DIRECTORATE GENERAL OF FORESTRY PLANNING
MINISTRY OF FORESTRY OF REPUBLIC INDONESIA

UN-REDD
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Social-economic Analysis and REDD+ Locations

at Sub-district Level in Central Sulawesi, Indonesia

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AT SUB-DISTRICT LEVEL
IN CENTRAL SULAWESI, INDONESIA

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1. Introduction

Reducing emissions from deforestation and forest degradation entails dimensions beyond carbon and forest canopy. Social-economic dimension represent one key dimension both in terms of underlying causes and associated repercussions of deforestation and forest degradation (e.g. Geist and Lambin, 2002; Jaung and Bae, 2012). In this regard social economic dimensions can include a range of issues such as well-being, economic inequality, and equity consideration concerning benefit sharing from forest-based benefits.

REDD+ has emerged as one of the most prominent schemes in reducing emission from deforestation and forest degradation. It has been promoted in developing countries and numerous pilot projects and demonstration activities in these countries are underway, especially in countries with high carbon stock and deforestation and degradation rate such as Indonesia and Brazil (Cerbu et al, 2011). In addition to other criteria, such as e ectiveness and efficiency to address key drivers of deforestation and degradation, it has been identified that poverty reduction and benefit sharing respectively are one of co-benefits and equity criteria required to assess the institution of REDD+ (Vatn and Angelsen, 2009). Moreover, some observers suggest that REDD+ implementation has potential implications for the poor, forest-dependent community and local jurisdiction (Peskett et al, 2008).

This study was driven by one general question: how to consider socio-economic dimensions in selecting and proposing locations for REDD+ activities? The study uses sub-district or kecamatan as unit of analysis since specific site condition is important in selecting location for REDD+ activities (Lin et al, 2012). Central Sulawesi, which has become one of REDD+ pilot provinces in Indonesia, is chosen as context.

The study employs linear programming method with an objective to maximize carbon stock of a sub-district in concern, while simultaneously considers a number of variables. It confines attention to only selected variables which are related to REDD+ (i.e. deforestation and forest degradation, village area inside and bordering with forest, and mining license), to social economic conditions (i.e. number of poor and near poor households, housing conditions, and rice consumption), and to public finance (i.e. own source revenues, fiscal capacities and public expenditures for economic and social protection measures).

The report of the study is organized as follows. The opening section describes the context in terms of general economic, social, and biophysical background. The conceptual foundation that underlies site selection for REDD+ follows from that in Section 2. Methodology regarding data, variables and output-oriented data envelopment analysis is described in Section 3. Results of the study including the recommended locations are presented in Section 4. The last sections (5 and 6) conclude and outline further implications for REDD+.

2. The Context

Economic Structure

In economic terms, Central Sulawesi represents one of the least developed provinces by both Sulawesi and Indonesia standards. Moreover, viewed from the linkage between economic growth and structural change in a longer time horizon, the province has been slow in making transition from primarily agrarian economy (Hill et al, 2008). Agricultural households still derive about 60% of their main income from farm holding (Booth, 2012). At a district level, presently at about 40-50% agriculture sector still makes up the largest part of the economic structure in Central Sulawesi, as Table 1 indicates.

TABLE 1. PERCENTAGE OF LOCAL GRP FOR SELECTED SECTORS IN 2010.

District/ Municipality	Agriculture (%)	Mining (%)	Manufacture (%)	Services (%)	All sectors (Trillion IDR)
Banggai	50.7	1.1	8.4	11.7	4.1
Banggai Kepulauan	49.0	0.6	4.5	10.4	1.5
Morowali	42.2	28.3	3.0	8.0	2.5
Poso	45.7	0.81	8.0	11.2	2.3
Donggala	41.4	4.2	4.8	19.3	3.6
Tolitoli	47.6	1.4	7.4	14.8	2.7
Buol	55.4	0.8	8.2	10.1	1.3
Parigi Moutong	51.8	1.7	7.2	7.5	6.3
Tojo Una-Una	43.3	1.2	10.9	16.4	1.0
Sigi	53.0	2.2	2.98	16.8	3.1
Palu	2.4	4.3	12.6	28.9	5.3

Notes: (1) Gross Regional Product (GRP) data are based on current price. (2) Manufacturing sector excludes oil. (3) 2010 data are used except for Morowali and Palu, for which only 2009 data are available. Source: Own table, data from various District/Municipality in Figures published by Central Board of Statistics.

Manufacture makes up less than 10% of the economy, while service sector has a somewhat higher percentage. Mining represents small proportion of the economy, although in the case of Morowali District it can be a substantial part of the economy. In the near future, sector based on extractive resources may contribute significantly to some local economies. For instance, thousand hectares of concessions have been granted for nickel exploitation in the districts of Morowali, Banggai and Tojo Uno-Uno. Natural gas production in Banggai will start in 2014.[1]

Selected Social Indicators

A number of selected poverty-related indicators are shown in **Table 2**. At a district level, between 7 to 13 percent of population in Central Sulawesi are poor according to the 2010 statistics, in addition to 4 to 11 percent of the population which is under the category of very poor (Palu is excluded). It is worth noting that 12 to 17 percent of the people in this province are near poor, which is highly likely to fall below poverty line given its vulnerability to economic shocks.

The poor spend about 70% of their money for food. Around 60% of the poor live in a very small house, not larger than 8 m^2. In the district of Sigi this indicator is even at slightly above 90%. Moreover, less than half of the poor population has an access to clean water. The table also indicates that there remain approximately 30% of the poor households who have not received *Raskin*, the government-initiated rice for the poor program.

General Biophysical Background, Carbon Stock and Deforestation

The area of Central Sulawesi is fringed by di erent type of lowland forest, which is one of the major natural vegetation types of the province. Alluvial, montane and ultrabasic soils make up the province's interior vegetations. As for rainfall, Central Sulawesi has a complex climatic map in which the variation in annual rainfall is quite large. The province covers di erent zones with varying length of consecutive wet and dry periods, ranging from ten wet months and two dry months (for instance along its border to South Sulawesi and in Morowali District) to two wet months and up to six dry months such as in the area around Palu. For an overview of biophysical background in Central Sulawesi see Whitten et al (2002).

1 On the planned 72,500 ha cross-district nickel exploitation, see DESDM Sulawesi Tengah (2010). For natural gas production in Banggai, see http://www.donggisenorolng.co.id/dslng/?sb=Development%20Plan&ver=ind (accessed on September 20, 2012).

TABLE 2. SELECTED POVERTY-RELATED INDICATORS FOR CENTRAL SULAWESI IN 2010 (IN PERCENTAGE OF TOTAL)

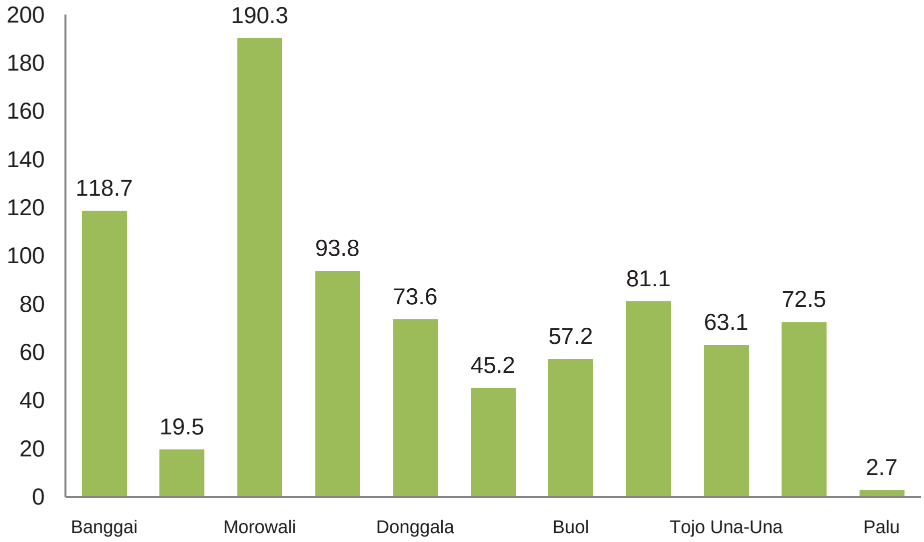
District/ municipality	Poor population			Per capita expenditure for food of poor people	Per capita floor area less than or equal to 8m2	Poor household with access to clean water	Poor people using health care program for the poor (Jamkesmas)	Household with access to rice for the poor program (Raskin)
	Very poor	Poor	Near poor					
Banggai	4.8	7.3	17.3	73.3	34.8	48.5	78.4	72.0
Banggai Kepulauan	6.9	12.6	13.1	75.0	52.8	43.9	64.7	79.7
Morowali	9.3	11.0	13.2	67.8	56.4	37.5	38.5	77.9
Poso	9.4	12.0	14.0	68.8	53.8	58.7	51.1	76.2
Donggala	9.1	10.3	12.5	74.7	72.1	26.4	59.7	53.4
Toli Toli	3.8	12.4	15.4	73.5	69.5	46.6	70.1	76.6
Buol	6.0	12.7	16.0	72.7	57.0	47.1	45.6	81.6
Parigi Moutong	8.3	11.9	17.5	67.8	71.4	34.2	49.9	63.8
Tojo Una-Una	11.0	13.0	13.7	72.4	49.4	64.5	75.4	73.5
Sigi	5.7	9.4	17.5	74.8	91.4	27.7	65.9	52.9
Palu	2.8	7.2	6.8	60.3	44.1	68.7	57.6	77.8
Sulawesi Tengah	6.8	10.5	14.2	70.7	60.4	45.2	58.4	69.8

Source: Own table, data from BPS (2011).

Morowali District has the largest Carbon stock with about 190 million tones Carbon, measured using 2011 data. The districts of Banggai, Poso and Parigi Moutong also rank among the top (**Figure 1**). At the same time, these are areas where deforestation is taking place at the highest rate between 2009 and 2011 (**Figure 2**). Morowali lost about 1.3 million ha of its forest during this period, and Banggai, Poso, and Parigi Moutong are respectively at the rate of 0.9, 0.7, 0.6 million hectares.

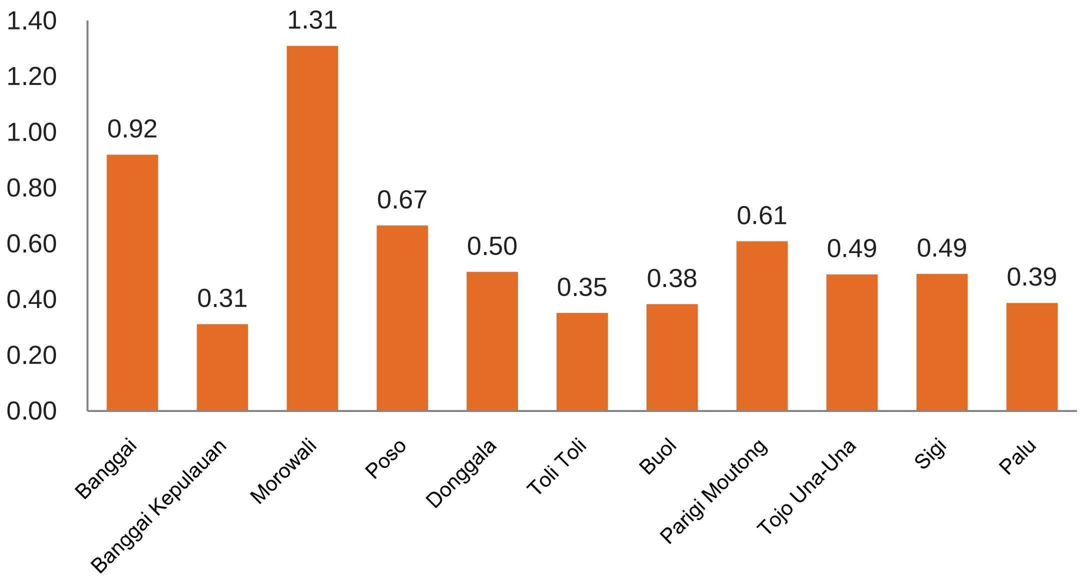
These seem to have served the main pretext for proposed REDD+ activities in Central Sulawesi. In October 2010, the province was selected to be the pilot province of UN-REDD program along with other ten provinces across the country. Its selection has been justified by, among others, high carbon density that Central Sulawesi has and it is considered relatively easy to address the drivers of deforestation and forest degradation there. (See UN-REDD, 2011).

FIGURE 2. DEFORESTATION AND FOREST DEGRADATION, 2009-2011 (IN MILLION HA)



Source: Own figure, data from UNREDD database.

FIGURE 1. CARBON STOCK IN 2011 (IN MTC)



Source: Own figure, data from UNREDD database.

3. REDD+ Scheme and Locations

Conceptually, the selection of REDD+ location depends on carbon stocks as well as deforestation and forest degradation rate. In addition, its selection considers role of conservation, sustainable management of forest and enhancement of forest carbon stocks. These standards for site selection are implied from the very definition of REDD+ (see e.g. Angelsen, 2009). The logical further step is to select site where significant deforestation or forest degradation is or has been taking place in order to achieve additionality, that is, emission reductions and carbon stock enhancement compared to the condition without REDD+ activity (Lin *et al*, 2012).

Empirically, however, the choice of REDD+ site appears to be driven by a number of considerations. These considerations may be more nuanced than the afore-mentioned core REDD+ objectives of reducing the rate of deforestation and forest degradation. In Indonesia for instance, according to a recent study by Lin et al (2012), changing the behavior of relevant actors who are presently involved in deforestation and forest degradation in the specific local area of the project, is an important focus in the existing REDD like projects. Another prime focus of such projects is on "preventing or pre-empting anticipated future deforestation or degradation threats" (Lin et al, 2012: 215). Using data from Indonesian outer islands and Brazilian non-Amazon areas, however, the study also found that REDD like projects tend to select places with higher forest cover and higher forest carbon content, yet not necessarily with higher deforestation rates (Lin et al, 2012: 221).

Some lessons could be taken here. First, there are multiple factors that can drive site selection for REDD like projects; Second, while large carbon stock is always an important criteria to select REDD locations, the threats to carbon stock such as from future deforestation, against conventional wisdom do not necessarily represent the main consideration for site selection; Third, location matters – the importance of specific local area in order to enable understanding of the behavior of actors who are involved in deforesting and degrading the forests.

The criteria for REDD+ site selection increasingly seems to go beyond the initial heavily carbon and deforestation rate oriented measures that can directly threaten emission reductions. For instance, ways have been explored to link REDD with biodiversity conservation (e.g. Harvey et al, 2010) although the protection of biodiversity through carbon-based conservation may have ambiguous impacts; some high-biodiversity area would benefit from REDD, some would not, and even would be under increased pressure if carbon-focused REDD activities are in place (Strassburg et al, 2010). Governance is another important issue brought forward to broaden site selection criteria for REDD. Decentralized governance system, tenure laws and legal framework to protect local stakeholder (Phelps et al, 2010) and curbing corruption (Brown, 2010; Tacconi et al, 2009) for instance have been viewed as enabling conditions to ensure that REDD can meet its objectives. Concerning site selection for REDD, the importance of both biodiversity and governance issues has been confirmed by findings of a global survey looking at the intensity and geographic distribution of existing REDD activities (Cerbu et al, 2011).

Social-economic aspects are other important dimensions to take into account of. Equitable sharing of benefits and rents from REDD+ activities, for instance, has been one important criterion in terms of equity regarding REDD+ institution building (Vatn and Angelsen, 2009) and improved governance (e.g. Jaung and Bae, 2012), while poverty reduction has been envisioned as one major co-benefits that REDD+ might bring (Vatn and Angelsen, 2009). Addressing poverty in REDD+ can potentially, among others, enhance the sustainability of REDD system by reducing conflict over forest-related resources. In addition, there is bundling issue that makes social-economic agenda hardly separable from REDD objectives. For the time being, most international funding for REDD+ comes from aid budget, which in itself put development and poverty reduction objectives high on its agenda (Angelsen and McNeill, 2012).

Nevertheless, concerns have been raised on how poverty is related to REDD+ or larger tropical forest issue. For instance, in addition to being region and context-specific (Narain et al, 2008; Culas, 2012), there is a less clear relationship between poverty alleviation and forest conservation; alleviating poverty may or may not necessarily lead to more forest conservation (see e.g. Wunder, 2001). Although in this light Wunder (2001) maintains that public investment such as in health, education, and institutional capacity building may enable synergies between poverty alleviation and forest conservation, so could compensation schemes for forest services that create cross-jurisdictional benefits. Some observers also suggest that adding poverty reduction into REDD to a certain degree can reduce effectiveness and efficiency of an instrument that is in the first place aimed at addressing environmental objectives (Peskett et al, 2008). Some observers even suggest (Agrawal et al, 2011) that in the future, social and ecological co-benefits might receive relatively lesser attention in carbon investment especially in one that is likely to expand the most in the carbon market.

Other considerations are also at play for REDD+ site selection both individually or as a set of mixed criteria. The province of Central Sulawesi can be a case in point here. In picking up priority district and municipality for REDD+ demonstration activities, it considers local government support, and demographic and biophysical conditions of forest resources as major selection criteria (Dinas Kehutanan Sulawesi Tengah, 2012). Interestingly, the final selected jurisdictions were not ones with the most carbon stock nor with highest deforestation rate (see discussions in Section 5).

4. Methodology

4.1.Data

This study uses secondary data from various sources: willage Potential (Podes) 2011 for area within and bordering with forest and number of sub-district population and household; Budget Plan (APBD) for fiscal data; and Mining and Natural Resources Agency's statistics for provincial mining license. Carbon stock and deforestation and forest degradation data were obtained from unpublished UN REDD Database. Information on poverty uses the combination poor family category of BKKBN (National Family Planning Coordination Office), as it provides data at the sub-district level, and poor family category of BPS (Central Office for Statistics) in *Data dan Informasi Kemiskinan Kabupaten/Kota 2010*. Detail description on data source is given in **Table 3**.

As the unit of analysis under investigation is sub-district (155 in total), data at the district/municipality level is transformed through population or household weight for each jurisdiction. Meanwhile, data at the village level are scaled up to sub-district level.

4.2.Method

In general this study intends to investigate the possibility of incorporating social-economic and other variables in relation to REDD+ objectives in order to select sub-districts with the most efficient combination of existing conditions reflected in the variables.

This study uses so-called frontier analysis which is known in linear programming literature as Data Envelopment Analysis (DEA), a technique for estimating efficiency and capacity utilization. The frontier analysis as it is used here traces out the best frontier from the performance of measure for each sub-district (*kecamatan*) under investigation. Then all sub-districts are assessed in relation to that best frontier, that is, either they are located along or below the frontier to assess their relative efficiency. See Cooper *et al* (1994) for an elaboration of this method.

The Model

At a conceptual level the DEA analysis used here should be interpreted as a way of finding "e ectiveness" of prescribed policy goals rather than "efficiency" of resource utilization (Takamura and Tone, 2003: 92) although the logic of the maximization in this analysis still follows resource efficiency. This study looks at how a pre-determined output, i.e. the carbon stock of the jurisdiction, is maximized given fixed inputs to estimate the potential output e ectiveness of each sub-district in the context of REDD+ activities.

Given the objective, the DEA model in the present study utilizes an *output-oriented approach* which is configured to maximize carbon stock of a sub-district. In its scale assumption, the model assumes *variable returns to scale* in which both increasing and decreasing returns to scale are possible (Banker et al, 2004). The basic output-oriented model, following Faere et al (1994), as quoted in Pascoe et al (2003), can be expressed as follows:

$$\max_{\theta, z} \theta$$

Subject to

$$\theta y_{jm} \leq \sum_{j=1}^{J} z_j y_{jm}, \quad \forall m$$

$$\sum_{j=1}^{J} z_j x_{jn} \leq x_{jn}, \quad \forall n \in F$$

$$\sum_{j=1}^{J} z_j x_{jn} = \lambda_{jn} x_{jn}, \quad \forall n \in V$$

$$\sum_{j=1}^{J} z_j = 1$$

$$\lambda_{jn} \geq 0, \quad \forall n \in V$$

Where

θ	=	Output efficiency measure,
y_{jm}	=	Quantity of output *m* produced by sub-district *j*
x_{jn}	=	Quantity of input n used by sub-district
F	=	Input set for fixed factors
V	=	Input set for variable factors
λ_{jn}	=	Input utilization rate
z_j	=	Intensity variable (or the weighting factor) for sub-district *j*
j	=	Sub-disctrict or Kecamatan
m	=	Output, i.e. carbon stock
n	=	Input

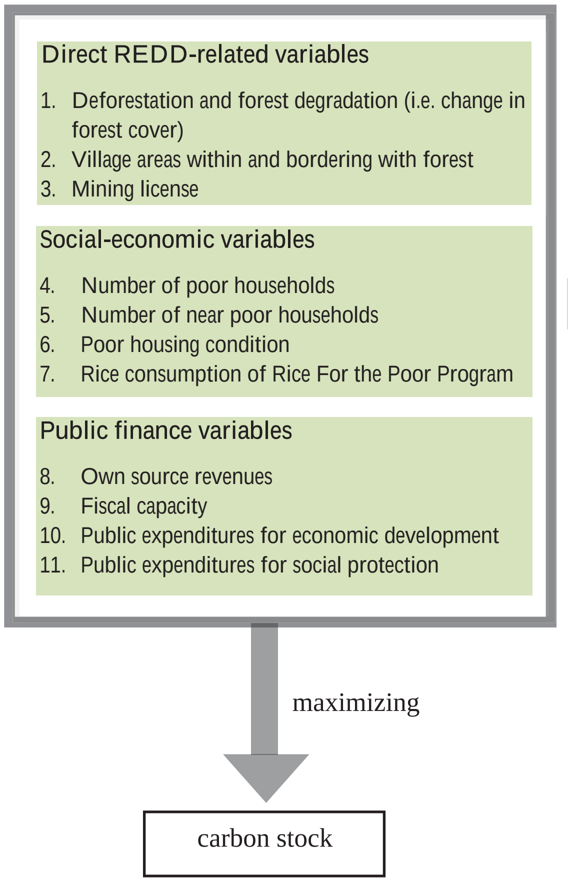
A value of θ=1 indicates that the performance of sub-district in concern is fully efficient (i.e. 100% efficient), while a value of θ>1 signifies that the sub-district is inefficient or weakly efficient. The restriction $\sum_{j}^{J} z_j = 1$ is imposed to allow for variable returns to scale.

Variables

Deforestation and forest degradation are caused by multiple drivers. The reasons why tropical forests have disappeared and continue to disappear include both proximate and underlying causes (e.g. Geist and Lambin, 2002; Angelsen and Kaimowitz, 1999). Proximate causes can be human activities or immediate actions that come from land use and with a direct impact on forests. These rather local causes include, among others, infrastructure extension (such as for roads or mining-related activities), agricultural extension (such as for cultivation) and wood extraction. Underlying causes, which constitute fundamental social processes, define the proximate causes just mentioned. These causes operate at local as well as national and global level (Geist and Lambin, 2002). Underlying causes include demographic, economic, technological, policy and institutional as well as cultural factors. Economic factor is one underlying cause which, in the view of Geist and Lambin (2001:9), takes in specific economic structures whose examples include poverty and related factors, such as lack of income opportunities, joblessness, resource poverty and low living standard.

The present study basically utilizes three set of variables or indexes: (i) variables related directly to REDD such as deforestation and forest degradation, territory within and bordering with forest and mining license; (ii) social variables, mostly related to poverty, such as the number of poor and near poor households, their housing condition and rice consumption; and (iii) economic and public finance variables including own source revenues, fiscal capacity and public expenditures for economic development and for social protection. **Figure 3** illustrates the relationship between input variables and output variable. Using output-oriented data envelopment model, carbon stock is to be maximized by taking these variables simultaneously into consideration. Overall there are one output variable (i.e. carbon stock) and eleven input variables.[2] The names and descriptions of the variables used in this analysis are given in **Table 3**.

FIGURE 3: THE RELATIONSHIP AMONG VARIABLES USED IN THIS STUDY



The rationale for variables related directly to REDD seems straightforward. As elaborated above, human settlement inside and adjacent to forest area and mining activities have been identified as proximate causes for deforestation. As for social dimensions, the number of poor and near poor household, their housing and consumption conditions are selected to be representative of poverty indicator. In Indonesia, the poor spend considerable part of their income for food (e.g. Sumarto et al, 2006).

2 The efficiency plot of each variable is depicted in Figure A1 in appendix.

Name of Variable	Role in Frontier Analysis	Operational Definition	Data Source	Notes on Data
Carbon stock	Output	Carbon stock (ton C/ha) in 2011.	Unpublished UN REDD database. Base data is from the Ministry of Forestry.	Total carbon stock is defined from total area of a given jurisdiction multiplied by carbon stock of land cover derived from spatial analysis.
Deforestation and forest degradation	Input	Deforestation and forest degradation occurring from 2009 to 2011.	Unpublished UN REDD database. Base data is from the Ministry of Forestry.	Deforestation refers to changes in carbon stock, counted from previous reference year. Forest degradation refers to changes in forest cover.
Villages inside the forest area and bordering with forest	Input	The territory which is located both inside and bordering with forest area, in hectare.	Village Potential data from Podes 2011.	The summation of village area inside the forest and one third of the village area bordering with forest are utilized in this variable. They are derived from village level data and scaled up to sub-district level.
Mining license	Input	The area of mining licenses in the form of IUP (mining business license) both under the active and non-active status, for both exploration and exploitation granted as of 2010, in Ha.	Dinas Energi dan Sumberdaya Mineral Daerah Provinsi Sulawesi Tengah (2010).	Area is based on the total area of village (*desa/kelurahan*) mentioned in IUP. Cross-district mining licenses are excluded from the data. There are additional 72,500 ha nickel concessions covering cross-district area between Morowali-Banggai and Tojo Una Una-Banggai, which are not included here.
Poor household	Input	The number of poor family using both the category of Pra-Sejahtera and Sejahtera II (under BKKBN category) and very poor and poor (under the category of BPS) in 2010.	Various Daerah Dalam Angka publications (2010) and from Badan Pusat Statistik (2011).	Data is transformed from district/municipal data weighted by the number of households of each sub-district from Podes 2011.
Near poor household	Input	The number of family categorized as near poor, in 2010.	Badan Pusat Statistik (2011).	Data is transformed from district/municipal data weighted by the number of household of each sub-district from Podes 2011.
Poor house condition	Input	The number of poor household with house floor per capita less than or equal to 8 m^2, in 2010.	Badan Pusat Statistik (2011).	Data is transformed from district/municipal data weighted by the number of household of each sub-district from Podes 2011.

Rice consumption of the poor	Input	Average house consumption of rice from rice for the poor program (Raskin) in 2010, in Kg.	Badan Pusat Statistik (2011).	Data is transformed from district/municipal data weighted by the number of population of each sub-district from Podes 2011.
Own source revenue	Input	Own source revenue in 2011, in percentage of total (Central Sulawesi = 100).	Penjabaran Anggaran pendapatan dan Belanja Daerah Tahun Anggaran 2012, (Revenue and Expenditure Plan 2012) from 10 Districts and 1 Municipality.	Data is transformed from district/municipal data weighted by the number of population of each sub-district from Podes 2011.
Fiscal capacity	Input	Own source revenue in 2011 consisting own source revenues and balancing fund from central government to district/municipality government, in percentage of total (Central Sulawesi = 100).	Penjabaran Anggaran pendapatan dan Belanja Daerah Tahun Anggaran 2012, (Revenue and Expenditure Plan 2012) from 10 Districts and 1 Municipality.	Balancing fund includes general-purpose transfer (DAU) and revenue-sharing arrangements (DBH). Data is transformed from district/municipal data weighted by the number of population of each sub-district from Podes 2011.
Expenditure for economic purpose	Input	Function-based public expenditure for economic purpose in 2011, in percentage of total (Central Sulawesi = 100).	APBD data, Direktorat Jenderal Perimbangan Keuangan, Kementerian Keuangan RI (Directorate General for Fiscal Balance, Ministry of Finance, the Republic of Indonesia).	In Indonesia, public expenditures are classified and documented based on public function (*fungsi*) and sector (*urusan*); the former is used in this study to better address the explicit use of expenditures. Data is transformed from district/municipal data weighted by the number of population of each sub-district from Podes 2011.
Expenditure for social protection	Input	Function-based public expenditure for social protection in 2011, in percentage of total (Central Sulawesi = 100).	APBD data, Direktorat Jenderal Perimbangan Keuangan, Kementerian Keuangan RI (Directorate General for Fiscal Balance, Ministry of Finance, the Republic of Indonesia).	In Indonesia, public expenditures are classified and documented based on public function (*fungsi*) and sector (*urusan*); the former is used in this study to better address the explicit use of expenditures. Data is transformed from district/municipal data weighted by the number of population of each sub-district from Podes 2011.

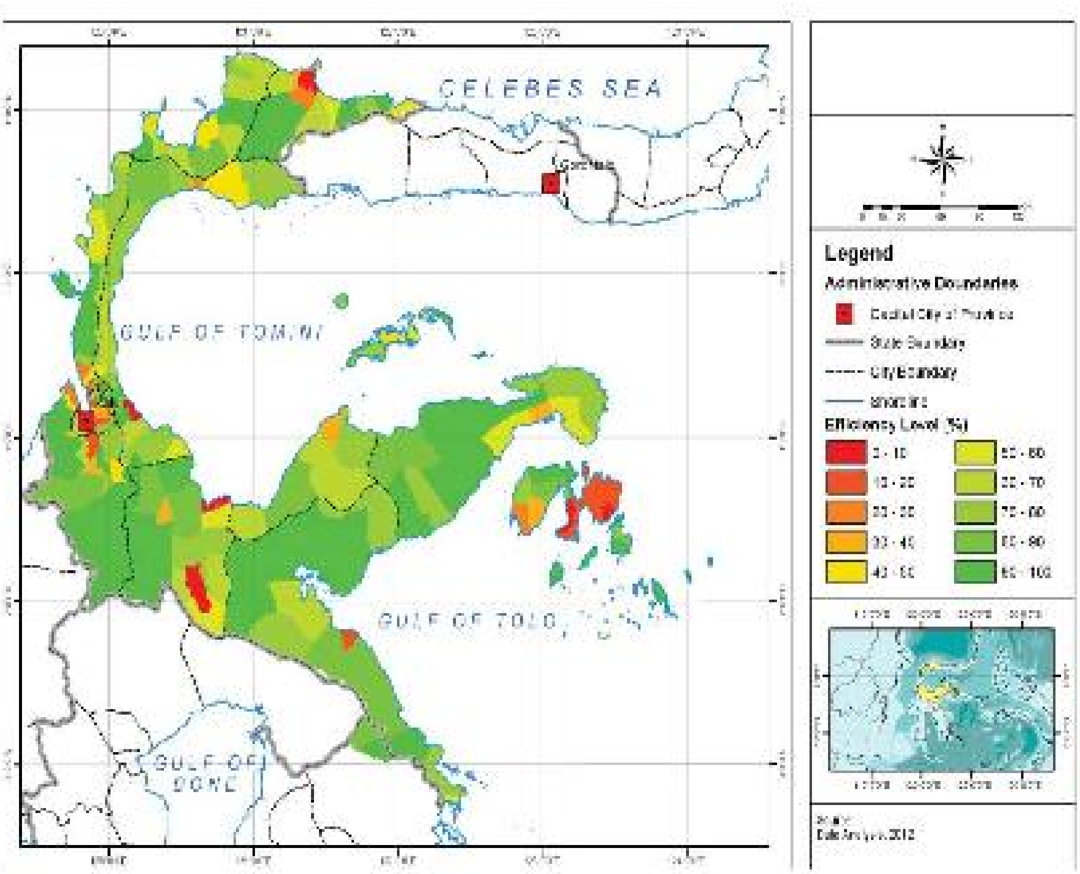
The choice of employing public finance-related variables is driven by the following considerations. First, revenues from own source and from transfers represent the level of wealth of a particular district or municipality as well as a proxy for its institutional capacity in delivering public functions for ecological or social-economic measures (Mumbunan, 2011). Second, in the literature about REDD+ in Indonesia there is an increasing tendency to use revenue-sharing based instruments and arrangements to collect revenues from REDD+ projects (Indartik et al, 2010) and to distribute REDD+ funds to local governments (e.g. Busch et al, 2012). If implemented, these instruments and arrangement would a ect own source revenues, fiscal capacity and the capacity for public goods provision of the jurisdiction in concern. Third, for conceptual and practical reasons, the use of public finance variables to some degree simultaneously consider demographic dimension as the data employed are transformed through either the number of population or households.

5. Results and Discussions

Sub-district Efficiency Level

The linear programming method facilitates identification of efficient sub-district(s) which maximize its/their carbon stock given a set of variables defined in Section 4.2. The analysis found that there are 38 sub-districts which are 100% efficient in the sense that they lie in the efficiency frontier. In terms of policy making, efficient sub-districts are highly recommended for intended REDD+

FIGURE 4. SPATIAL DISTRIBUTION FOR ALL EFFICIENCY LEVELS (100-0%) AT SUB-DISTRICT LEVEL



demonstration activities in Central Sulawesi. In these sub-districts, the maximum potential carbon stock is achieved given the inputs of its existing social-economic and other conditions concerned in this study.

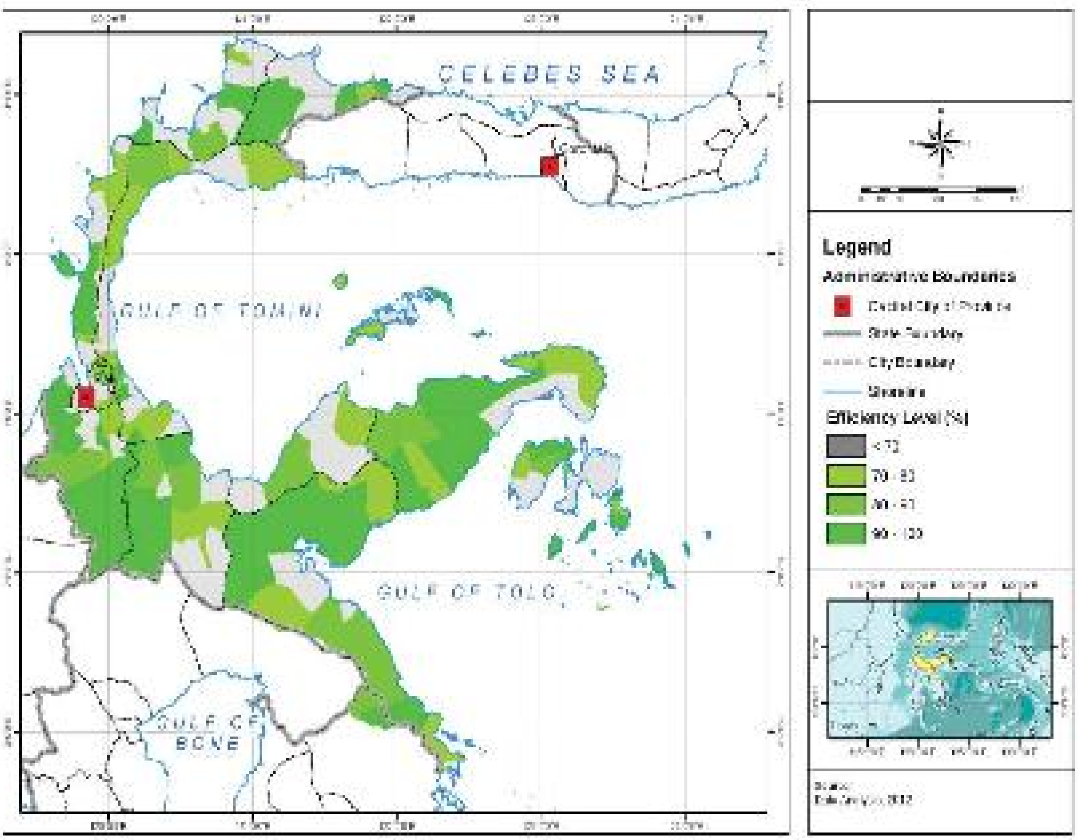
Table A1 in appendix provides the efficiency level for all sub-districts whereas technical information on the efficient sub-districts is given in **Table A.2**. The District of Sigi turns out to have the most efficient sub-districts (8 sub-districts), followed by the districts of Banggai and Banggai Kepulauan (each 6) and Buol (4).

Spatial Distribution

Spatial distribution based on the efficiency level of sub-district for all levels, i.e. from 100 to 0% level, is depicted in **Figure 4**. As can be seen, expectedly the entire sub-districts in the capital (Palu) and its surroundings, some in the north of Buol and the east of Poso, as well as those in the east of the main island in Banggai Kepulauan District, belong to clusters of the least efficient sub-districts.

When the level of efficiency is confined to only those scoring in the range of 70-100%, as illustrated in **Figure 5**, sub-districts with higher efficiency levels seem to concentrate in some areas such as in the border between Tolitoli and Buol or between Donggala and Poso. The same observation also applies to the northern and southern parts of Morowali, as well as in the interior area of Banggai.

FIGURE 5. SPATIAL DISTRIBUTION FOR SELECTED EFFICIENCY LEVELS (100-70%) AT SUB-DISTRICT LEVEL



Comparison with Existing Policy

A study on selecting priority district and municipality for REDD+ Demonstration Activities locations had been undertaken by the provincial Forestry Agency (Dinas Kehutanan Provinsi Sulawesi Tengah, 2012). The recommendation of this study has been adopted as a policy under a Governor Decree.[3] In decreasing order of priority, the study selected and proposed Donggala, Tolitoli, Sigi, Tojo Una Una and Parigi Moutong for locations of REDD+ Demonstration Activities in the province. The unit of analysis is district/municipality level (n=11).

There are three set of indicators employed in this study with a pre-determined weight assigned to each set, i.e. local government support (weight: 25%), demographic (weight: 20%), and forest biophysical indicators (weight: 55%). Indicator of local government support comprises criteria of budget allocation, institution for forest management, cooperation between local government and community as well as between private/NGO and community. Demographic indicator includes the number of village, population density and human resources. Forest biophysical indicators consist of carbon stock, area of critical land, forest area, forest cover, and management of forest area. All indicators are ordered according to three simple measures – high, middle, low. District and municipality are then ranked on the basis of their weighted value of the indicators.

Although seemingly similar, this study is not to be compared directly with the present study. The two studies serve somewhat different purposes and employ different methodologies. They also put different emphasis on several aspects. **Table 4** presents their differences, whereas **Table 5** shows the comparison of the two studies' results.

TABLE 4: DIFFERENCES IN THE TWO STUDIES

Items	The Study by Forestry Agency	The Present Study
Unit of analysis	District/municipality	Sub-district/sub-municipality
Number of observation	11	155
Methodology	Description scoring with weighted value from all indicator	Output-oriented linear programming (DEA) with variable returns to scale specification
Category of indicator	Biophysical, government support, and demographic indicators	Biophysical, social-economic, and public finance indicators
Weighting to indicator	Pre-determined weight with 55% assigned to forest biophysical indicator category	No weight assigned to indicator; referring to the efficient frontier which maximizes carbon stock
Basis of indicator selection and public policy legitimacy	Based on policy document; likely to have high policy legitimacy	Based on scientific references; likely to have moderate policy legitimacy
Consideration of demographic dimension	Direct and explicit, with demographic indicators	Indirect (i.e. transformed data through population and household proportions) and somewhat direct (i.e. indicator of the amount of poor and near poor households).
Consideration of poverty	None	Direct and explicit with poverty indicators
Consideration of institutional capacity	Direct, with indicators under government support category	Indirect, with indicators under public finance category

[3] Keputusan Gubernur Sulawesi Tengah No. 533/330/DISHUTDA-G.ST/2012

TABLE 5: COMPARISON BETWEEN THE PROPOSED PRIORITY AREA AND THE PRESENT STUDY

Level of priority	The study of Forestry Agency (2012)				The present study			
	Jurisdiction	Priority points	Carbon stock (MtC)	Deforestation and forest degradation (Million Ha)	Jurisdiction	Number of efficient sub-districts	Carbon stock (MtC)	Deforestation and forest degradation (Million Ha)
First	Donggala	68.8	73.6	0.50	Sigi	8	72.5	0.49
Second	Tolitoli	66.8	45.2	0.35	Banggai	6	118.7	0.92
					Banggai Kep.	6	19.5	0.31
Third	Sigi	65.9	72.5	0.49	Buol	4	57.2	0.38
Fourth	Tojo Una Una	65.4	63.1	0.49	Morowali	3	190.3	1.31
					Donggala	3	73.6	0.50
Fifth	Parigi Moutong	63.4	81.1	0.61	-			
AVERAGE			67.1	0.49			88.6	0.65

4. Concluding Remarks

Social-economic dimensions are important for REDD+ sustainability. Social-economic analysis in this study aims to see the consideration of social economic dimensions in more explicit ways into the discourse about and decision on jurisdictional selection for REDD+ activities. These social economic dimensions are reflected in this study both directly, such as in poverty-related variables, or indirectly, such as in the variable of public expenditures for social protection. These dimensions are treated with the objective of maximizing potential carbon stock which is in line with REDD+ objectives. Linear programming method is employed to derive the most efficient jurisdictions that use their existing social-economic, biophysical and public capacities in achieving this carbon objective. Sub-district (*kecamatan*) becomes the jurisdictional level chosen as the unit of analysis for this study. 155 sub-districts in Central Sulawesi, one of REDD+ pilot provinces in Indonesia, serve the context of the study.

The study found that there are 38 efficient sub-districts, and a number of more sub-districts with di erent degree of efficiency, that can be proposed as candidate sites for REDD+ activities. Sigi (8 sub-districts), Banggai and Banggai Kepulauan (both 6), Buol (4) and Morowali and Donggala (both 3) constitute districts with the most number of efficient sub-districts.

The study was also able to make comparisons with the study REDD+ demonstration activities site selection in Central Sulawesi whose results and recommendation have become the basis for a decree and provincial plan of REDD+ locations. Despite several di erences in conceptual and methodological features between these two studies, the present study shows a possibility and the importance of incorporating social-economic dimensions for the purpose of REDD+ site selection. The districts which are proposed by the present study have more average tones of carbon stock and higher rates of deforestation and forest degradation than ones selected and proposed by the alternative study. The present study suggests that there is a greater possibility to enhance more carbon stock and to reduce more deforestation and forest degradation if social-economic dimensions are taken into account of REDD+ site selection.

5. Implications for REDD+

The study can serve one technical tool to help decision making process on the planned REDD+ activities in Central Sulawesi. In particular, if social-economic dimensions are taken as important attributes that are likely to determine the success or failure of REDD+ scheme. The study provided one plausible way to incorporate social-economic dimensions into REDD+ and was able to underscore its empirical importance in the context of REDD+ selection in the context under investigation, relative to existing alternative policy, in achieving REDD+ objectives. It is advisable to consider social-economic dimensions for future selection of REDD+ location, along with heavily carbon or forest related dimensions, especially when REDD+ implementation would make use of public mechanism and institution and put in place in areas where welfare issues such as poverty of forest-dependent communities is a concern.

In terms of conceptual and methodological implications for future REDD+ site selection, there is a need for a hybrid approach. Conceptually, more comprehensive dimensions relevant to REDD+ activities should also be plausible to be addressed under the framework of such an approach, including biodiversity conservation provided that species data at sub-district level are available. In this approach, a more subjective method (such as under the proposal of Dinas Kehutanan Sulawesi Tengah, 2012) can be integrated with a more objective method (as in the present study). Methodologically, subjective judgments that arise for instance from public deliberative process or from pre-determined public policy decision in early stages can then be integrated with objective ways of synthesizing these judgments together with hard biophysical, social-economic and institutional information. (An example for such a combination can be seen in Takamura and Tone, 2003, although it is in a di erent policy context).

It can be expected that such a hybrid, integrated approach should have sounder foundations than standard approach to locations for REDD+ activities. Furthermore, it may provide better policy legitimacy for REDD+, both in terms of political support from decision makers and of scientific basis.

Acknowledgements

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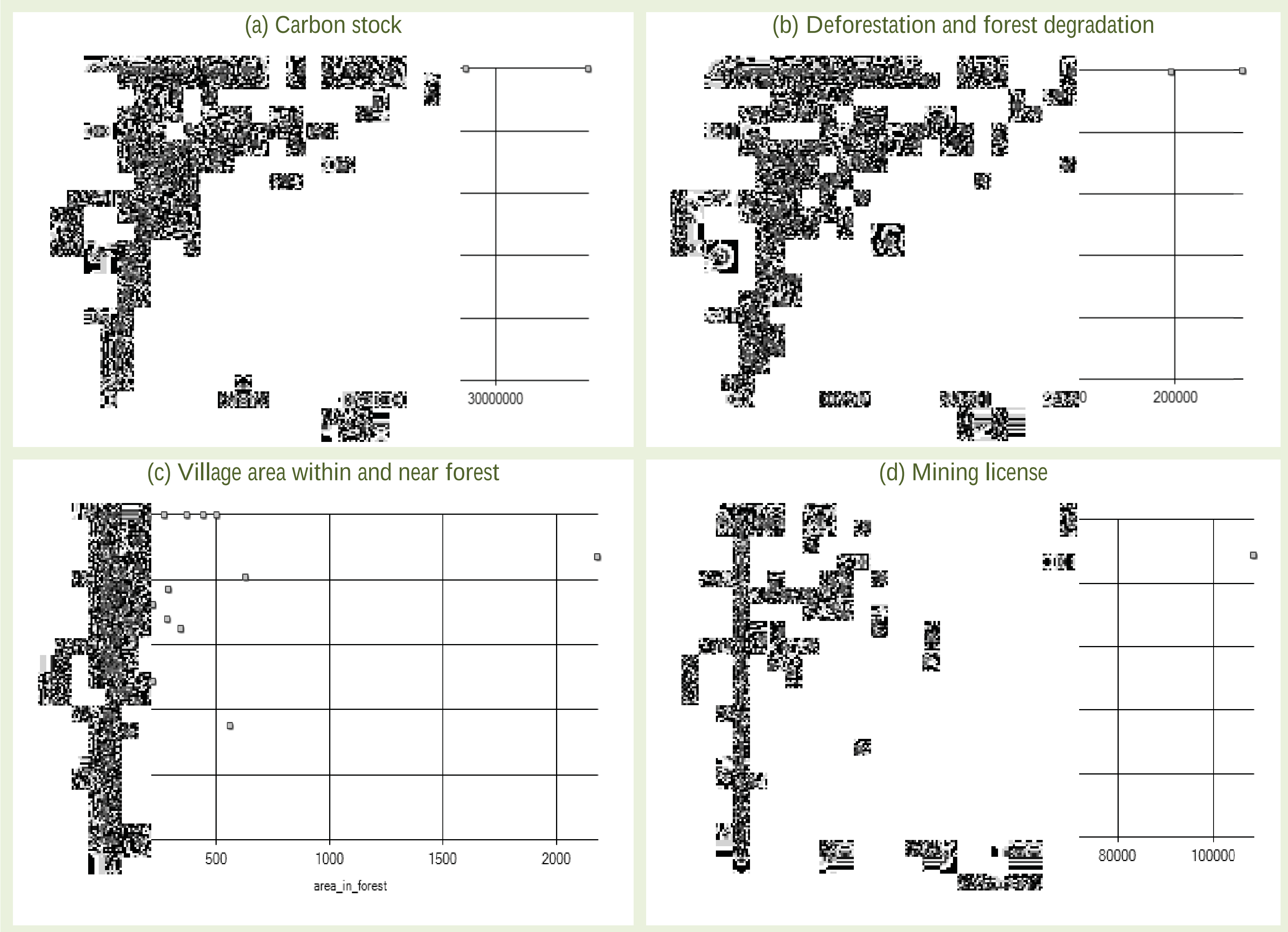
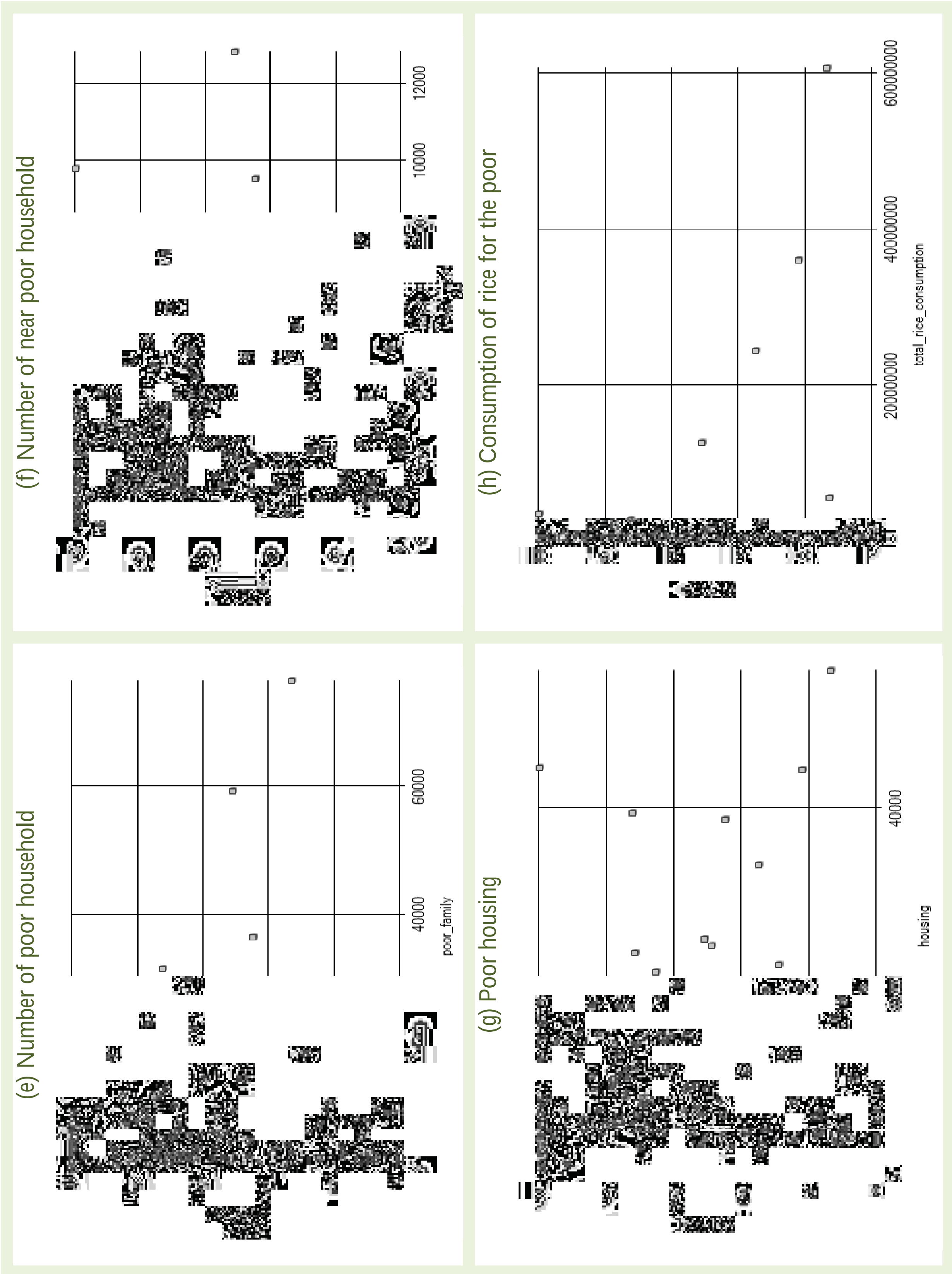
Appendices

Figure A1. Efficiency plots of each variable




(e) Number of poor household
40000
60000
poor_family
(f) Number of near poor household
10000
12000
(g) Poor housing
40000
housing
(h) Consumption of rice for the poor
200000000
400000000
600000000
total_rice_consumption

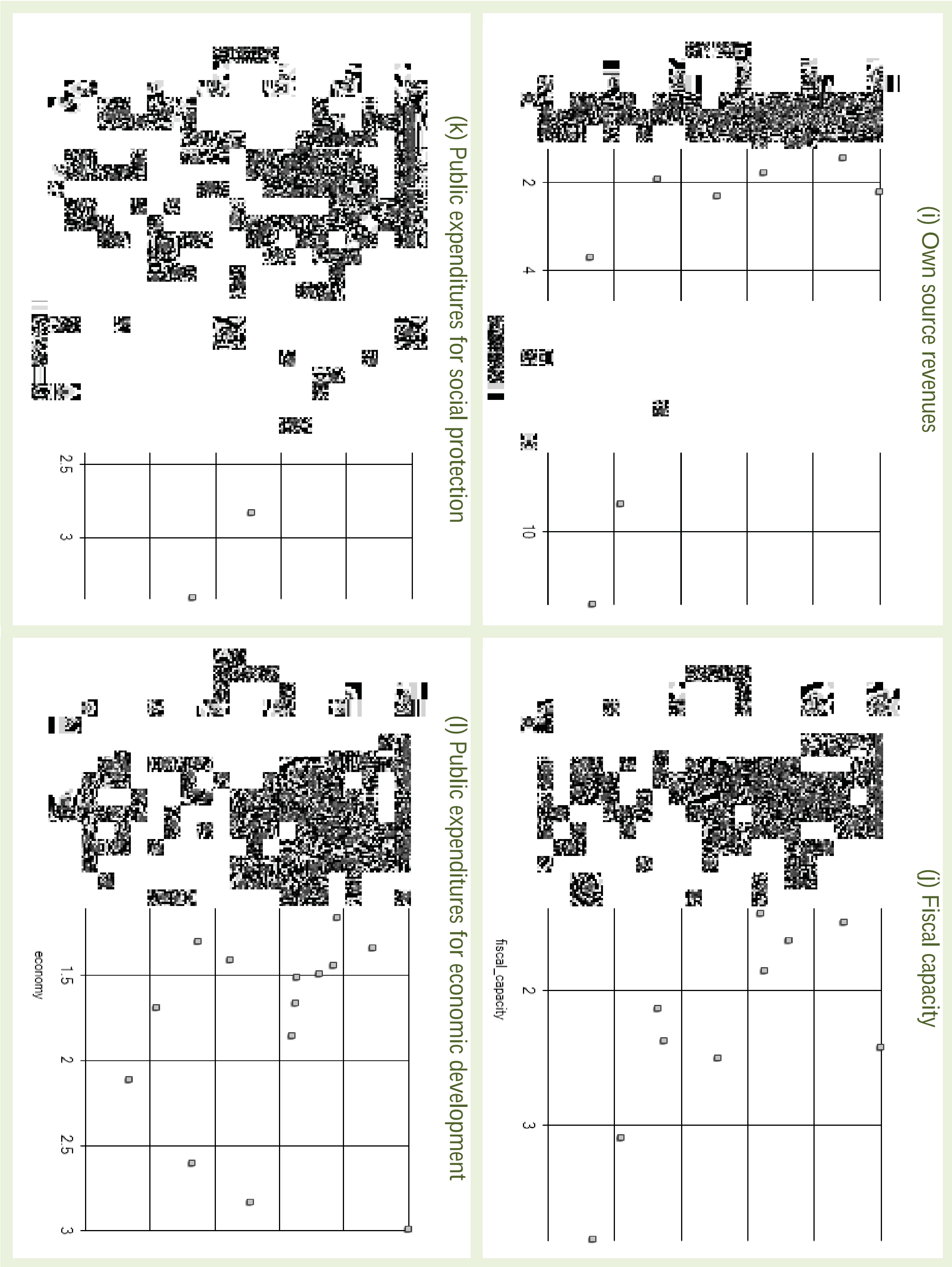

(i) Own source revenues
(j) Fiscal capacity
fiscal_capacity
(k) Public expenditures for social protection
(l) Public expenditures for economic development
economy

Table A1. Level of efficiency for each sub-district

District / Municipality	Sub-district	Percentage	Bar Graph
Banggai Kepulauan	Labobo	100	100%
	Bokan Kepulauan	100	100%
	Bangkurung	96.3	96%
	Banggai	74.1	74%
	Banggai Utara	100	100%
	Banggai Tengah	100	100%
	Banggai Selatan	100	100%
	Totikum	10.5	10%
	Totikum Selatan	8.3	8%
	Tinangkung	17.4	17%
	Tinangkung Selatan	11.4	11%
	Tinangkung Utara	12	12%
	Liang	13.2	13%
	Peling Tengah	9.6	10%
	Bulagi	87	87%
	Bulagi Selatan	33.2	33%
	Bulagi Utara	100	100%
	Buko	71.2	71%
	Buko Selatan	25.3	25%
Banggai	Toili	77.8	78%
	Toili Barat	100	100%
	Moilong	0	
	Batui	97.2	97%
	Batui Selatan	0	
	Bunta	100	100%
	Nuhon	87.3	87%
	Simpang Raya	100	100%
	Kintom	100	100%
	Luwuk	50.9	51%
	Luwuk Timur	34.1	34%
	Pagimana	92.9	93%
	Bualemo	79.3	79%
	Lobu	100	100%
	Lamala	50.9	51%
	Masama	52.1	52%
	Balantak	70.8	71%
	Balantak Selatan	100	100%
Marowali	Menui Kepulauan	52.5	52%

	Bungku Selatan	78.5	78%
	Bahodopi	100	100%
	Bungku Tengah	89	89%
	Bungku Barat	81.2	81%
	Bumi Raya	18.1	18%
	Wita Ponda	83.7	84%
	Lembo	74.5	75%
	Mori Atas	99.4	99%
	Mori Utara	0	
	Petasia	65.1	65%
	Soyo Jaya	100	100%
	Bungku Utara	100	100%
	Mamosalato	78.8	79%
Poso	Pamona Selatan	55.9	56%
	Pamona Barat	64.4	64%
	Pamona Tenggara	43.3	43%
	Lore Selatan	99.1	99%
	Lore Barat	100	100%
	Pamona Pusalemba	0	
	Pamona Timur	67.8	68%
	Pamona Utara	77.1	77%
	Lore Utara	87	87%
	Lore Tengah	100	100%
	Lore Timur	35	35%
	Lore Peore	92.2	92%
	Poso Pesisir	84.8	85%
	Poso Pesisir Selatan	81.8	82%
	Poso Pesisir Utara	97.7	98%
	Lage	50.8	51%
	Poso Kota	7	7%
	Poso Kota Utara	9.3	9%
	Poso Kota Selatan	17.7	18%
Donggala	Rio Pakava	82.6	83%
	Pinembani	100	100%
	Banawa	28.9	29%
	Banawa Selatan	91.9	92%
	Banawa Tengah	57.7	58%
	Labuan	57	57%
	Tanantovea	73.7	74%
	Sindue	28.3	28%
	Sindue Tombusabora	70.6	71%
	Sindue Tobata	100	100%
	Sirenja	95.3	95%

	Balaesang	100	100%
	Balaesang Tanjung	0	
	Damsol	59.7	60%
	Sojol	73.2	73%
	Sojol Utara	66	66%
Toli-Toli	Dampal Selatan	100	100%
	Dampal Utara	54.2	54%
	Dondo	63.2	63%
	Ogodeide	46.6	47%
	Basidondo	82.3	82%
	Baolan	100	100%
	Lampasio	67.7	68%
	Galang	65.2	65%
	Tolitoli Utara	62.7	63%
	Dako Pamean	72.2	72%
Buol	Lakea	100	100%
	Biau	63.8	64%
	Karamat	39	39%
	Momunu	24.9	25%
	Tiloan	100	100%
	Bokat	53.4	53%
	Bukal	67.9	68%
	Bunobogu	100	100%
	Gadung	71.3	71%
	Paleleh	46	46%
	Paleleh Barat	100	100%
Parigi Moutong	Sausu	56.5	56%
	Torue	77.1	77%
	Balinggi	72	72%
	Parigi	3.8	4%
	Parigi Selatan	61.1	61%
	Parigi Barat	100	100%
	Parigi Utara	100	100%
	Parigi Tengah	86.8	87%
	Ampibabo	64.7	65%
	Kasimbar	69.3	69%
	Toribulu	62.1	62%
	Siniu	77.4	77%
	Tinombo	71.4	71%
	Tinombo Selatan	76.5	76%
	Tomini	72.1	72%
	Mepanga	22.9	23%

	Palasa	84.3	84%
	Mouton	78	78%
	Bolano Lambunu	44.6	45%
	Taopa	74.9	75%
Tojo Una-Una	Tojo Barat	68.3	68%
	Tojo	80.9	81%
	Ulubongka	68.9	69%
	Ampana Tete	76.7	77%
	Ampana Kota	32.8	33%
	Una - una	76.1	76%
	Togean	46.3	46%
	Walea Kepulauan	55	55%
	Walea Besar	100	100%
Sigi	Pipikoro	100	100%
	Kulawi Selatan	100	100%
	Kulawi	100	100%
	Lindu	100	100%
	Nokilalaki	100	100%
	Palolo	48.7	49%
	Gumbasa	78.7	79%
	Dolo Selatan	88.4	88%
	Dolo Barat	38.5	38%
	Tanambulava	100	100%
	Dolo	100	100%
	Sigi Biromaru	72.5	72%
	Marawola	10.6	11%
	Marawola Barat	100	100%
	Kinovaro	69.3	69%
Palu	Palu Barat	22	22%
	Palu Selatan	13.3	13%
	Palu Timur	34.6	35%
	Palu Utara	12.7	13%

Table A2: Technical DEA information of the efficient sub-districts (efficiency level = 100%, –=1).

Item	Carbon stock	Deforestation and forest degradation	Village in and near forest	Mining license	Number of poor household	Number of near poor household	Number of poor housing	Rice consumption of poor household	Own source revenues	Fiscal capacity	Expenditures for social protection	Expenditures for economic purposes
LABOLO, Banggai Kepulauan. *Frequency = 14.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.23	2.13	0	0	1.58	0	0	0	0	0	0.34	0
Targets	897,301	7,386	0	0	801	738	2,974	558,344	0.12	0.23	0.05	0.18
BOKAN KEPULAUAN, Banggai Kepulauan. *Frequency = 8.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.04	0.55	0	0	0	0	0	0	0	0	3.03	0
Targets	2,413,328	24,119	0	0	1,462	1,510	6,088	2,181,204	0.24	0.48	0.11	0.36
BANGGAI UTARA, Banggai Kepulauan. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	2.66	7.94	0.27	0	0	0	0	0	0	0	4.45	0
Values	498,893	4,370	12	0	1,007	823	3,317	600,665	0.13	0.26	0.06	0.2
BANGGAI TENGAH, Banggai Kepulauan. *Frequency = 11.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.24	1.93	0	0	0	0	0	0	0	0	0.89	0
Targets	853,954	5,359	0	0	1,309	853	3,439	588,630	0.14	0.27	0.06	0.2
BANGGAI SELATAN, Banggai Kepulauan. *Frequency = 15.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.54	1.89	0	0	0	0	0	0	0	0	0.57	0
Targets	143,1987	8,743	9	0	938	655	2,641	440,010	0.1	0.21	0.05	0.16
BULAGI UTARA, Banggai Kepulauan. *Frequency = 2.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.21	0.03	0.19	0	0	0	0	0	0	0	6.32	0
Targets	3,164,150	36,647	22	0	1,762	1,213	4,889	1,461,967	0.19	0.38	0.09	0.29
TOILI BARAT, Banggai. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.04	0	17.46	0	0	0	0	0	0	0	0	0
Targets	10,757,392	81,320	1	9,000	4,386	3,583	7,219	8,946,321	0.64	0.7	0.79	0.79
BUNTA, Banggai. *Frequency = 5.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.97	1.02	0	0	0	0	2.14	0	0	0	0.1	0
Targets	10,447,995	72,731	0	6,875	3,410	3,174	6395	6,888,345	0.57	0.62	0.7	0.7

SIMPANG RAYA, Banggai. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	46,891.92	0	0	0	0	0	0	0	0	0	0	623,790.98
Targets	1	0	0	0	1,784	2,353	4,742	3,429,056	0.42	0.46	0.52	0.52
KINTOM, Banggai. *Frequency = 13.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.97	1	0	0	0	0	0.07	0	0	0	0	0
Targets	8377679	61,655	0	0	1,800	2,260	4,554	3,785,429	0.4	0.44	0.5	0.5
LOBU, Banggai. *Frequency = 10.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	46862.54	0	0	0	0	0	0	0	0	0	0	147,344.32
Targets	1	0	109	0	131	589	1,186	294,452	0.11	0.11	0.13	0.13
BALANTAK SELATAN, Banggai. *Frequency = 11.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	46,862.54	0	8,932.16	0	0	0	0	0	0	0	0	158,767.17
Targets	1	0	8	0	248	782	1,575	601,270	0.14	0.15	0.17	0.17
BAHADOPI, Morowali. *Frequency = 13.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.01	1.07	0	0	0	0	0	0	0	0	0	0.26
Targets	14,680,651	81,456	27	70,032	1,191	894	3,832	528,596	0.35	0.36	0.43	0.33
SOYO JAYA, Morowali. *Frequency = 6.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.99	0.77	0.11	0.03	0	0	0	0	0	0	0	1.48
Targets	19,574,217	120,957	33	16,904	1,546	1,025	4,395	677,285	0.4	0.42	0.5	0.38
BUNGKU UTARA, Morowali. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.97	0.74	0	0	0	0	0	0	0	0	0	0
Targets	37,213,735	230,773	198	6,180	5,708	1,997	8,563	2,431,143	0.78	0.81	0.97	0.73
LORE BARAT, Poso. *Frequency = 28.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.09	1.32	0.01	0	0	0	0	0	0	0	0.4	0
Targets	5,484,739	30,887	140	0	216	405	1,563	294,395	0.12	0.14	0.14	0.14
LORE TENGAH, Poso. *Frequency = 4.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.02	0.84	0.01	0	0	0	0.46	0	0	0	0	1.76
Targets	10,209,516	64,542	502	0	473	566	2,187	721,733	0.17	0.19	0.19	0.19
PINEMBANI, Donggala. *Frequency = 23.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0

Weights	1.03	1.25	0	0	0	0	0	0	0	0	0.37	0
Targets	8,748,281	48,595	371	0	622	747	4,310	172,665	0.16	0.2	0.22	0.19
SINDUE TOBATA, Donggala. *Frequency = 33.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.99	1.54	0	0	0	0	0	0	0	0	0.71	0
Targets	4,698,507	25,697	0	0	1410	1105	6377	405,316	0.23	0.29	0.32	0.29
BALAESANG, Donggala. *Frequency = 8.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.98	1.08	0	0	0.19	0	0	0	0	0	0	0
Targets	7,914,373	46,810	0	17,000	8,917	2,883	16,644	2,379,371	0.61	0.75	0.84	0.75
DAMPAL SELATAN, Toli-Toli. *Frequency = 2.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.08	1.3	0	0	5.49	0	0	0	0	0	0	0
Targets	2,229,207	21,474	0	4,204	543	3,336	15,084	5,678,717	0.75	0.83	0.54	1.02
BAOLAN, Toli-Toli. *Frequency 11.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.97	1.14	0	0	0	0	0	0	0	0	0	0
Targets	8,009,954	53,726	0	0	4,432	9,776	44,204	35,219,582	2.19	2.42	1.59	2.99
LAKEA, Buol. *Frequency = 92.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.92	0	0	0	0	0	0	0	0	0	0	0
Targets	1,683,116	0	0	0	3,215	1,659	5,947	414,892	0.4	0.56	0.7	0.73
TILOAN, Buol. *Frequency = 70.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.97	1.17	0.05	0	0	0	0	0	0	0	0	0.41
Targets	27,620,751	152,827	59	0	3,753	1,662	5,956	563,657	0.4	0.56	0.71	0.73
BUNOBOGU, Buol. *Frequency = 2.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.99	1.13	0	0	0	0.12	1.74	0	0	0	0	0
Targets	4,789,204	28,901	0	0	2,707	1,479	5,302	370,130	0.35	0.5	0.63	0.65
PALELEH BARAT, Buol. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.44	1.52	0.14	0	0	0	0	384.04	0	0	0	0
Targets	1,697,649	13,976	47	0	1,006	894	3,205	139,860	0.21	0.3	0.38	0.39
PARIGI BARAT, Parigi Moutong. *Frequency = 9.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.4	1.63	0.13	0	0	0	0	0	0	0.14	0	0.78
Targets	1,841,968	10,907	12	0	584	1,211	4,927	278,358	0.09	0.16	0.2	0.18

PARIGI UTARA, Parigi Moutong. *Frequency = 2.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	2.17	2.25	0.42	0	0	0	0	0	0	7.32	0	0
Targets	697,938	6,053	39	0	358	991	4,033	15,6340	0.07	0.13	0.17	0.15
PIPIKORO, Sigi. *Frequency = 6.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.99	0.92	0	0	0	0	0	0	0	0	0	1.37
Targets	16,498,202	102,089	443	0	1,196	1,385	7,228	1,156,904	0.09	0.3	0.35	0.27
KULAWI SELATAN, Sigi. *Frequency = 11.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.05	1.27	0.03	0	0	0	0	0	1.86	0	0	0.1
Targets	7,284,149	41,811	85	0	1,285	1,493	7,788	1,149,448	0.1	0.32	0.38	0.3
KULAWI, Sigi. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	0.98	1.01	0.17	0	0	0	0	0	6.17	0	0	0
Targets	18,416,622	113,889	50	0	3,839	2,487	12,980	3,696,321	0.17	0.54	0.64	0.49
LINDU, Sigi. *Frequency = 1*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.12	1.29	0	0	0	0	0	0	10.77	0	0	0
Targets	4,777,685	32,149	273	0	409	830	4,334	376,894	0.06	0.18	0.21	0.16
NOKILAKI, Sigi. *Frequency = 2.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.18	1.31	0.18	0	0	0	0	0	5.2	0	0	0
Targets	3,562,317	23,166	16	0	550	995	5,191	474,441	0.07	0.21	0.25	0.2
TANAMBULAVA, Sigi. *Frequency = 3.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.14	1.67	0	0	0	0	0	0	14	0	0	0
Targets	1,256,760	11,455	0	0	1,070	1,389	7,247	920,746	0.09	0.3	0.36	0.27
DOLO, Sigi. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	46891.92	0	0	0	0	0	0	0	646,087.52	0	0	0
Targets	1	0	0	0	7,063	3,636	1,8974	5,853,824	0.25	0.79	0.93	0.72
MARAWOLA BARAT, Sigi. *Frequency = 1.*												
Slacks	0	0	0	0	0	0	0	0	0	0	0	0
Weights	1.27	1.56	0	0	0	0	0	0	7.3	0	0	0
Targets	2,545,237	15,824	118	0	704	1,127	5,879	606,146	0.08	0.24	0.29	0.22