Statistical Sampling Frame and Methods Used for the Selection of Villages and Households in the Scope of the Research Program on Stability of Rainforest Margins in Indonesia (STORMA)

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1. Introduction

1.1 Research area

The Lore Lindu National Park (LLNP) is located in the province of Central Sulawesi, Indonesia, south of its capital Palu (see Figure 1). The park hosts some of the world's most unique plant and animal species. However, changing land use systems are threatening the integrity of the park as is the increase of land used for farming. These processes are being studied by an international group of scientists in a program known as STability Of Rain forest MArgins (STORMA).

Figure 1: The Islands of Indonesia

STORMA is jointly undertaken by scientists from the Universities of Göttingen and Kassel in Germany and the Institut Pertanian Bogor and Universitas Tadulako in Indonesia. The research is funded by the German Scientific Foundation (DFG), and supported by a number of other organizations in Indonesia and Germany

The forest margins of the Lore Lindu National Park were selected as the research area (for a detailed map see Annex 1). In this area exists a great variation in ecology, agriculture and socio-economic conditions, while at the same time the area is confronted by many complicated problems. These are problems that will have to be confronted by policy makers at different levels of aggregation.

1.2 Scope and objectives of STORMA

The STORMA program has been divided into four sub-programs (Table 1) focusing on different disciplinary and interdisciplinary aspects of land use change and deforestation and its underlying causes as well as impacts on socio-economic development, nature conservation and ecology. A fifth subprogram Z provides support and central services to the four subprograms.

Table 1: Sub-programs of the STORMA program

Sub-Program	Field of research
A	Social and economic dynamics
B	Water and nutrient turnover
C	Biodiversity
D	Land use systems
Z	Support services to other projects

The sub-programs have been divided into projects. During the first phase from July 2000 to June 2003, the STORMA program comprises of 5 sub-programs and 20 projects. Over 100 German and Indonesian scientists and doctoral as well as M.Sc. students participate during the first phase of the program.

The overall goal of the STORMA program is to identify processes of destabilization and to determine factors of stabilization in forest margin areas. Several long-term objectives are pursued, namely:

- identification of ecological and socio-economic indicators of instability;
- development of principles and procedures of resource utilization that contribute to the stabilization of forest margins;
- development of procedures of resource utilization that contribute to the stabilization of the forest margins;
- promotion of interdisciplinary and intercultural research.

The guiding principles of the STORMA program are:

- agreement about the objects and sites of research to warrant synergistic cooperation among the projects and sub-programs;
- identification of options for participatory approaches in all sub-programs; the populations responsible for the use of resources should thus have the opportunity of intervention in all phases of the research process, bringing indigenous knowledge and local priorities to bear on the results;
- concentration of research on processes in the field, as far as possible outside the range of research stations;
- warranting transparent, systematic procedures of planning and decision-making, securing the parity of Indonesian and German scientists in the steering of the research.

It is foreseen that STORMA research would – on the basis of rigorous scientific research-generates policy-relevant information that may assist decision-makers at local, regional and national level to identify suitable options for development policy and projects.. Considering the objectives of the STORMA research program, there was general consensus that the working area of all STORMA projects should concentrate on the same subset of villages in the research area. The purpose of this paper is to describe the manner in which these villages were randomly selected and briefly discuss the preliminary survey that was conducted at the beginning of the program.

2. Sampling procedure at village level

2.1 Objectives and criteria for stratified sampling frame for villages

Overall, the research area is administratively divided into 5 sub districts (*kecamatan*) and 117 villages (*desa*). To facilitate cooperation among the different projects of STORMA, it was decided to define a sampling frame with commonly accepted stratification criteria. This would allow the random selection of villages in order to pursue the following objectives:

- Random selection of villages in the research area in which the different STORMA projects would focus their empirical work;
- Facilitation of information and data exchange and comparability among different projects.
- Reduction of costs for transport and other logistics.

The report by ANZDEC (ANZDEC, 1997) contains detailed socio-economic information for the 115 of the 117 villages located in the research area of STORMA. The data for the 115 villages was used for defining the sampling frame. For a number of reasons, stratified random sampling was preferred over simple random sampling method. The first major reason for this choice is that stratified random sampling allows the analyst to make sure that infrequent types of elements of the population will be included in the sample. The second reason is that the stratified sampling method has a higher efficiency than simple random samples, i.e. the same precision can be achieved with a smaller sample.

At a workshop in July 1999 in Göttingen, the ANZDEC information was reviewed. Three variables were selected for distinguishing various sampling strata within all 115 villages in the sampling frame. The selected criteria (SC) are:

- Proximity of village to Lore Lindu Park (2 subgroups). The first subgroup includes 58 villages that are rated by the ANZDEC report as being close to and affected by the park. The other subgroup contains the remaining 57 villages.
- Population density of village (2 subgroups). The median of population density for all 115 villages in the population was computed. Villages were then grouped into one subgroup containing villages below or equal to the median for population density. The other subgroup contained the remainder of villages above the median.
- Ethnic composition of village population (3 subgroups). Here, three subgroups were differentiated to ensure that villages will be randomly selected that feature the considerable ethnic diversity in the study region with respect to migrant and indigenous population. The first subgroup includes all villages with 75 % or more of their population belonging to indigenous ethnic groups. These are termed indigenous villages in Table 2. The second subgroup are villages that have 75 % or more population from migrant groups (so-called migrant villages in Table 2), and the third subgroup includes the remainder of the villages (so-called mixed villages in Table 2).

The first SC distinguishes villages on the basis of their proximity to and economic linkages with the park as defined by ANZDEC. Population density was chosen as the second SC because it is closely correlated with the development of rural infrastructure and markets, recognizing that the latter determines access to markets, technology and information as well as other critical socio-economic conditions. These factors (in)directly influence land use systems in the vicinity of the Lore Lindu National Park. Based on the literature review and informa-

tion gained during the field visits in 1998 and 1999, ethnicity of the village population was chosen as the third SC. It is hypothesized that the ethnic composition of the population strongly influences practices of land cultivation as well as use of forest and other resources.

Theoretically, the three stratifying variables and their subgroups should lead to 12 distinct strata (2 times 2 times 3). After inspection of the data, 10 strata were formed. One of the potential strata was empty and another potential strata contained only one village[1].

Table 2: Absolute and relative frequency of villages in the population (N=115)

No of strata	SC 1: Close to park	SC 2: Population density	SC 3: Ethnicity	Abs. Frequency in population	Relative frequency in population (%)
1	No	Low	Indigenous	16	13.9
2	No	Low	Mixed	7	6.1
3	No	High	Indigenous	14	12.2
4	No	High	Migrant	9	7.8
5	No	High	Mixed	11	9.6
6	Yes	Low	Indigenous	24	20.9
7	Yes	Low	Migrant or mixed	9	7.8
8	Yes	High	Indigenous	4	3.5
9	Yes	High	Migrant	5	4.3
10	Yes	High	Mixed	16	13.9
All				115	100.0

Source: ANZDEC (1997) for data concerning the three sampling criteria, and own computations

2.2 Method for random selection of 80 villages for analysis of land use changes and underlying determinants at regional level

Overall, a sample size of 80 was deemed sufficient to cover the diversity with respect to physio-geographic, agro-ecological and socio-economic conditions of the 115 villages in the research area.

[1] The strata with the following characteristics was empty: not close to park, low population density, and migrant population. One other strata contained only two villages. One of the two villages is Wuasa in the sub-district Lore Utara. After having randomly selected Wuasa, we noticed during the pre-phase (May 2000) that the sampling frame information for Wuasa given by the ANZDEC report was erroneous. The ANZDEC report reported 440 inhabitants, but the data reported by the village head was 1802. This new population figure leads to a population density of 23 which is slightly above the median for all 115 villages. In addition, the ANZDEC report stated that Wuasa had less than 10 % indigenous population. Because of this information from the ANZDEC report, Wuasa was initially grouped as a village with migrant population. However, this information was false as the share of indigenous population in Wuasa is much higher so that we had to reclassify Wuasa as a village with mixed population. The village Wuasa was therefore included in an aggregated strata that includes villages close to the park, with mixed or migrant population and with high population density.

A central objective of STORMA is to identify the influence of man on the stability of the forest margin near the LLNP. It is hypothesized that the population living in villages that are close to the park would have a greater influence on the stability of the forest margins of the LLNP. We therefore chose to take a disproportionately larger sample among villages that are close to the park. Hence, we chose that 49 of the 80 randomly selected villages (i.e. almost two thirds) of the sample villages were selected among villages being close to the park. With respect to the second and third screening criteria, the random selection was aimed to be made proportionate to the distribution of the criteria in the population of 115 villages. Overall, we therefore determined the sample sizes for each strata as shown in Table 3, and used the random number generator of Statistical Program for the Social Sciences (SPSS) to randomly select the chosen number of villages within each strata. The random selection of villages took place during the preparation phase of STORMA in July 1999.

Table 3: Absolute and relative frequency of villages in the population and in the stratified random sample

No of strata	SC 1: Close to park	SC 2: Population density	SC 3: Ethnicity	Abs. frequency in Population	Relative frequency in population (%)	Abs. frequency in random sample	Relative frequency in random sample (%)	Sampling weight for regional extrapolation from village sample to all 115 villages of research area
1	No	Low	Indigenous	16	13.9	8	10.0	1.3910343
2	No	Low	Mixed	7	6.1	4	5.0	1,2173913
3	No	High	Indigenous	14	12.2	8	10.0	1.2173913
4	No	High	Migrant	9	7.8	5	6.3	1.2521739
5	No	High	Mixed	11	9.6	6	7.5	1.2753623
6	Yes	Low	Indigenous	24	20.9	20	25.0	0.8347826
7	Yes	Low	Migrant or mixed	9	7.8	8	10.0	0.7826087
8	Yes	High	Indigenous	4	3.5	3	3.8	0.9275362
9	Yes	High	Migrant	5	4.3	4	5.0	0.8695652
10	Yes	High	Mixed	16	13.9	14	17.5	0.7950311
All				115	100.0	80	100.0	

Source: Own computations

Table 3 shows that villages close to the park have been systematically oversampled whereas villages not close to the park are disproportionately represented in the sample compared to the population. In order to extrapolate any result from the sample of 80 villages to the population of 115 villages, the descriptive statistical and econometric analysis will need to use sampling weights. These weights adjust for the disproportionate sampling in each of the ten strata. In general, the weight for a strata i is being computed as:

(1) $W_i = [(n_i / N) / (s_i / S)]$

- n_i is the number of elements in strata i;
- N is the total number of elements in the sampling frame;
- s_i is the size of the sample having elements belonging to strata i;

- S is the size of the sample.

Based on the data shown in Table 3, one can compute the weight for each strata. For example, for strata 2, the formula is:

(2) $W_2 = [(n_2 / N) / (s_2 / S)] = [(7 / 115) / (4 / 80)] = 1{,}2173913$

It always must hold that the sum of all weights for each sampled element is equal to the sample size. The sampling weights can be used in statistical programs, such as SPSS, to compute weighted arithmetic means or absolute frequencies (or any other statistical measure) as a statistical estimate of the characteristics of the entire project area. Thus, the weights correct for any over- or under-sampling in the stratified random sample. In these 80 villages, project A3 undertook a quantitative village survey, and will use the sampling weights to extrapolate the results to the entire project area[2].

2.3 Method for random selection of a smaller sub-sample of villages for in-depth analysis at household, watershed and plot level

As many projects of STORMA work at lower levels of regional differentiation, two smaller sub-samples of 20 and 12 villages, respectively, were chosen subsequently out of the above list of 80 villages. The random sub-sample of 20 villages is shown in Annex 3, and contains 10 strata as well. It has been originally selected in July 1999 so as to assist STORMA researchers in the selection of additional research sites in case that the 12 villages may not be suitable for their purposes. The last sub-sample of 12 villages is shown in Table 4.

Table 4: Random sample of villages for STORMA (smallest sub-sample of 12 villages)

Sub-district	Village	Strata	Pop. Density	Population
Sigi Biromaru	Maranata	3	349	2792
	Pandere	10	126	2134
	Sidondo II	4	98	784
Palolo	Berdikari	5	242	1210
	Sintuwu	8	65	1162
Kulawi	Bolapapu	9	61	3098
	Lempelero	7	3	694
	Lawe	2	3	353
Lore Utara	Wuasa	10	23	1804
	Watumaeta	6	3	439
	Wanga	6	5	266
	Rompo	6	3	198

[2] In this paper, weights are derived on the basis of the number of villages in each of the strata in the entire project region. Alternatively, weights could be derived with respect to other criteria, e.g. the share of population in the sample villages (or strata) compared to overall share of population in all villages (or strata), or area-based weighing differentiated by strata. Such weights can be computed by modifying equation 1.

Source: ANZDEC (1997), and own computations

3. Sampling procedure at household level

3.1 Objectives of the explorative household survey

During May 2000, an explorative household survey was conducted with the following objectives:

- to give a brief introduction the objectives and activities of the STORMA program to the village authorities in the 12 randomly selected villages (see Table 4);
- to request the cooperation of the village authorities for the STORMA research program
- to randomly select households for the household survey of project A4 in each of the 12 villages;
- to introduce the STORMA program to the selected households and request their cooperation in the explorative and in future surveys and other research activities of STORMA; and
- to collect information from the selected households in order to assist other research projects, mainly in sub-program C and D in their selection of households with suitable farm plots or forest gardens.

3.2 Questionnaire design

The design of the survey questionnaire was coordinated by project A4, and involved German and Indonesian scientists belonging to projects from all subprograms. In a number of subsequent meetings in Göttingen, Bogor and finally in Palu, questions and criteria were defined that would be used later by other projects to select households and plots. The socio-economic criteria included demographic characteristics, migration, ethnicity and wealth. With respect to agricultural production, key household-level criteria identified by subprogram B, C and D were the cultivation of maize, cocoa, alang-alang (Imperata cylindrica) and forest gardens. Other questions covered the existence of shifting cultivation, problems with erosion, and the type of crops grown. The questionnaire was edited first in the English language, and then translated into Bahasa Indonesia.

In May 2000, two German staff of project A4 and twelve scientific staff of UNTAD undertook the explorative survey. The questionnaire was pre-tested in one of the villages, and a final version in the Indonesian language was printed at UNTAD in Palu. Annex 4 shows the translation of this final version in the English language. Some days before the survey began, the heads of the villages were informed about the explorative survey as well as the overall objectives of the STORMA program.

3.3 Method of random selection of households

In each village, the head of the village (*desa*) as well as the leaders of the hamlets in the village (*RTs*) were informed by the survey team about the objectives of STORMA and the explorative survey. The head of the village was then requested to list the names of all heads of households currently living in the village. The gathering of this list was not based on administrative records alone because many villages did not have updated or accurate records, in

particular with reference to recent in-migrating households. In order to cross-check and complete the list of households, the leaders of the hamlets were consulted in addition[3]. In large villages with many households, it would have been too time-consuming and costly to list households in all hamlets of a village. In cases of large villages, a random sub-sample of the hamlets (*RTs*) was chosen first, and in these randomly selected hamlets, a complete enumeration of all resident households was undertaken with the assistance of the leaders of the village and the respective hamlets. This procedure was also chosen to reduce logistical and time costs of future household surveys as some of the survey villages, like Maranata or Bolapapu, spread out over quite a large area[4].

The sample size in each village was determined with respect to the share of the village population in the overall population of the strata to which the village belongs. These figures have been adjusted somewhat according to two criteria. In small villages, a disproportionately higher number of households has been selected, mainly in view of logistical and cost considerations in undertaking future survey in small villages. Second, as the STORMA research program is interested in households with agricultural plots closer to the National Park, more households have been selected in villages closer to the Lore Lindu National Park.

Once the sample size in a particular village was determined, a random sample of households was drawn from the list of all households in that village. As described in Carletto and Morris (1999), it is important to randomly select households from the entire list. Therefore, the step size was calculated by dividing the number of households in the list by the sample size. The first household to be chosen was determined by randomly choosing a number between one and the value for the required step size. Once the random selection was completed, the sample households were visited. Some of the households were absent during the survey, and could not be contacted even after repeated visits. In such cases, an additional household was randomly selected from the same hamlet (RT). In total, 302 households were successfully interviewed, and only one of those households chose to not participate in future STORMA research activities. In addition to administering the survey, a map of the village with the location of the households was made in order to assist other STORMA project members to re-visit the household in the future.

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[3] Even if an administrative list of households existed, it was necessary to check and cross-check with various respondents if all households were included. Various types of lists are available in villages and have been used for setting up the sampling frame of households residing in the village: demographic lists, list of landowners and of participants in various health programs. The latter two types of lists, for example, do not always contain all households in the village. Lists if existing are available in smaller villages through the head of the village and in bigger villages through the head of the hamlet (RT). In some more difficult cases, the names of the head of the households were collected street by street and house by house. This was a very time consuming but reliable way to identify the names of households in a particular village.

[4] For example, the village Maranata covers a large area. In the exploratory survey as well as in future surveys and other field work of STORMA, a village-wide random selection would have led to a great dispersion of sample households and plots. In order to reduce time costs and logistical constraints, we decided to randomly select three hamlets out of the total five hamlets, and then to only randomly select households living in these hamlets. The selection of hamlets was done proportionately to the size of the hamlet in relation to the overall size of the village. Thus, this cluster sampling procedure through which the different clusters were selected proportionate to their size is equivalent to a simple random sample of all households in a village (Carletto and Morris, 1999).

Table 5 shows the number of selected households in each of the twelve villages.

Table 5: Number of randomly selected households, by sub-district and village

Sub-District (*Kecamatan*)	Village (*Desa*)	Number of households
Lore Utara	Watumaeta	20
	Wuasa	27
	Wanga	18
	Rompo	17
Palolo	Sintuwu	25
	Berdikari	21
Sigi Biromaru	Maranata	31
	Pandere	31
	Rahmat/Nopu[5]	25
	Sidondo II	33
Kulawi	Bolapapu	32
	Lempelero	30
	Lawe	17
All villages		326

Source: Sampling frame for random selection of households, and own computations

In order to extrapolate a result from the sample of 326 randomly chosen households to the entire project area, the descriptive statistical and econometric analysis at household level will use sampling weights. This is required because the number of selected households in a particular strata is disproportionate to the number of households that is found in the same strata for the entire population in the STORMA research area.

[5] The hamlet Nopu which belongs to the village Rahmat were purposely selected as an additional site for the household survey in January 2001. Nopu is a very young hamlet that is situated in a small watershed directly bordering the Park. It features a number of on-going processes of destabilization of the forest margin that were interesting to project A4 and projects in other subprograms, in particular those in sub-program B. In order to increase the exchange of data across subprograms focusing on nutrient flows in watersheds, and also in view of the objectives of another related research program, Rahmat/Nopu was being chosen as an additional village for the household survey.

4. Summary

The STORMA program has a diverse set of projects with different disciplinary research objectives. Yet, the overall objective is the same, namely acquiring a greater understanding of the processes that contribute towards the stabilization of the forest margins of the Lore Lindu National Park. Only when these processes are properly understood, will it be possible to provide improved and in-depth information to decision-makers that wish to enhance the development and conservation efforts in the vicinity of the Lore Lindu National Park.

The overall objective of STORMA calls for interdisciplinary collaboration between its different subprograms. This calls for the identification of joint research sites –either at the watershed, village, household, or plot level- at which different disciplines work and obtain data on underlying processes. The sharing of data concerning the same research sites is seen as an essential basis for interdisciplinary collaboration. Moreover, the chosen research sites need to be representative of the research area as a whole. Mainly for these two reasons, a joint sampling frame for the entire STORMA research area has been set up as described in this paper.

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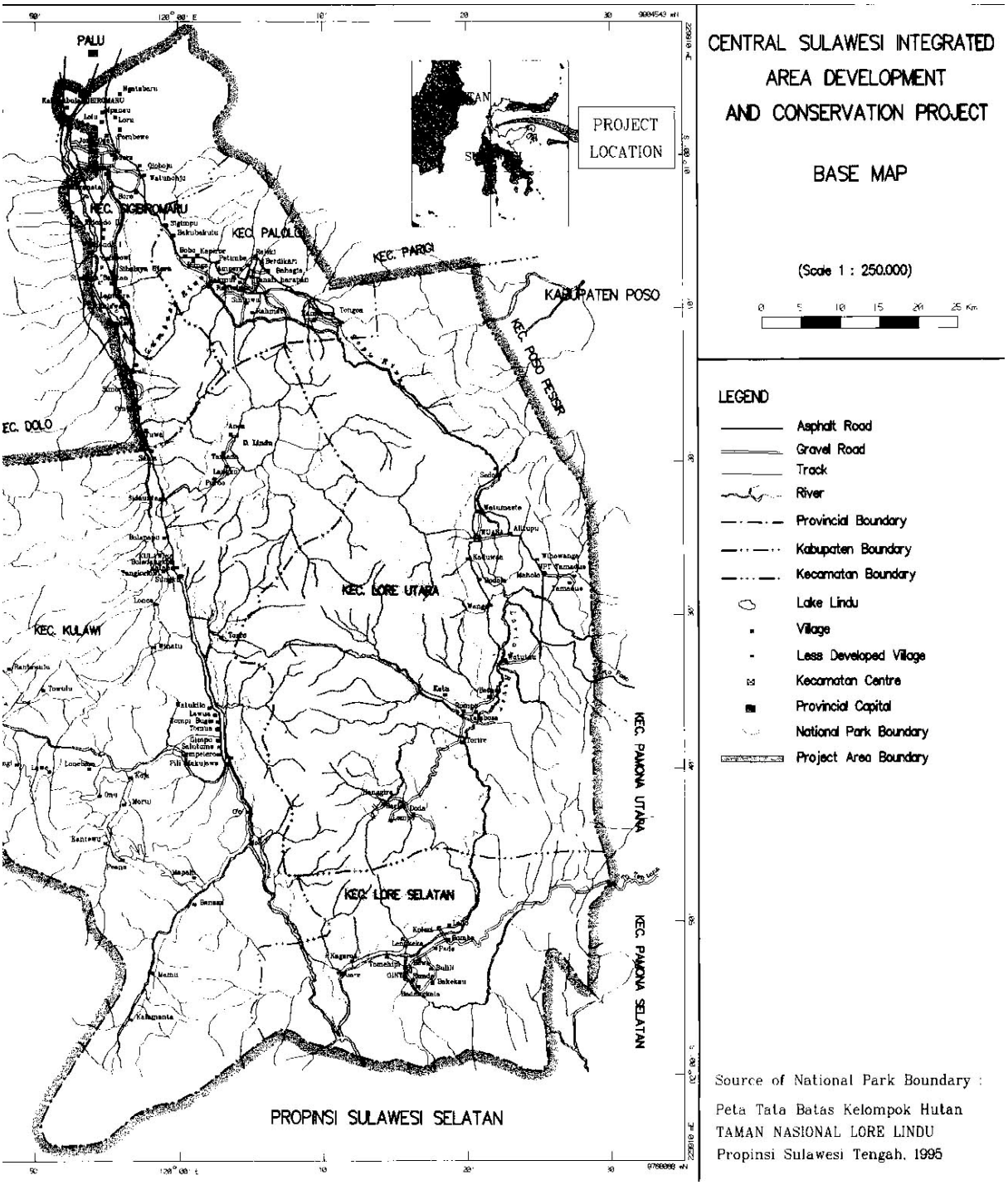
Annex 1: Map of the Research Region



Annex 2: Sub-sample of 80 randomly selected villages for descriptive and econometric analysis of land use changes at village- and regional level

Sub-district (*Kecamatan*)	Name of Village (*Desa*)	Strata[6]	Close to Park[7] (LLNP)	Population density	Ethnicity group
Sigi Biromaru	Sidondo I	5	0	2	3
Sigi Biromaru	Mpanau	5	0	2	3
Sigi Biromaru	Pakuli	10	1	2	3
Sigi Biromaru	Maranata	3	0	2	1
Sigi Biromaru	Lolu	4	0	2	2
Sigi Biromaru	Pandere	10	1	2	3
Sigi Biromaru	Kalawara	10	1	2	3
Sigi Biromaru	Omu	10	1	2	3
Sigi Biromaru	Sidera	4	0	2	2
Sigi Biromaru	Lambara	10	1	2	3
Sigi Biromaru	Watunonju	3	0	2	1
Sigi Biromaru	Tuwa	10	1	2	3
Sigi Biromaru	Soulowe	3	0	2	1
Sigi Biromaru	Sidondo II	4	0	2	2
Sigi Biromaru	Simoro	9	1	2	2
Palolo	Kamarora UPT	8	1	2	1
Palolo	Rahmat	10	1	2	3
Palolo	Tanah Harapan	4	0	2	2
Palolo	Lembah Tongoa UPT	3	0	2	1
Palolo	Makmur	5	0	2	3
Palolo	Berdikari	5	0	2	3
Palolo	Sintuwu	8	1	2	1
Palolo	Ranteleda	3	0	2	1
Palolo	Bahagia	5	0	2	3
Palolo	Ampera	5	0	2	3
Palolo	Bunga	10	1	2	3
Palolo	Bobo	10	1	2	3
Palolo	Kapiroe	10	1	2	3
Palolo	Sigimpu	7	1	1	3
Kulawi	Bolapapu	9	1	2	2
Kulawi	Toro	10	1	2	3
Kulawi	Tamado	7	1	1	3
Kulawi	Lawua	9	1	2	2

[6] The ten types of strata are defined in Table 2.

[7] Variable Close to Park: A value of 1 means that the village is close to the borders of the park. The value zero means the opposite. The variable Population Density has been computed as the number of inhabitants in a village, divided by the village area. All 115 villages were then grouped into two equal groups, one below or equal to the median and one above the median. The value 2 here reports villages that are above the median, the value 1 the opposite. The variable Ethnicity has three values: The value 1 indicates villages where 75 % or more of the population are from indigenous ethnic groups; the value 2 indicates villages where 75 % or more of the population are from migrant ethnic groups. The value 3 includes all other cases, i.e. ethnically mixed villages.

Annex 2: Sub-sample of 80 randomly selected villages (continued)

Sub-district (*Kecamatan*)	Name of Village (*Desa*)	Strata	Close to Park (LLNP)	Population density	Ethnicity group
Kulawi	Winatu	1	0	1	1
Kulawi	Peana	3	0	2	1
Kulawi	Lonebasa	2	0	1	3
Kulawi	Salua	7	1	1	3
Kulawi	Puroo	7	1	1	3
Kulawi	Sungku	8	1	2	1
Kulawi	O'o	10	1	2	3
Kulawi	Langko	6	1	1	1
Kulawi	Lempelero	7	1	1	3
Kulawi	Siwongi	2	0	1	3
Kulawi	Tomua	2	0	1	3
Kulawi	Mapahi	1	0	1	1
Kulawi	Rantewulu	3	0	2	1
Kulawi	Mantaue	6	1	1	1
Kulawi	Watukilo	10	1	2	3
Kulawi	Anca	6	1	1	1
Kulawi	Boladangko	7	1	1	3
Kulawi	Tompi Bugis	9	1	2	2
Kulawi	Lawe	2	0	1	3
Kulawi	Moa	6	1	1	1
Kulawi	Mamu	1	0	1	1
Kulawi	Pili/Makujawa	7	1	1	3
Lore Utara	UPT Tamadue	4	0	2	2
Lore Utara	Wuasa	10	1	2	3
Lore Utara	Hanggira	6	1	1	1
Lore Utara	Doda	6	1	1	1
Lore Utara	Watutau	1	0	1	1
Lore Utara	Watumaeta	6	1	1	1
Lore Utara	Talabosa	6	1	1	1
Lore Utara	Dodolo	6	1	1	1
Lore Utara	Wanga	6	1	1	1
Lore Utara	Betue	6	1	1	1
Lore Utara	Katu	6	1	1	1
Lore Utara	Bariri	6	1	1	1
Lore Utara	UTP Wanga	7	1	1	2
Lore Utara	Rompo	6	1	1	1
Lore Selatan	Badangkaia	1	0	1	1
Lore Selatan	Lengkeka	6	1	1	1
Lore Selatan	Bewa	6	1	1	1
Lore Selatan	Bulili	3	0	2	1
Lore Selatan	Bomba	1	0	1	1
Lore Selatan	Kolori	6	1	1	1
Lore Selatan	Tuare	6	1	1	1
Lore Selatan	Pada	1	0	1	1
Lore Selatan	Lelio	6	1	1	1
Lore Selatan	Tomehipi	6	1	1	1
Lore Selatan	Bakekau	1	0	1	1

Annex 3: Sub-sample of 20 randomly selected villages

Sub-district (*Kecamatan*)	Name of Village (*Desa*)	Strata	Close to Park (LLNP)	Population density	Ethnicity group
Sigi Biromaru	Maranata	3	0	2	1
Sigi Biromaru	Pandere	10	1	2	3
Sigi Biromaru	Omu	10	1	2	3
Sigi Biromaru	Tuwa	10	1	2	3
Sigi Biromaru	Sidondo II	4	0	2	2
Palolo	Lembah Tongoa UPT	3	0	2	1
Palolo	Berdikari	5	0	2	3
Palolo	Sintuwu	8	1	2	1
Kulawi	Bolapapu	9	1	2	2
Kulawi	Salua	7	1	1	3
Kulawi	Lempelero	7	1	1	3
Kulawi	Mantaue	6	1	1	1
Kulawi	Lawe	2	0	1	3
Lore Utara	Wuasa	10	1	2	3
Lore Utara	Watumaeta	6	1	1	1
Lore Utara	Wanga	6	1	1	1
Lore Utara	Katu	6	1	1	1
Lore Utara	Rompo	6	1	1	1
Lore Selatan	Badangkaia	1	0	1	1
Lore Selatan	Tomehipi	6	1	1	1

Annex 4: Sub-sample of 13 villages for the analysis of changes in the use of land and other resources at the (farm) household and plot level [8]

Sub-district (*Kecamatan*)	Name of Village (*Desa*)	Strata	Close to Park (LLNP)	Population density	Ethnicity group
Sigi Biromaru	Maranata	3	0	2	1
Sigi Biromaru	Pandere	10	1	2	3
Sigi Biromaru	Sidondo II	4	0	2	2
Palolo	Berdikari	5	0	2	3
Palolo	Rahmat/NOPU	10	1	2	3
Palolo	Sintuwu	8	1	2	1
Kulawi	Bolapapu	9	1	2	2
Kulawi	Lempelero	7	1	1	3
Kulawi	Lawe	2	0	1	3
Lore Utara	Wuasa	10	1	2	3
Lore Utara	Watumaeta	6	1	1	1
Lore Utara	Wanga	6	1	1	1
Lore Utara	Rompo	6	1	1	1

[8] An additional error in the ANZDEC data that were used to set up the sampling frame for the village selection concerned the data for the village Wanga, again in the sub-district of Lore Utara. Wanga was rated by ANZDEC as a village not close to the park although it was later found out that it is quite close to the LLNP. Because of this erroneous information in the ANZDEC report (possibly a mix-up with the data for the village UPT Wanga which is farther away from the park), Wanga was grouped in the sampling frame as an element of strata 1. This strata contains villages with low population density, not close to park, and with indigenous population. The random selection of the sub-sample of 12 villages was performed in a way that each strata would be represented by at least one randomly selected village. However, after retrospection of the data for Wanga, we corrected its grouping, and therefore reclassified the village Wanga into strata 6. Because of this reclassification, however, the strata 1 is not represented in the random sample of 12 villages.

Annex 5: Questionnaire used in the explorative survey in May 2000

Sample household / replacement household *)
Number of Questionnaire : ----------
Date of Interview : ----------
Name of Interviewer : ----------

University of Göttingen/Kassel -- IPB/Bogor -- UNTAD/Palu (STORMA)
Household Questionnaire for Identification of Randomly Selected Survey Households
May 29,2000 (translation of Final Indonesian Version back into English language)

Enumerator : give a brief introduction on the objective of this survey. Ask respondent for cooperation
We are researchers from Universitas Tadulako, Universitas Göttingen - Germany, and Institut Pertanian Bogor. We come to learn how the people in this area live and work in agriculture, as well as in non-agriculture works. Your answer will be used strictly for research purpose and will be treated as confidential.

0. General
0.1. Name of Village/Hamlet/RW/RT : ..... / ..... / ..... / .....
0.2. Name of Household Head (first name, family name) : .....
0.3. Name of father of Household Head (first name, family name) : .....
0.4. Name of respondent : ..... (relation to Household Head : .....)

1. Demography
1.1. How many adults and children belong to this household ?
Answer : ..... adult (10+ year) ..... children (0-9 year)

1.2. Did the Household Head come from outside this village ? (1=yes, 2=no)
If yes, how many years does this family live in this village ? ..... years.

1.3. To which ethnic group does the Household Head belong to :
Code for ethnic group :

01. Kaili (Ledo, Uma, Da'a, Tohulu)	*05. Koro*	*09. Jawa*
02. Kulawi	*06. Lore (Napu, Behoa, Bada, Tawaili)*	*10. Bali*
03. Pakawa	*07. Pekurehua*	*11. Minahasa*
04. Sigi (Ledo, Idia, Ta'a, Ado)	*08. Bugis*	*12. Mandar*
13. Makassar	*14. Toraja.*	*15. Lainnya (sebutkan)*

2. Farming Status and Land Use Systems of the Household
(Enumerator : questions in this part is about activities of Household Head and household members)
2.1. Do you, or other family members usually grow agricultural crops ? (1=yes, 2=no)

2.2. Did you, in the past 12 months, grow : (a) padi sawah / wetland rice (1=yes, 2=no) ;
b. maize (1=yes , 2=no)

2.3. Did you, in the past 3 years, clear forest (=make a new plot) to cultivate maize ? (1=yes, 2=no)
If yes, how old is the forest that you cleared ? ..... year

2.4. After clearing forest, for how many years do you usually grow maize ? ..... year.

2.5. In your plots, do you grow only maize (=monoculture) or maize with other kind of crops (=intercropping) ? (1=monoculture, 2=intercropping).
If you do intercropping, name the dominant crops .....

2.6. What do you usually plant in your plots after maize cultivation ? (1=cocoa, 2=fallow, 3=other crop, namely .....)

2.7. For how many years do you usually practice fallowing on the same plot? (0=less than a year, 1=1-5 years, 2=6-10 years, 3=>10 years)

2.8. Do you grow crops other than maize and wetland rice ? (1=yes, 2=no).
If yes, name two (2) most often grow crops. ..... and .....

2.9. Do you grow maize on sloping (>15 degree) plot ? (1=yes, 2=no)
If yes, do you notice soil runoff when raining ? (1=yes, 2=no, 3=do not know)

2.10. Do you have plots full of alang-alang (Imperata grass) ? (1=yes, 2=no)

2.11. Do you, or other family members grow cocoa ? (1=yes, 2=no)

2.12. Do you plant 'pohon pelindung' for your cocoa ? (1=yes, 2=no)
(Enumerator : pohon pelindung is shadow tree that purposively planted)
If yes :
a. How many plots with pohon pelindung do you have ? ..... plots.
b. In the oldest plot with pohon pelindung, what is the average age of your cocoa ? ..... years.
c. In the youngest plot with pohon pelindung, what is the average age of your cocoa ? ..... years.

2.13. Do you, or other family members, plant crops under pohon hutan ? (1=yes, 2=no)
(Enumerator : pohon hutan are shadow trees that originate from the original primary/secondary forest)

2.14. Do you, or other family members, plant crops under pohon tuak (aren, saguer) ? (1=yes, 2=no)

3. Extent of Land-Use Systems
3.1. What is the size of wetland rice (=padi sawah) that you cultivate in the past rainy season ?
Answer : ..... are *(Enumerator : local unit is to be transferred to hectares)*

4. Closing
(Enumerator : explain that this survey is part of a medium-term cooperative project between the three universities. Therefore, there is a possibility that researchers of this project will return to the same household for more interviews that each may take longer. Then, proceed to question 4.1)

4.1. Are you willing to be interviewed (for in-depth research/study) in the future ? (1=yes, 2=no)