



Forest plantations' investments in social services and local infrastructure: an analysis of private, FSC certified and state-owned, non-certified plantations in rural Tanzania

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1. Introduction

Forest plantations are increasingly promoted as a means to satisfy the rising demand for forest products in the world. The global decline of timber supply from natural forests has been accompanied by an increase in the supply of timber from planted forests in the past three decades and this trajectory is expected to continue in the coming years (FAO, 2015; Indufor, 2012a,b; Payn et al., 2015; Pirard et al., 2017). While the global forest area decreased from 4.28 billion hectares in 1990 to 3.99 billion hectares in 2015, the area of planted forests increased from 167.5 to 277.9 million hectares in the same period (FAO, 2015; Payn et al., 2015). Rising wood demand, availability of land and suitable climatic conditions in the tropics have encouraged investment in forest plantations in this region (Indufor, 2012a,b). The area of planted forests in Africa increased by about 37% between 1990 and 2015: from 11.7 million hectares in 1990 to 16 million hectares in 2015 (FAO, 2015). Tanzania is one of the countries in Africa which have witnessed rapid expansion of forest plantations and the country's area of planted forests almost doubled in the past three decades: from 150,000 hectares in 1990 to 290,000 hectares in 2015 (FAO, 2015). Private investments in sustainable forest plantations are growing especially in developing countries because public institutions often lack the financial incentives and capacity to ensure sustainable forest management (FAO, 2015; World Bank, 2008). Tanzania has a long history of promoting private forestry to contribute to development and poverty alleviation (URT, 1998). Accordingly, private forest plantations have been expanding rapidly in the country and are expected to overtake state-owned plantations as the major source of wood supply in the coming years (AFF, 2011; Indufor, 2011). Tanzania is also among the countries with the fastest growing area of FSC certified forests in Africa (FSC, 2015).¹

Views regarding large-scale private forest plantations and the outcomes of their activities for local communities are mixed. On the one hand, non-governmental organizations, researchers and local communities have voiced concerns about adverse outcomes of such plantations. Recurring concerns are related to conflicts about land ownership, displacement of local households and restrictions on their access to and control over land and other natural resources (Bleyer et al., 2016; Byakagaba and Muhirwe, 2017; Charnley, 2005; Gerber, 2011; Gerber and Veuthey, 2010; German et al., 2014; Locher and Müller-Böker, 2014; Schoneveld et al., 2011). For example, Gerber (2011) found that displacement of local people was associated with the expansion of industrial forest plantations in the global south. In a review of perceptions towards socio-economic outcomes related to plantation forestry, Schirmer (2006) found that such plantations are associated with a loss of social services (schools, financial institutions) in rural areas as a result of population decline due to voluntary or forced displacements of rural dwellers. On the other hand, studies and anecdotal evidence indicate that local households perceive forest plantations positively in terms of their socio-economic outcomes (Bleyer et al., 2016; FAST, 2014; Landry and Chirwa, 2011; Pirard et al., 2017). Positive perceptions are commonly related to employment opportunities, higher wages, better living conditions and infrastructure investments by plantations. For example, private forest plantations were associated by local households with improved wealth and perceived well-being of local households and with improved employment opportunities and infrastructure in Mozambique (Bleyer et al., 2016; Landry and Chirwa, 2011). Perceptions of communities towards changes associated with plantations may differ from actual changes linked with plantation activities. Even in situations where plantations have undertaken investments in social services, community perceptions may not reflect these as positive changes. This may arise if the social services are not of use to local communities but rather just promote the activities of the plantations and if

¹ Forest Stewardship Council (FSC) is an independent global not-for-profit organization that sets standards for responsible forest management to promote socially, economically and environmentally beneficial outcomes (FSC, 2015).

44 communities value the social investments by the plantations less than the value they place on the village
45 land used by the plantations. Moreover, even though actual investments have been made by plantations,
46 these may not necessarily translate into uniform positive (perceived) changes to all community
47 members. Differences between actual and perceived changes may partly be indicative of differential
48 effects of plantations' activities on various groups.

49 In this study, we examine the perceptions of local households in rural villages in Tanzania about
50 investments by private, FSC certified forest plantations in social services (school enrolment and quality
51 of education) and local infrastructure (health centers, roads and bridges), and compare them with
52 perceptions towards a state-owned, non-certified plantation. It is important to consider the perceptions
53 of local people in investigating the outcomes of investments in land use changes, especially in long-term
54 and risky investments such as forestry operations (Edelman et al., 2013; Pirard et al., 2017; Smalley and
55 Corbera, 2012). In developing countries, forest plantations are often established on village lands which
56 used to be under customary land use arrangements. Whether land use changes to plantations are accepted
57 by adjacent communities partly depends on the legal nature of the land acquisition, consultation of
58 communities in the acquisition process and on the land use type before the plantations (Purdon, 2013).
59 An analysis of perceptions of communities towards forest plantations provides insights into the
60 expectations of communities about rural land use changes to plantations and the acceptability of different
61 types of plantations. Such an analysis can inform the formulation of a land use policy as social
62 acceptability is an important element in designing such a policy. Social acceptance of plantations
63 depends on acceptance by local communities and can influence the sustainability of plantations
64 (Williams, 2014). Using household data from villages nearby private, FSC certified and state-owned,
65 non-certified plantations, we apply ordered logistic regression analysis to quantitatively examine the
66 relation between the plantations and households' perceived changes in social services and infrastructure.
67 Further, we examine whether the perceptions of households vary over socio-economic characteristics.
68 Evidence shows that perceptions of households towards forest plantations vary among different socio-
69 economic groups. For example, richer households and households who work for plantations perceived
70 the outcomes of plantations' activities positively in Mozambique (Bleyer et al., 2016; Landry and
71 Chirwa, 2011). Unlike previous studies, we compare private, FSC certified plantations with state-owned,
72 non-certified plantations to assess whether ownership and certification status drive differences in
73 perceived changes associated with plantations. We use a mixed method approach whereby we
74 complement the results from the quantitative analyses with a qualitative analysis of community
75 perceptions based on focus group discussions and with results from visual inspection of the size,
76 operation and quality of social services and infrastructure in the study villages.

77 Despite the continued expansion of private forest plantations in developing countries, there are few
78 quantitative studies on the perceptions of rural communities towards the outcomes of the investments of
79 these plantations (Pirard et al., 2017). Moreover, these studies have focused on the perceptions of
80 communities on the (expected) roles of plantations in employment generation, changes in incomes or
81 wealth and access to forest products for households in adjacent villages (Bleyer et al., 2016; Landry and
82 Chirwa, 2011). However, community development implies more than an increase in household income
83 or wealth: investments in social services and infrastructure sustain long-term development and poverty
84 alleviation (Arrow et al., 2012; Casaburi et al., 2013; Duffy-Deno and Eberts, 1991). Still, national and
85 local governments in developing countries often lack the financial resources to improve infrastructure
86 provision, especially in remote rural areas. In such situations, the role of private sector investments can
87 be vital (Collier and Cust, 2015).

88 Our study contributes to two academic areas. First, it extends the literature on the perceptions of local
89 communities towards forest plantations by providing quantitative evidence on perceptions of villagers
90 towards changes associated with plantations' investments in social services and local infrastructure. We
91 take a comparative approach involving households in villages adjacent to FSC certified plantations of a

92 private forest company and households in villages neighboring a state-owned, non-certified plantation.
93 We account for differences between villages to relate the investments of the plantations to perceived
94 changes in social services and local infrastructure. Most studies on the interplay between forest
95 plantations and local communities are based on qualitative data and do not triangulate the results from
96 the qualitative surveys with results from quantitative survey data (Locher and Müller-Böker, 2014;
97 Obidzinski et al., 2012; Pirard et al., 2017). Quantitative studies on the perceptions of households
98 towards private forest plantations thus far have not used a comparative approach to assess differences
99 in household perceptions among plantations under different ownership and certification status.
100 Ownership and certification status can potentially affect how plantations conduct their activities and
101 thereby driving differences in (perceived) changes associated with plantations. These are due to the
102 profit maximization motive of private owners and the standards and criteria of certifying bodies which
103 demand contributions to local communities and thus making private, certified plantations more likely to
104 be associated with positive changes in local development (Bass et al., 2001; FSC, 2012). Landry and
105 Chirwa (2011) used quantitative data to assess the potential socio-economic outcomes of plantations in
106 Mozambique and dealt with anticipated outcomes reported by local households (ex-ante analysis), not
107 perceptions related to actual outcomes realized after operations started. Bleyer et al. (2016) used
108 quantitative ex-post data to analyze the socio-economic outcomes of private investments in land use
109 changes using a village without plantations for comparison. In our study, we include villages nearby a
110 state-owned, non-certified plantation for comparison.

111 Second, our study contributes to the literature on the private provision of public goods by highlighting
112 the role of corporate social responsibility and sustainable business interest as drivers of pro-social
113 investments in social services and local infrastructure by private forest plantations. Following Besley
114 and Ghatak (2007) and Starr (2008) we hypothesize that the private, FSC certified plantations are
115 expected to have stronger incentives to invest in public goods in the form of social services and local
116 infrastructure, as compared to the state-owned, non-certified plantation. Since investors and
117 shareholders may demand corporate social responsibility (CSR) to secure long-term returns from their
118 investments, private, certified plantations may invest in public goods to attract investors and
119 shareholders (Starr, 2008). In addition, multilateral development agencies and creditors may condition
120 availing finances to plantations on their contributions to surrounding communities, which may influence
121 how plantations engage with local communities. Though governments could perhaps demand CSR from
122 their plantations, this is less likely than for profit-seeking private investors. Private firms are more
123 efficient than public firms in investing in social services (Besley and Ghatak, 2007). In addition, weak
124 monitoring in public sector of developing countries imply lower scope for social investments by state-
125 owned plantations (Besley and Ghatak, 2007). This is also partly reflected in the lack of incentives to
126 get certified by state-owned plantations in developing countries. Certification is often regarded as an
127 indicator of socially responsible investment and is expected to lead to better market access and price
128 premiums and enhance brand credibility and corporate reputation among customers, socially and
129 environmentally oriented NGOs and potential investors and donors (Auld et al., 2008). In addition,
130 private owners of plantations need to guarantee their access to land as compared to state-owned
131 plantations and one mechanism of doing this can be investing in local development (Ribot and Peluso,
132 2003). The results of the study are pertinent to current concerns about the integration of modern large-
133 scale private forest plantations with adjacent communities and their contributions to public goods (social
134 services and infrastructure) in rural areas of developing countries.

135 The remainder of the paper proceeds as follows. The next section introduces the analytical framework.
136 Section 3 describes the study context and data. Section 4 presents the methods. The results and
137 robustness checks are described in Section 5. The last section concludes.

138 **2. Analytical framework**

139 To assess the perceptions of households towards investments by private, FSC certified and state-owned,
140 non-certified forest plantations in social services and local infrastructure, we conceptualized how the
141 incentives of the private, FSC certified plantations to make such investments may be stronger. There
142 can be multiple reasons for a profit-seeking private, FSC certified plantation company to have stronger
143 incentives to invest in social services and local infrastructure as compared to a state-owned, non-certified
144 plantation. First, studies show that corporate social responsibility (CSR) leads to the provision of public
145 goods by for-profit private firms operating in a competitive environment. Besley and Ghatak (2007)
146 show that more responsible firms with social investments enjoy higher returns as a reward for good
147 behavior. Hence, CSR can be part of profit-maximizing strategy by businesses with external effects.
148 Besley and Ghatak (2007) also show that CSR by profit seeking firms can be more efficient in providing
149 public goods compared to state-owned or non-for profit entities. This is mainly due to government
150 failure and weak monitoring in the public sector. Starr (2008) extends the notion of reciprocal fairness
151 to the case of businesses. Reciprocal fairness implies that people treat kindly those people who have
152 treated them well, but treat negatively those who have treated them poorly. Drawing from insights
153 gained from experimental studies on social preferences and pro-social behavior of individuals, she posits
154 that people react positively to companies that are considered to be fair in dealing with their stakeholders.
155 Investors screen companies into socially responsible portfolios based on their relations with customers,
156 workers and communities. To attract shareholders and investors, private companies may invest in a
157 socially responsible way, even at the cost of forgoing some profits. Hence, public goods can be
158 voluntarily supplied by private economic agents (Bergstrom et al., 1986; Cornes and Sandler, 1996).
159 Second, companies may invest in local development to retain FSC certification or to become certified.
160 One of FSC's sustainable forest management principles (Principle 4: community relations) requires
161 forest owners to maintain or enhance workers' and local communities' long-term social and economic
162 well-being (FSC, 2012).² The standards and monitoring by certifying bodies, and the expected market
163 gains of certification, can add to the incentives of private companies to invest in social services and local
164 infrastructure (Bass et al., 2001; FAO, 2018; Tumlinson and Morgan, 2013; Zivin and Small, 2005).
165 Consumers are expected to be willing to pay more for the products of certified plantations as certification
166 is regarded as an indicator of the positive contribution of plantations to the development of neighboring
167 communities (Romero et al., 2013; Romero et al., 2017). Third, there is a direct benefit to the company
168 where roads and bridges are used to transport inputs and outputs, and schools and health centers may
169 contribute to better educated and healthier workers. Though this own benefit incentive may apply to
170 both private and state-owned forest plantations, it is likely to be stronger in case of private plantations
171 than state-owned plantations due to stronger profit seeking orientations of the former. We use these
172 insights from the literature to guide our expectations as to why households nearby the FSC certified
173 plantations of a private company may perceive its investments more positively as compared to
174 households near a state-owned, non-certified plantation.

175 The private forest company, to be introduced in Section 3, invests in tree planting and wood processing
176 activities (e.g. sawmill). These activities generate direct and indirect outputs. Examples of direct outputs
177 are sawn timber, poles, and pallets as well as non-wood products such as carbon credits. Indirect outputs
178 include social services and infrastructure that the company (co-)finances in villages adjacent to its
179 plantations. The private forestry company may decide (for reasons discussed earlier in this section) to

² Indicators 4.3 and 4.4 under this principle state respectively that plantations “ ... shall provide reasonable opportunities for employment, training and other services to local communities” and “...contribute to the social and economic development of local communities.” (FSC, 2012)

180 invest in the construction and improvement of school and health center facilities, roads and bridges in
181 neighboring villages. These investments can lead to improved access to social services (e.g. quality
182 education and increased school enrolment) and infrastructure (e.g. roads and bridges) in the villages.
183 We measure such outcomes using subjective indicators based on the perceptions of local households
184 regarding the changes in social services and local infrastructure associated with the investments of the
185 plantations. The specific indicators used in this study are households' perceptions about the extent to
186 which investments by the plantations changed the number and quality of health centers, quality of
187 education, the number of children in schools and the length and quality of roads and bridges in their
188 villages. In addition, we visually assessed the functionality, quality and use of the services and
189 infrastructure by villagers.

190 Improved availability of social services and infrastructure is expected to enhance the relation of the
191 company with stakeholders such as local communities, customers, workers and NGOs and help its
192 plantations retain their FSC certification. Improved relations with stakeholders are expected to lead to
193 better business outcomes for the company such as increased profit, market share and market access.
194 Investments in roads and bridges may facilitate the activities of the company thereby raising profits.
195 Roads and bridges contribute to increased market integration and access to information for local
196 households and may lead to positive local livelihoods outcomes in the form of social services and
197 infrastructure. According to the Sustainable Livelihoods Approach (SLA), livelihood assets consist of
198 natural, financial, physical, social and human capital (Ellis, 2000). The activities of the private forest
199 company may contribute to improved human capital in the form of increased school enrolment and
200 education quality as well as physical capital (health centers, roads and bridges). Based on our analytical
201 framework, we hypothesize that households in villages adjacent to the private, FSC certified forest
202 plantations are more likely to associate the plantations with improved social services and infrastructure
203 as compared to households nearby the state-owned, non-certified plantation.

204

205 **3. Study setting and data**

206 **3.1 The setting**

207 The study was carried out in four villages in Mufindi district, in the Iringa region of Tanzania: Idete,
208 Kihanga, Mapanda and Nzivi (Figure 1).³ Mufindi district covers an area of 7,515 km² and in 2012 had
209 a population of 265,829 with a density of 35.4 persons/km² (NBS, 2013). Iringa is one of the regions in
210 Tanzania with the largest growing area of forest plantations (PFP, 2017). The study villages were
211 selected according to the following criteria. First, they had to be located near forest plantations within
212 the same administrative region. Second, community development projects had to have been undertaken
213 in the villages by the respective plantations and that at least some villagers had to work for the respective
214 plantations. This criterion ensures that we are comparing plantations at relatively similar stages of
215 development and engagement with adjacent communities. Third, there had to be sufficient distance
216 between the villages nearby the private, FSC certified and state-owned, non-certified plantations as we
217 want to minimize the likelihood that the investments by the private, FSC certified plantations affect the
218 villages nearby the state-owned, non-certified plantation and vice-versa. Finally, the villages had to be
219 of comparable size in terms of number of households living in the villages. We used information from
220 district offices, company documents and plantation managers to identify villages that fulfil these criteria.

³ The village is the lowest administrative unit in Tanzania. In this paper, the terms village and community are used interchangeably.

221 Idete and Mapanda are adjacent to FSC certified plantations owned by a private company. The plantation
 222 in Mapanda also has Verified Carbon Standard (VCS) certification. Kihanga and Nzivi are adjacent to
 223 a state-owned, non-certified plantation. Table 1 provides information on the characteristics of the
 224 villages. All villages were established in the 1970's and can be regarded large size villages in terms of
 225 the number of households. While Kihanga and Nzivi are relatively located closer to the major district
 226 town of Mafinga and are more easily accessible by road transport, Idete and Mapanda are located further
 227 away from the town. We take into account such differences between the villages in our analyses as
 228 discussed in Section 4.2.

229

230

<< Insert Figure 1 about here >>

231

232

Table 1. Characteristics of study villages

Village	Year established	Number of households	Distance to the nearest town market (in minutes by public transport)	Connected to at least one road useable by cars in all seasons?	Owner of nearby Plantation	FSC Certification
Idete	1974	864	42	Yes	Private	Yes
Mapanda	1974	1080	105	Yes	Private	Yes
Kihanga	1974	850	50	Yes	State	No
Nzivi	1974	821	40	Yes	State	No

233

Source: Focus group discussions and company documents

234

The private plantations are owned by Green Resources AS and are FSC-certified. Green Resources is the largest forest plantation company in East Africa and was established in the 1990s. By 2016, Green Resources had developed about 17,000 ha of standing forest plantations on 74,000 ha of land in Tanzania, the majority of which used to be grassland with scattered shrubs and isolated trees.⁴ The company acquired the land on a 99 years lease from the Government of Tanzania, by negotiating with the relevant authorities in accordance with the 2006 Land Law (Green Resources AS, 2009; Purdon 2013). Under this law, land is granted by the village under the supervision and mandate of the district authorities and authenticated by the Ministry of Lands and Human Settlement Development through the regional office in Mbeya. The company's strategy is based on the sustainable development of the areas in which it operates. Its mission is to be Africa's leading afforestation company working for the benefit of shareholders, employees and adjacent communities by establishing, maintaining and harvesting high

244

⁴ The discrepancy between the size of land holding and standing forest plantation arises because plantation development occurs in phases. It takes time to get the finances and other inputs to start planting after obtaining the land. Besides, standing forests may decrease due to harvesting for commercial purposes and natural loss of trees.

245 quality forest plantations for offsetting carbon and producing timber, electricity poles, pallets, briquettes
246 (Green Resources AS, 2017).

247 For comparison purposes, we identified a state-owned, non-certified plantation of comparable size with
248 eucalyptus and pine trees, Sao-Hill forest plantation, which is also located in Mufindi district. Sao Hill
249 is the largest state-owned plantation which currently provides the bulk of wood supply in the country.
250 Even though it was established much earlier than Green Resources, major planting expansions occurred
251 in the 1990s with funding by the World Bank (World Bank, 1983). By 2016, it had a total standing
252 plantation area of 41,600 ha on 65,000 ha of land. By 2013, Sao Hill forest plantation Division I, which
253 is the plantation block adjacent to our study villages, had a total planted area of 12,829 ha (URT, 2013b).

254

255 **3.2 Data**

256 In October 2014, we made a short visit to the study area and interviewed stakeholders including
257 villagers, village leaders, plantation workers and managers, teachers, health workers, tree grower
258 association members, district officers and customers of plantations (Ingram et al., 2016). We used the
259 results of the interviews to inform the design of the survey. Data were collected in 2016 through a survey
260 amongst 338 randomly selected households (171 in villages adjacent to the private, FSC certified
261 plantations and 167 in villages adjacent to the state-owned, non-certified plantation). Using structured
262 questionnaires, we collected data on the socio-demographic and economic characteristics of households
263 and their perceptions about the changes associated with the investments of the plantations in their
264 villages. We asked respondents about perceived changes in social services and local infrastructure that
265 are related to the operations and investments of the plantations. Two enumerators administered the
266 survey per respondent to avoid enumerator bias and errors from fatigue. A focus group discussion (FGD)
267 was held in each village to discuss the perceptions of the community about the socio-economic changes
268 related to the investments and activities of plantations. Village leaders and key informants were asked
269 to suggest representative groups of people in the villages (in terms of profession, gender, age and
270 wealth). The research team then randomly selected every third person from the list of potential
271 participants provided by the village leaders and key informants to participate in the FGD. The focus
272 groups had 10-20 participants to allow for a thorough discussion and active participation and took on
273 average 1.5 hours. The household surveys and FGD were conducted by enumerators fluent in the local
274 languages and English.

275 Additionally, we used government reports (URT, 2013a; URT, 2015) and visual inspections to assess
276 the existence, operation and quality of social services and infrastructure (co-)financed by the plantations
277 in the villages and to triangulate with the survey data findings. We used a 5-point Likert scale (1 =
278 Unusable, 2 = Poor, 3 = Satisfactory, 4 = Good, 5 = Very good) to rate the quality and operation of each
279 unit of infrastructure according to predefined criteria. The criteria include the condition, age and quality
280 of each unit of social service and infrastructure and whether it is in need of (urgent) maintenance. For
281 example, we assessed whether facilities like class rooms, teachers offices, toilets, desk chairs in schools
282 are in good condition and functional or need urgent maintenance. We assessed whether roads and bridges
283 can be used for motorized transport during all seasons of the year.

284

285 **4. Methods**

286 **4.1 Comparative approach**

287 A comparative investigation of perceptions of villagers towards investments of private and state-owned
288 plantations with different ownership and certification status in villages within similar settings allows us

289 to assess and interpret differences in perceptions related to changes associated with these investments
 290 (Ragin, 2014). Our comparative approach uses villages adjacent to private, FSC certified forest
 291 plantations and villages adjacent to a state-owned, non-certified plantation, all of which are located in

292

293

Table 2. Mean comparisons of household characteristics

Characteristics	Description	Villages near by private, FSC certified plantations	Villages near by state-owned, non-certified plantation	p-value ^a
Age of head	Age in years	44.50 (15.59)	44.91 (13.15)	0.79
Sex of head	Dummy, 1 = male	0.82 (0.38)	0.76 (0.42)	0.15
Education of head	Education level, 0 = no schooling, 1 = kindergarten, 2 = primary, 3 = secondary, 4 = college and above	1.82 (0.90)	1.84 (0.87)	0.84
Household size	Number of members within the household	4.49 (1.96)	5.23 (2.06)	0.00***
Total farm size	Land size in hectares	1.98 (2.33)	1.43 (1.58)	0.01**
Employed by plantation	Dummy, whether at least a household member is employed by plantation, 1 = yes	0.07 (0.26)	0.09 (0.29)	0.36
Forest use	Dummy, whether a household collects forest products, 1 = yes	0.95 (0.21)	0.90 (0.29)	0.08*
Total household income	Annual household income in million TZS in 2015 ^b	1.27 (1.48)	1.81 (4.09)	0.13
Share of agricultural income	Percentage of agricultural income in total income	59.13 (39.81)	43.45 (39.20)	0.00***
Share of business income	Percentage of business income in total income	11.30 (25.36)	22.44 (33.53)	0.00***
Share of forest income	Percentage of forest income in total income	5.18 (19.47)	7.39 (21.50)	0.33
Share of off-farm income	Percentage of off-farm income in total income	17.24 (30.63)	22.14 (35.60)	0.18

294 Note: Standard deviations in parentheses. */**/** indicate mean differences between villages adjacent
 295 to the private, FSC certified and state-owned, non-certified plantations are statistically different at
 296 10/5/1% significance level respectively.

297 ^a We used t-tests for comparing the means of the variables.

298 ^b TZS is the Tanzanian currency shilling. The August 8, 2016 exchange rate was €0.41 for 1,000 TZS.

299

300

301 the same district with similar agro-ecological and administrative environment. The villages adjacent to
 302 the state-owned, non-certified plantation are used as a benchmark to compare differences in perceptions.
 303 Thus, our approach enables us to assess the relation between the plantations and perceived changes in
 304 social services and local infrastructure associated with their investments, while controlling for household
 305 and village characteristics. Since data on social services and infrastructure prior to the start of the
 306 operations of the plantations were not available, we focused on the perceptions of households about the
 307 changes associated with the investments of the plantations. In such villages, local households are largely
 308 expected to know who financed the social services and infrastructure, which enables us to assess the

309 perceptions towards the changes related to the investments by the plantations. To mitigate the limitations
 310 of using such subjective indicators, we triangulated the household perceptions with community
 311 perceptions using FGDs, information from company documents and with visual observations of social
 312 services and infrastructure.

313 Table 2 presents the results of the difference in means tests of the characteristics of the households in
 314 villages adjacent to the private, FSC certified and state-owned, non-certified plantations. The households
 315 in the two groups of villages differ in some of their characteristics. There are statistically significant
 316 differences in terms of average household size and share of income from agriculture of the households.
 317 However, households in both groups consist on average of about five persons and agriculture is the main
 318 economic activity. Households in villages adjacent to the state-owned, non-certified plantation earn a
 319 larger share of their income from business activities such as petty trade. Households in villages
 320 neighboring the private, FSC certified plantations farm on average larger area of land than households
 321 in villages near the state-owned, non-certified plantation. A slightly higher percentage of households in
 322 villages nearby the private, FSC certified plantation are engaged in collecting forest products than in
 323 villages adjacent to the state-owned, non-certified plantation. The most commonly collected forest
 324 product in the villages is fire wood which is mostly collected from natural and community forests. Some
 325 households also reported to have collected forest products from the plantations. We control for the
 326 differences in these characteristics in our quantitative analyses as described in the next section.

327

328 4.2 Methods of analysis

329

330 As our dependent variable uses a Likert scale, we use an ordered logistic model to analyze the relation
 331 between the private forest plantations and perceived changes in each type of social service (school
 332 enrolment and quality of education) and infrastructure (number and quality of health centers, length and
 333 quality of roads and bridges) in the villages. We asked respondents to what extent they think that the
 334 forest plantations have changed the social services or infrastructure in their villages. Accordingly, the
 335 dependent variable has three ordered categories: 1 if the household perceived the plantation to have
 336 (greatly) decreased the quantity or quality of the social service or infrastructure, 2 if the household
 337 related the plantation with no change, and 3 if the household perceived the plantation to have (greatly)
 338 increased it. In the ordered logistic model, the probability that household i from village j selects category
 339 $k \in \{1,2,3\}$, is

$$340 \quad P(Y_{ij} = k | \mathbf{x}_{ij}) = \frac{e^{\alpha_k - \mathbf{x}'_{ij}\beta}}{1 + e^{\alpha_k - \mathbf{x}'_{ij}\beta}} - \frac{e^{\alpha_{k-1} - \mathbf{x}'_{ij}\beta}}{1 + e^{\alpha_{k-1} - \mathbf{x}'_{ij}\beta}}, \quad (1)$$

341

342 where $\alpha_3 = \infty$ and $\alpha_0 = -\infty$. The vector \mathbf{x} includes the independent variables. The main explanatory
 343 variable indicates whether household i lives in a village adjacent to a private, FSC certified forest
 344 plantation.⁵ We refer this variable as ‘private, FSC certified’ in the regression tables in Section 5.2 and
 345 in the appendix. The variable takes a value of 1 if the household lives in a village adjacent to a private,
 346 FSC certified plantation, and 0 otherwise. We also include village dummies to capture (un)observable
 347 factors which may vary between the villages and influence the perceptions of the households about the
 348 changes in social services and infrastructure related to the plantations. These include differences in other

⁵ The value of the variable which indicates whether household i lives in a village adjacent to a private, FSC certified forest plantation is the same for households who live in the same village. Hence, it is important to cluster standard errors at the village level to relax the independent observations assumption. This implies that the observations are independent only across villages.

349 kinds of infrastructure, topographic characteristics, effects of other projects working on local
350 development and differences in the trustworthiness of village leaders and councils in utilizing the funds
351 allocated by plantations for community development projects. Furthermore, we include a vector of
352 household controls to account for relevant household characteristics expected to influence their
353 perceptions about the outcomes of the investments by the forest plantations. These include sex and
354 education level of the household head, household size, size of farm land, total household income and
355 whether a household member works for the plantation in its village. Studies and anecdotal evidence
356 indicate that vulnerable groups (women, the less educated and the land poor) may perceive the
357 investments of plantations negatively (Bleyer et al., 2016). This may be due to the exclusion of these
358 groups from the activities of the plantations or due to disproportionate effects of plantations on these
359 groups. For example, women and the less educated may be less likely to be employed to work on the
360 plantations (Pirard et al., 2017). Differences in responses may also be due to other household specific
361 factors (e.g., conflicts with plantations about land rights) unrelated with actual changes in the outcome
362 variables. For example, households who were relocated from their farm plots and those who largely rely
363 on land for their livelihoods may perceive the investments of plantations negatively (Bleyer et al., 2016).
364 Hence, we included shares of the different income sources of the households as controls to proxy for the
365 livelihood strategies of the households.

366 As noted, we use ordered logistic regression analysis. Since the coefficients of an ordered logit
367 regression cannot be interpreted directly, we further report marginal effects and odds ratios. The
368 marginal effect approximates the effect of a unit change in an explanatory variable on the expected value
369 of an outcome variable, keeping other variables constant (Wooldridge, 2010). The odds ratio is the ratio
370 of the odds of an outcome – i.e. $P(Y_{ij} = k | \mathbf{x}_{ij}) / (1 - P(Y_{ij} = k | \mathbf{x}_{ij}))$ – to the odds of the same
371 outcome when an explanatory variable changes by a unit (Verbeek, 2012).

372

373 5. Results

374 5.1 Cross-sectional mean comparisons of perceived changes in social services and infrastructure

375 Figure 2 compares the mean values of the outcome variables between the villages adjacent to the private,
376 FSC certified and state-owned, non-certified plantations. These outcome variables are the dependent
377 variables in the econometric analyses in Section 5.2. The responses are aggregated from a 5-point Likert
378 scale (greatly decreased, decreased, no change, increased, greatly increased) to a 3-point Likert scale:
379 (greatly) decreased, no change, (greatly) increased.⁶ We used the 5-level Likert scale in the household
380 survey to give respondents more options to choose from. Households in all villages on average reported
381 positive perceived changes in social services and local infrastructure associated with the investments by
382 the plantations. However, the mean values for households nearby the private, certified plantations are
383 higher than the mean values for households nearby the state-owned, non-certified plantation. A one-
384 sided t-test shows that the mean values of the outcome variables in the villages nearby the state-owned,
385 non-certified plantation are statistically greater than 2: the category that corresponds to the response ‘no
386 change’ (See Table A1 in Appendix A). These are cross-sectional mean comparisons and do not control
387 for household and village level characteristics that may also affect perceptions. In the econometric

⁶ We used the Brant test of parallel regressions to assess whether all coefficients for each of the outcome variables satisfy the parallel slopes assumption. The results show that we cannot reject the null hypothesis of proportional odds ratios or parallel regressions (p-values > 0.05). This indicates that the outcome categories are independent and we can merge adjoining categories of the 5-point Likert scale for ease of interpreting the coefficients.

388 analyses in Section 5.2, we include household covariates and village dummies to describe the variation
389 between the villages adjacent to the private, FSC certified and state-owned, non-certified plantations.

390

391 << Insert Figure 2 about here >>

392

393 **5.2 Econometric results**

394 In this section, we present the results of the econometric analyses of the perceived changes in each of
395 the social services and infrastructure associated with the investments by the plantations. Due to missing
396 observations, which are evenly distributed over the villages nearby the private, certified and state-
397 owned, non-certified plantations, the estimations were done using 289 observations. Table A2 in
398 Appendix A provides the descriptive statistics of the explanatory and dependent variables used in the
399 estimations. We estimated all regressions using the 3-point Likert scale outcome variables. The results
400 using the 5-point scale are qualitatively the same and are presented in Table A3 in Appendix A.

401

402 **5.2.1 Household perceptions about perceived changes in number and quality of health centers**

403 Table 3 presents the results regarding the perceived changes in the number and quality of health centers.
404 In column (a), we present the ordered logistic regression coefficients. The marginal effects and odds
405 ratios are provided in columns (b) and (c) respectively. There is a statistically significant positive relation
406 between the private, FSC certified plantations and perceived increases in the number and quality of
407 health centers in adjacent villages. Households in villages adjacent to the private, certified plantations
408 are on average 25.2% more likely to perceive that the plantations have improved the number and quality
409 of health centers, than households in villages adjacent to the state-owned, non-certified plantation
410 (Column (b)). The odds ratio of 3.52 indicates that the odds of households in villages adjacent to the
411 private, certified plantations to report that the plantations have (greatly) increased the number and
412 quality of health centers in their villages are 252% higher than the odds for households in villages
413 adjacent to the state-owned, non-certified plantation. The positive perceptions towards the private,
414 certified plantations might be due to the investments of the company in improving health centers in the
415 villages. According to FGD and field observations, the company has financed a dispensary and
416 improvement of existing health centers in adjacent villages (see Section 5.3).

417 Households with higher income were more likely than poorer households to report positive perceptions
418 towards the changes in health centers associated with the plantations. Households who collect forest
419 products were less likely, as compared to those who do not, to report positive changes.

420

421 **5.2.2 Household perceptions about perceived changes in quality of education**

422 We find a statistically significant positive relation between the private, certified plantations and
423 perceived increases in the quality of education in adjacent villages (Table 4). Households in villages
424 adjacent to the private, certified plantation are on average 26.4% more likely than households in villages
425 adjacent to the state-owned, non-certified plantation to perceive that the plantations have (greatly)
426 improved the quality of education in their villages (Column (b)). The odds ratio is 3.68. FGDs and field
427 observations show that the private, certified plantations company invested in the construction and
428 improvement of school buildings (class rooms and teachers' offices) and facilities (student desk chairs,
429

429

Table 3. Perceived changes in number and quality of health centers

Variables	Ordered logit coefficients	Marginal effects	Odds ratio
	(a)	(b)	(c)
Private, FSC certified	1.259*** (0.120)	0.252*** (0.027)	3.522*** (0.421)
Age of head	0.013 (0.013)	0.002 (0.002)	1.012 (0.013)
Sex of head	-0.156 (0.206)	-0.031 (0.042)	0.855 (0.176)
Education of head	-0.020 (0.198)	-0.004 (0.039)	0.979 (0.194)
Household size	-0.077 (0.063)	-0.015 (0.012)	0.926 (0.058)
Total farm size	-0.032 (0.022)	-0.006 (0.005)	0.968 (0.021)
Employed by plantation	-0.039 (0.208)	-0.008 (0.042)	0.962 (0.200)
Forest use	-0.573** (0.179)	-0.115** (0.033)	0.563** (0.100)
Total household income	0.029* (0.015)	0.006* (0.003)	1.029* (0.015)
Share of agriculture income	-0.007 (0.011)	-0.001 (0.002)	0.993 (0.011)
Share of business income	-0.012 (0.014)	-0.002 (0.002)	0.988 (0.013)
Share of forest income	-0.009 (0.010)	-0.002 (0.002)	0.991 (0.009)
Share of off-farm income	-0.010 (0.007)	-0.002 (0.001)	0.990 (0.006)
Village dummies	Yes		
Pseudo-R ²	0.058		
Observations	289		

431 Note: The dependent variable is response to “To what extent do you think that the forest plantations
432 have changed the number and quality of health centers in your village?”, 3-point Likert scale where 1 =
433 (greatly) decreased, 2 = no change, 3 = (greatly) increased. Robust standard errors in parentheses are
434 clustered at village level. */**/** indicate statistically significantly different from zero in columns (a)
435 and (b) and different from 1 in column (c) at 10/5/1 % levels respectively.

436

437 teachers’ housing duplex, toilets; see Table 7). Such investments are expected to reduce the number of
438 teachers who leave the villages to work in urban areas (most likely to be the best quality teachers).

439 Households with older and more educated heads and those with higher incomes are more likely than
440 their counterparts to perceive that the nearby plantation to have (greatly) increased the quality of
441 education in their villages. On the other hand, male-headed households and households whose members
442 work for the plantations are less likely to perceive that the activities of the plantations have improved
443 quality of education. The result related to households who work for the plantations is not as expected
444 and could be due to household specific factors (e.g., conflicts related to working conditions and salary
445 levels) which could influence their responses.

446

Table 4. Perceived changes in quality of education

Variables	Ordered logit coefficients	Marginal effects	Odds ratio
	(a)	(b)	(c)
Private, FSC certified	1.303*** (0.045)	0.264*** (0.015)	3.679*** (0.164)
Age of head	0.035*** (0.006)	0.007*** (0.001)	1.036*** (0.006)
Sex of head	-0.858** (0.409)	-0.174** (0.078)	0.424** (0.173)
Education of head	0.468** (0.180)	0.095** (0.033)	1.596** (0.287)
Household size	0.081 (0.079)	0.016 (0.016)	1.084 (0.086)
Total farm size	-0.118 (0.076)	-0.024 (0.015)	0.889 (0.067)
Employed by plantation	-0.882*** (0.222)	-0.179*** (0.049)	0.413*** (0.912)
Forest use	0.122 (0.237)	0.025 (0.048)	1.129 (0.267)
Total household income	0.093* (0.052)	0.019* (0.010)	1.097* (0.056)
Share of agriculture income	0.005 (0.005)	0.000 (0.000)	1.004 (0.005)
Share of business income	0.002 (0.005)	0.000 (0.000)	1.002 (0.005)
Share of forest income	-0.002 (0.008)	-0.000 (0.001)	0.998 (0.007)
Share of off-farm income	0.007 (0.009)	0.001 (0.002)	1.007 (0.009)
Village dummies	Yes		
Pseudo-R ²	0.083		
Observations	289		

448 Note: The dependent variable is response to “To what extent do you think that the forest plantations
449 have changed the quality of education in your village?”, 3-point Likert scale where 1 = (greatly)
450 decreased, 2 = no change, 3 = (greatly) increased. Robust standard errors in parentheses are clustered at
451 village level. ***/*** indicate statistically significantly different from zero in columns (a) and (b) and
452 different from 1 in column (c) at 10/5/1 % levels respectively.

453

454 5.2.3 Household perceptions about perceived changes in school enrolment

455 Households in villages adjacent to the private, certified plantations are on average 15 % more likely than
456 households in villages adjacent to state-owned, non-certified plantation to perceive that the plantations
457 have (greatly) increased the number of children going to school (Table 5). The odds ratio of 3.18
458 indicates that the odds of households in villages adjacent to the private, certified plantations to report
459 that the plantations have (greatly) increased the number of children going to school in their villages are
460 218% higher than the odds of households in villages adjacent to the state-owned, non-certified
461 plantation. This may be explained by an increase in the capacity of schools to accommodate more
462 children due to school buildings, class rooms and school facilities (co-) financed by the private plantation
463 company (see Section 5.3).

Table 5. Perceived changes in school enrolment

Variables	Ordered logit coefficients	Marginal effects	Odds ratio
	(a)	(b)	(c)
Private, FSC certified	1.157*** (0.111)	0.150*** (0.014)	3.182*** (0.354)
Age of head	0.009 (0.015)	0.001 (0.002)	1.009 (0.015)
Sex of head	-0.838** (0.314)	-0.109** (0.037)	0.432** (0.136)
Education of head	0.271 (0.250)	0.035 (0.031)	1.312 (0.328)
Household size	0.039 (0.069)	0.005 (0.009)	1.039 (0.072)
Total farm size	-0.016 (0.076)	-0.002 (0.009)	0.984 (0.074)
Employed by plantation	-0.323 (0.507)	-0.042 (0.07)	0.724 (0.367)
Forest use	1.168*** (0.341)	0.151*** (0.043)	3.215*** (1.097)
Total household income	0.072** (0.030)	0.009** (0.004)	1.075** (0.032)
Share of agriculture income	0.002 (0.005)	0.000 (0.000)	1.002 (0.005)
Share of business income	0.003 (0.004)	0.000 (0.000)	1.002 (0.004)
Share of forest income	-0.005 (0.008)	-0.000 (0.001)	0.995 (0.008)
Share of off-farm income	-0.002 (0.013)	-0.000 (0.001)	0.998 (0.013)
Village dummies	Yes		
Pseudo-R ²	0.084		
Observations	289		

465 Note: The dependent variable is response to “To what extent do you think that the forest plantations
466 have changed the number of children going to school in your village?”, 3-point Likert scale where 1 =
467 (greatly) decreased, 2 = no change, 3 = (greatly) increased. Robust standard errors in parentheses are
468 clustered at village level. **/** indicate statistically significantly different from zero in columns (a)
469 and (b) and different from 1 in column (c) at 5/1 % levels respectively.

470

471 The results also indicate that male-headed households are less likely than female-headed households to
472 perceive that the plantations have increased the number of children going to school. Richer households
473 and households who are involved in collecting forest products are more likely than their counterparts to
474 perceive that the plantations have improved school enrolment in the villages.

475

476 **5.2.4 Household perceptions about perceived changes in roads and bridges**

477 There is a statistically significant positive relation between the private, FSC certified plantations and
478 perceived increases in the length and quality of roads and bridges in adjacent villages (see Table 6).
479 Households in villages adjacent to the private, certified plantations are on average 22.9% more likely

480 than households in villages adjacent to the state-owned, non-certified plantation to perceive that the
 481 plantations have (greatly) improved the length and quality of roads and bridges. The odds ratio is 2.75.
 482 FGDs and observations of infrastructure in the villages confirm that the private forest company had (co-
 483)financed the construction and improvement of roads and bridges in neighboring villages.

484 Households with older and more educated heads and with higher income are more likely, as compared
 485 to their counterparts, to report positive changes in the length and quality of roads and bridges associated
 486 with the investments by the plantations in their villages. On the other hand, male-headed and larger size
 487 households are less likely to associate plantations with positive changes in the length and quality of
 488 roads and bridges.

489

490

Table 6. Perceived changes in length and quality of roads and bridges

Variables	Ordered logit coefficients	Marginal effects	Odds ratio
	(a)	(b)	(c)
Private, FSC certified	1.011*** (0.032)	0.229*** (0.008)	2.747*** (0.087)
Age of head	0.019*** (0.005)	0.004*** (0.001)	1.018*** (0.005)
Sex of head	-0.504** (0.202)	-0.114** (0.045)	0.604** (0.122)
Education of head	0.261*** (0.073)	0.059*** (0.016)	1.298*** (0.095)
Household size	-0.056** (0.024)	-0.013** (0.005)	0.945** (0.022)
Total farm size	-0.060 (0.057)	-0.014 (0.013)	0.941 (0.054)
Employed by plantation	-0.165 (0.278)	-0.037 (0.09)	0.848 (0.235)
Forest use	-0.373 (0.379)	-0.085 (0.086)	0.688 (0.261)
Total household income	0.051** (0.020)	0.011** (0.005)	1.052** (0.021)
Share of agriculture income	0.000 (0.007)	0.000 (0.002)	1.000 (0.007)
Share of business income	-0.003 (0.009)	-0.000 (0.002)	0.997 (0.008)
Share of forest income	-0.001 (0.013)	-0.000 (0.003)	0.999 (0.013)
Share of off-farm income	-0.006 (0.009)	-0.001 (0.002)	0.994 (0.009)
Village dummies	Yes		
Pseudo-R ²	0.048		
Observations	289		

491 Note: The dependent variable is response to “To what extent do you think that the forest plantations
 492 have changed the length and quality of roads and bridges in your village?”, 3-point Likert scale where
 493 1 = (greatly) decreased, 2 = no change, 3 = (greatly) increased. Robust standard errors in parentheses
 494 are clustered at village level. **/** indicate statistically significantly different from zero in columns
 495 (a) and (b) and different from 1 in column (c) at 5/1 % levels respectively.

496

497 **5.2.5 Robustness checks**

498 To examine the robustness of our results to alternative specifications, we first investigated if our results
499 hold true for each of the villages nearby the private, FSC certified plantations (Idete and Mapanda) by
500 including a dummy variable for each of the four villages in the estimations (See Table A4 in Appendix
501 A). While we find statistically significant positive relations between the plantations and perceived
502 increases in the length and quality of roads, school enrolment and quality of education in both Idete and
503 Mapanda, relative to the reference village (Kihanga), the plantation was related with positive changes
504 in the number and quality of health centers only in Mapanda (again relative to Kihanga). This result may
505 be due to the fact that while the private company co-financed a dispensary in Idete, it invested in building
506 a dispensary, maternity ward and houses for nurses in Mapanda (see Table 7). This may in turn be related
507 to the VCS certification the Mapanda plantation has in addition to being FCS certified. The Climate,
508 Community, Biodiversity (CCB) standards of VCS calls for project activities to enhance the wellbeing
509 of communities (Wood, 2011). This may also partly explain the relatively higher positive perceptions
510 of households in Mapanda village as compared to the positive perceptions in Idete regarding all of the
511 outcome variables except the changes in school enrolment associated with the activities of plantations
512 (See Table A4 in appendix A). Though the results are not perfectly consistent, this supports our claim
513 that certifications that include community related standards lead to improved perceptions about
514 investments in local social services by the plantations. Second, we explored whether the perceived
515 positive changes associated with the private, FSC certified plantations are heterogeneous among
516 different income groups. For this, we included an interaction variable of income quartile groups with
517 the dummy variable *Private, FSC certified*_{ij} as explanatory variable, dropped the ‘total household
518 income’ variable and estimated all the regressions. We did not find any significant effect of the
519 interaction variable, suggesting that perceived positive changes do not vary across income groups. Third,
520 to investigate whether household specific factors (unrelated to the investments in social services and
521 infrastructure by the plantations) affect the perceived changes associated with the private, certified
522 plantations, we estimated the regressions including two more household specific explanatory variables:
523 whether a household was relocated from its landholding and the extent to which a household considers
524 the plantation a ‘good neighbor’ (see Table A5 in Appendix A). Our results remain robust.

525

526 **5.3 Community perceptions and field observations of village social services and infrastructure**

527 Table 7 shows the various development projects undertaken by the plantations in each village as
528 indicated in the FGDs. Villagers neighboring the private, FSC certified forest plantations (Idete and
529 Mapanda) reported that the plantation company (co-)financed the construction and improvement of
530 school buildings, teachers’ houses, roads and bridges, dispensaries and related facilities. In contrast,
531 villagers neighboring the state-owned, non-certified plantation (Kihanga and Nzivi) reported fewer
532 community development projects by the plantation. While men and the youth were mentioned as the
533 groups who most benefitted from the community projects in the FGD in Idete, all members of the
534 community were mentioned to have benefitted in the other three villages.

535 Field observations and the plantation company reports (Green Resources AS, 2009) show that the
536 private, certified plantation company (co-)financed the construction of a secondary school, a maternity
537 ward, a house for nurses, two bridges and a graded road in Mapanda. Similarly, it (co-)financed a nursery
538 school, two class rooms in a primary school, teachers’ houses, a bridge and a road in Idete. Visual
539 inspections indicated that the infrastructure in villages adjacent to the private, certified plantations are
540 generally of better quality and equipped with better facilities. School records show that more children
541 attended schools in villages nearby the private, certified plantations as compared to villages neighboring

542 the state-owned, non-certified plantation. Hence, the FGD and field observations confirm the results
543 based on the reports by individual households in the villages.

544

545 **6. Conclusions and discussions**

546 Perceptions of local households matter in examining the operations and investments of forest plantations
547 in rural communities as perceptions can affect how communities relate to the plantations (Wiley and
548 Mbeya, 2001). Against this background, we examined the perceptions of local households in rural
549 villages in Tanzania about the investments of large-scale private, FSC certified and state-owned, non-
550 certified forest plantations in social services and local infrastructure. Our results show that households
551 in villages adjacent to the private, FSC certified and state-owned, non-certified forest plantations
552 perceived the changes in social services and local infrastructure associated with the plantations
553 positively. We found that villagers adjacent to the private, FSC certified plantations perceive the changes
554 more favorably as compared to those adjacent to the state-owned, non-certified plantation. Focus group
555 discussions and visual inspections confirm that villages adjacent to the private, FSC certified forest
556 plantations are better off in terms of the number and quality of health centers, number of students in
557 school as well as length and quality of bridges and roads. We further found that richer and female-
558 headed households are more likely to associate plantations with positive changes in social services and
559 infrastructure, indicating that perceptions with regard to forest plantation infrastructure investments are
560 not uniform across households.

561 The motivations for private companies to invest in public goods such as social services and infrastructure
562 differ. These motives include to maximize profit, to ease business operations, adhering to corporate
563 social responsibility and pro-social investments, as part of a (certification) strategy that requires
564 contributions to community development, and due to shareholder and donor requirements for sustainable
565 investments (Tumlinson and Morgan, 2013; Zivin and Small, 2005). These reasons appear to increase
566 the incentives of private, certified forest plantations to invest in public goods by raising the expected
567 (long-term) net benefits of investing in community development. Moreover, such investments and
568 resulting positive perceptions by local households may reduce the risk of conflicts with local
569 communities and associated losses (Indufor, 2012a). Positive perceptions of local communities
570 regarding the activities and investments of forest plantations may also reduce their vulnerability (and
571 associated costs) to pressures from socially and environmentally oriented NGOs which may otherwise
572 lead to reputational risks. So, investments in public goods may be regarded as the price private forest
573 plantation companies pay for reducing such risks for their businesses. This is sometimes referred to as
574 a social license to operate (Joyce and Thomson, 2000). Hence, investments in public goods by private,
575 certified forest plantation companies can be part of a risk reduction and profit maximization strategy.

576 Our results are consistent with the findings of other studies that show positive perceptions of households
577 towards forest plantations and certified forestry operations in terms of their contributions to public goods
578 in adjacent villages in East Africa (Bleyer et al., 2016; Kalonga and Kulindwa, 2017; Landry and
579 Chirwa, 2011). Our results further suggest that private forest plantations are perceived more positively
580 than state-owned, non-certified plantations by locals in the study villages, in terms of public goods
581 provision to adjacent communities, at least when the private plantations are FSC certified. Investors and
582 creditors in forest plantations in the study areas may boost these incentives by requiring private sector

583

Table 7. Social services and infrastructure projects undertaken by plantations in the villages

Village	Plantation owner	Teachers Offices	Houses for teachers	School building and class rooms	Road and bridges	Toilets for schools	Houses for nurses	Dispensary
Idete	Private, FSC certified	X	X	X	X	X		X
Mapanda	Private, FSC certified	X	X	X	X		X	X
Kihanga	State, non-certified			X				
Nzivi	State, non-certified	X	X					

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594 forest managers to make pro-social investments or become certified as a condition for investing in the
595 plantations. Hence, policies and strategies aimed at creating a conducive environment for private sector
596 investments in forest plantations in the study areas may enhance positive changes from sustainable forest
597 management beyond the boundary of the plantations. The differences in perceptions among different
598 social groups suggest that stakeholder engagement and monitoring of activities by forest plantations
599 should take into account the heterogeneous views within communities, their different needs and differing
600 outlooks towards their community related activities. It is important to ensure the coherence of forest
601 plantation activities with adjacent communities and listen to their needs and priorities if such
602 investments are to be beneficial for the majority of local stakeholders.

603 Our results give insights into the perceptions of villagers about changes in social services and physical
604 capital associated with large scale forest plantations in rural Africa. One implication of the results is that
605 such forest plantations may not necessarily be viewed negatively by local stakeholders in terms of the
606 interplay between their activities and the livelihoods of adjacent communities. It is however important
607 to note that in this study we looked at perceptions related to forest plantations' investments in public
608 goods only. Further studies on the perceptions of villagers towards the implications of the operations
609 and investments of forest plantations with regards to various socio-economic outcomes are highly
610 needed before we have a better understanding of the interplay between forest plantations and adjacent
611 communities. This requires in part well-designed studies on the topic using a large number of forest
612 plantations and villages in various countries.

613 It should be noted that Green Resources has been embroiled in land related conflicts concerning some
614 of its forest plantations in Uganda (Lyons and Westoby, 2014; Richards and Lyons, 2016). However,
615 we found no reported land related conflicts between villagers and the company's forest plantations in
616 Tanzania (for the year 2015). Most reports of negative perceptions of Green Resources' operations in
617 Tanzania occurred in the period 2010 to 2012. However, many press reports of 'land grabbing' have
618 since been found to be based on questionable data (Locher and Sulle 2014; Schoneveld, 2014), leading
619 to "a blurred situation regarding the status and actual impact of (proposed) investments in forestry,
620 providing an inadequate basis for related political decisions or social actions" (Locher and Sulle, 2013,
621 p.2). In our survey, three households reported being relocated due to the activities of the plantations in
622 the study villages in Tanzania. We asked households about perceived changes in availability of farm
623 land and did not find evidence of reductions in availability of farm land due to forest plantations in the
624 villages. The differences in perceptions towards the company's forest plantations in Tanzania and
625 Uganda may be due to differences in management of forest plantations between the countries and the
626 land leasing process. Furthermore, Malkamäki et al. (2017) concluded that several studies on outcomes
627 of forest plantations for local communities have focused on geographical areas associated with reports
628 of land related conflicts due to forest plantations. Unlike such studies, we have a large number of
629 randomly selected households in our study, which puts us in a better position to look into perceptions of
630 different groups of society.

631 The objective of our study is limited to assessing differences in the perceptions of households living in
632 the vicinity of FSC certified, private and non-certified, state-owned plantations with regard to the
633 overall changes in the quantity and quality of social services and infrastructure associated with
634 investments by the plantations. As such, our results do not necessarily imply that private, certified forest
635 plantations are always more likely than non-certified, state-owned plantations to lead to better benefits
636 from and access to social services and infrastructure for local households. Future studies interested in
637 examining the effects of plantations' investments in social services and infrastructure on local
638 communities would benefit from more objective and accurate measures of the changes in the uses,
639 benefits and access of villagers to the social services and infrastructure. For example, changes in

640 kilometers of tarmacked and/or graded roads and number of bridges constructed can be used to assess
641 changes in quantity and/or quality of roads and bridges; changes in quality of education can be measured
642 by changes in the number of teachers per students, teachers' education and remuneration, access to
643 learning aides, students' test scores; changes in school enrolment can be measured by changes in total
644 enrolment rates and enrolment rates of female students; changes in quantity and quality of health centers
645 can be measured by changes in qualified health personnel and access to health services (number of
646 people who received health care in a given period). This would require the availability of baseline data
647 on existing social services and infrastructure to be able to disentangle the contribution of the investments
648 of the plantations to the changes in the quantity and quality of the services and infrastructure.

649 Finally, the following points are pertinent regarding the validity of our results. First, although the study
650 was conducted in only four villages, which may reduce the statistical power of our quantitative analysis,
651 the internal validity of our results holds well because villages within the same district were homogenous
652 and our study villages can be regarded as representative of villages in the district. The outcome variables
653 of interest, which are related to perceived changes in social services and local infrastructure associated
654 with the investments by the plantations in adjacent villages, also justify focusing on villages in the
655 vicinity of the forest plantations as compared to including more villages located further away. Besides,
656 the large number of households - the level at which the outcomes are measured in our study - further
657 increases validity. Notwithstanding these, we triangulated our quantitative results with qualitative
658 analyses of community perceptions regarding the changes through focus group discussions and with
659 visual inspection of the level and quality of social services and infrastructure in the villages. Second, to
660 relate the perceived changes to private ownership of plantations, ideally the only difference between the
661 forest plantations should be the form of ownership. In our study, the private plantations are FSC-certified
662 while the state-owned forest plantation is not certified. So, our results should be seen as providing
663 insights on the relation of the combination of these factors with the perceived positive changes
664 associated with the plantations. Future research could try to disentangle the contribution of ownership
665 from the contribution of certification. Third, we looked at forest plantations owned by one company
666 operating in the same district, indicating a need for caution in generalizing our results to other forest
667 plantations in Tanzania and beyond. An important line of future research could be to expand the analysis
668 to larger number of forest plantations and villages with various socio-economic contexts, development
669 policies and land allocation processes in developing countries.

670

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676

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