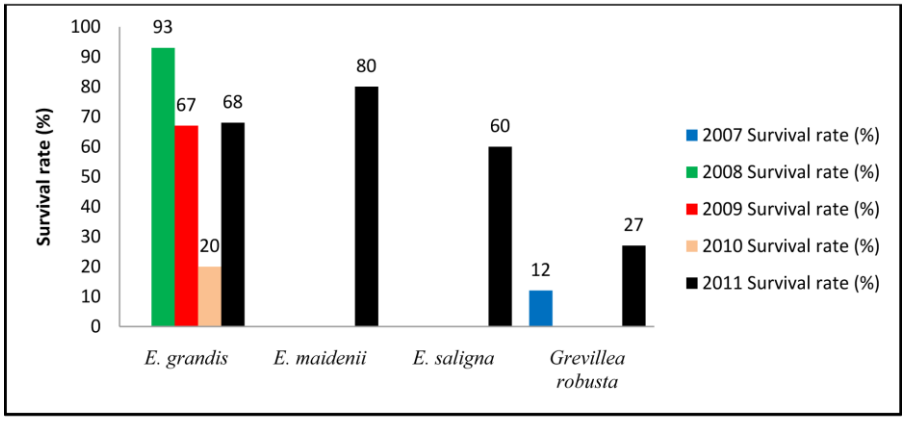

Figure 3: Survival rates in private woodlots and forest plantations

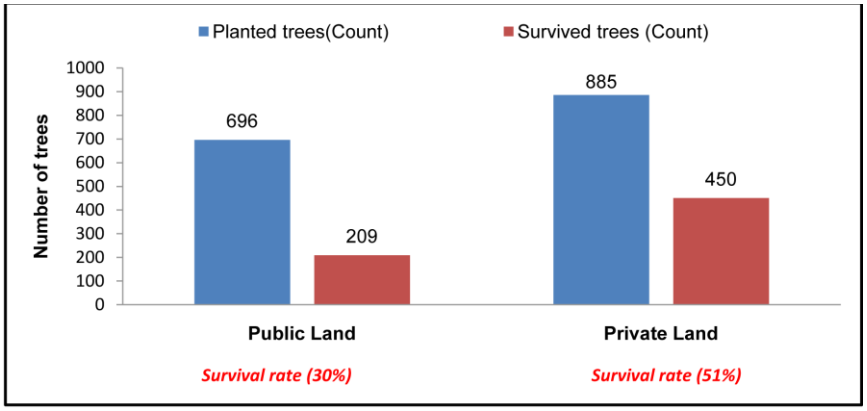

Figure1: Total count of trees in 50 sample farms and 8 public sites (along roads) bearing agroforestry trees planted from 2007 to 2011

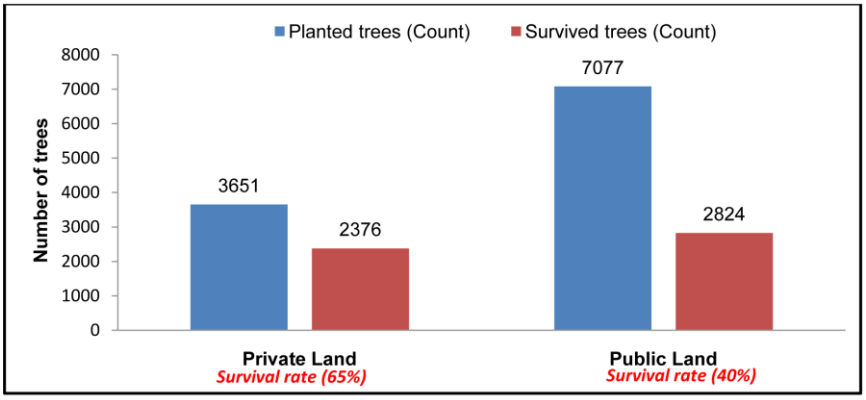

Figure 2: Total count of trees in 20 sample woodlots and forest plantations (10 on private land 10 on public land) established from 2007 to 2011.

The difference in survival rates on private and public lands may probably be attributed to inappropriate handling methods of seedlings while planting. Foster and Blaine (1978) remarked that one tree planting contractor lost 38% of sidewalks trees in Boston City in the first year due to careless handling of plant material. Poor survival may have resulted also from insufficient control and monitoring as well as insufficient post planting care provided to the public trees on different planting sites. This is because most public trees and forest plantations are generally established during community works known as "*Umugandarusange"*. Even when some post-planting care activities are undertaken on public lands, they are not properly done because

they are done during those community works by unskilled people often without any guidance from forestry professionals (Hategekimana, Forest extension officer, Pers. Communication).

4. Conclusion

This study has shown that a great number of trees fail to develop properly after each tree planting season which results in poor establishment of new forests in Huye District. Poor tree survival rate is generally attributed topoor post-planting care whereby 39% of respondents reported that they do not provide any post-planting care to their trees. Trees are generally planted and left to grow on their own. Nevertheless, some respondents (35%) reported to have carried out some kind of weeding in their woodlots or for agroforestry trees. This percentage is yet still inadequate since weeding is considered as one of the most important post-planting carethat can lead healthy woodlots and forestplantations with increased tree vigour and survival rate. Meanwhile, it was revealed that trees on private land survived better than those planted on public lands. Indeed, the mean survival rate of 51% in agroforestry on private land between 2007 and 2011was low but higher than the mean survival rate of 30% found in agroforestry on public land. In woodlots and forest plantations, private trees survived at 65% while on public land trees survived at 40% on average from 2007 to 2011.

Basing on above findings, it should be recommended that tree planting and tending activities during community works (*Umugandarusange*) should be supervised by skilled workers, instead of leaving people on their own without proper instructions on proper tree planting and tending techniques. Local authorities should also organize regular and supervised community works on each site where public trees have been planted in order to ensure proper post-planting care which will likely improve survival rate of planted trees. Furthermore, the forest extension services should be strengthened in order to ensure adequate farmer education and follow up of planted trees and forests.This study should also be carried out in other parts of the country in order to find out whether or not the underlying factors behind low survival rate after each tree planting season in Huye District are similar to those in other Districts.

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