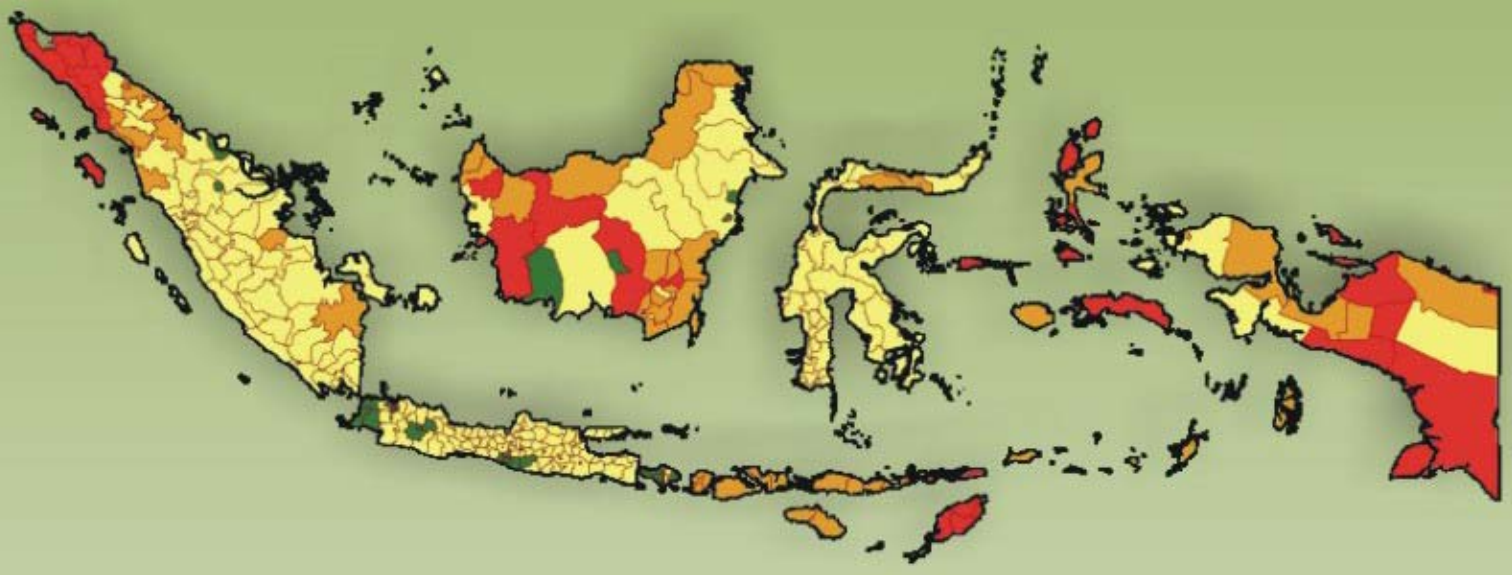
NUTRITION MAP OF INDONESIA

Small Area Estimation of Nutritional Status in Indonesia



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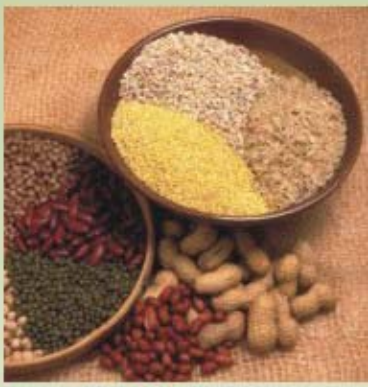

COORDINATING MINISTRY FOR PEOPLE'S WELFARE
REPUBLIC OF INDONESIA

BPS

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World Food Programme

NUTRITION MAP OF INDONESIA

Small Area Estimation of Nutritional Status in Indonesia

Coordinating Ministry for People's Welfare
World Food Programme
BPS-Statistics Indonesia
AusAID

2006

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Foreword by The Coordinating Minister for People's Welfare

Reducing hunger and malnutrition will serve as essential requisites for achieving the Millennium Development Goals. Having enough food to eat, attending schools and maintaining a healthy life are critical towards poverty reduction, achieving universal primary education, reducing disease and mortality of the people.

As one of the signatories of the Millenium Development Goals, Indonesia has made improvements in health, education and social services; however hunger and malnutrition remain the most devastating problems. Still high levels of under nutrition are prevalent among small children, pregnant and nursing mothers across in many parts of the country.

The publication of this *Nutrition Map of Indonesia* is an important step in identifying the hotspots, particularly of malnourished children, and it also relates to food insecurity in Indonesia. The results of this study can be used separately, or in combination with the other related published documents, as a tool for better geographic targeting areas across Indonesia for proper nutrition intervention.

I am sure that the provincial and district governments will get benefit of this study for a better understanding of malnutrition and food insecurity in their respective areas. I congratulate the World Food Programme and BPS-Statistics for jointly undertaking this valuable research and publication.

Jakarta, May, 2006

Coordinating Minister for People's Welfare

Aburizal Bakrie

BPS STATISTICS INDONESIA

Message from The Director General of BPS-Statistics Indonesia

Poverty, malnutrition especially for the children under-5 years, and high infant mortality rate are the problems that Indonesian people facing recently. It is realized that these problems will be impediment factors for the nation in entering into the globalization era, where productivity will be a major factor in determining of the comparative advantage of the nation in the various line of activity starting from education, research and development, industrial production and services, and finally the pace of economic development.

This publication focuses on the immediate concern of mapping the problems of malnutrition, children under-5 years undernourished and infant mortality rate, up to the lowest administrative level. The principal point that stands out in this publication is to produce a Nutrition Map to identify the under-nutrition hotspots cost effectively, by using the small area estimation technique and which further will transfer to the disaggregated maps of nutrition indicators.

As it is realized, combating of poverty and malnutrition will take a lot of time and efforts, since the resources available for improving the nutritional status and living standards of the people are severely limited in Indonesia. So that, in designing anti-poverty and anti-malnutrition programs, stronger efforts must be made to allocate the available resources in efficient manner. It is in this spirit, BPS – Statistics Indonesia and the World Food Programme of the United Nation are working together to publish the Nutrition Map and Analysis, with the aim to back-up the government anti-poverty and ant-malnutrition programs to become a successful program.

I trust that this scientific publication will be a considerable interest to all those concerned with the problems of poverty and malnutrition, and will contribute to better targeting areas for intervention and better formulation of effective and efficient policies to reduce malnutrition.

Jakarta, May, 2006

BPS-STATISTICS INDONESIA

Choiril Maksum
Director General

A Message from The Representative & Country Director of WFP Indonesia

Malnutrition remains a major public health concern in most developing countries, including Indonesia. It has been associated with mortality and morbidity, delayed mental development, decreased cognitive and behavioral functioning throughout childhood and adolescence, and poor performance in school. In Indonesia, 27.3% of the children under 5 years are underweight. Stunting is prevalent among 38% children. According to FAO estimate, almost 13 million people are chronically undernourished in Indonesia. The level of anemia among children and women are high. These are serious social costs for the country, not only for today but for years to come.

In the absence of a robust and reliable nation wide nutritional surveillance system, nutrition programmes suffer from lack of sophisticated data for targeting of poorest and most nutritionally insecure areas. In this regard, Nutrition Mapping serves as a valuable tool. Advances in this new research, known as Small Area Estimation, has given us a useful scientific tool to estimate the prevalence of undernutrition at sub-district level by imputing estimates of household parameters obtained from household survey (SUSENAS) into the household level information in the Census data.

The World Food Programme (WFP) collaborated with the Badan Pusat Statistik (BPS) to undertake 'Nutrition Map of Indonesia' with funding support from AusAID. The project began in mid 2004 with the establishment of a Technical Advisory Group to assist the project team. We are grateful for the active participation of the Ministry of Health, Ministry of Agriculture, BKKBN, AusAID, UNICEF and the World Bank and for the valuable inputs during the project. Commendable efforts were made by the Core Team of BPS and WFP in realizing this publication.

The report highlights the sub-districts with higher prevalence of underweight children, Infant Mortality Rate and the percentage of people consuming less than 1700 kcal per capita per day. More than one-third of the sub districts (out of 3688) have serious nutritional problems and these areas should be prioritized in any nutritional interventions. The report also analysed the links between these indicators and poverty by combining the findings of Nutrition Mapping and Poverty Mapping, which was jointly undertaken by BPS and the World Bank.

'A Food Insecurity Atlas of Indonesia' (FIA), which was jointly released by the National Food Security Council, Government of Indonesia and WFP in August 2005, highlighted 100 priority districts for food security interventions. The 'Nutrition Map of Indonesia' provides sub-district level information for further narrowing down the targets. I am sure this publication, along with Poverty Mapping and FIA will help in area prioritization for interventions related to nutrition and food security.

Jakarta, May, 2006

Mohamed Saleheen
Representative & Country Director
World Food Programme, Indonesia

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EXECUTIVE SUMMARY

Appropriate targeting of areas and intended beneficiaries are essential for the success of any intervention. In order to improve the targeting of nutritional interventions as well as other interventions for poverty alleviation and food security, we need to identify the hotspots of malnutrition at the lowest possible statistical level so that resources can be optimally utilized for those areas and maximum returns can be derived in terms of the desired results.

In Indonesia, reliable nutritional data is available only down to the provincial level. With a total of 33 provinces, 349 districts, 91 municipalities, 5,570 sub-districts and 71,634 villages in the country (BPS 2005), conducting a household survey to collect information on developmental parameters with a sample size that is representative of all districts and sub-districts in the country is prohibitively huge and expensive.

In recent research advances, a new methodology has been developed to estimate parameters from census-based secondary data that is normally available on a whole country basis. The core of the method is to identify the predictive indicators from the census survey information that can explain the information obtained from household surveys. A household survey usually collects very detailed information on household characteristics, including consumption level, but the sample coverage is generally limited and only representative for a relatively large geographical unit. On the other hand, a population census has a complete coverage of all households, but usually collects very limited information on household characteristics. Hence, the method, known as Small Area Estimation, tries to combine the advantage of detailed information on household characteristics obtained from household surveys with the complete coverage of a population census.

The objectives of the Nutrition Analysis and Mapping are:

1. to establish models showing the relationship between the nutritional and socio-economic status of the population concerned;
2. to estimate the percentage of people consuming less than 1,700 kcal per capita per day at sub-district level;
3. to estimate the prevalence of underweight children under-five years of age at sub-district level; and
4. to estimate the Infant Mortality Rate at sub-district level.

This is the first exercise of the application of the Small Area Estimation technique to measure the prevalence of malnutrition at the sub-district level in the country. In total, 30 provinces, 341 districts and cities, and 3,688 sub-districts were included in this analysis.

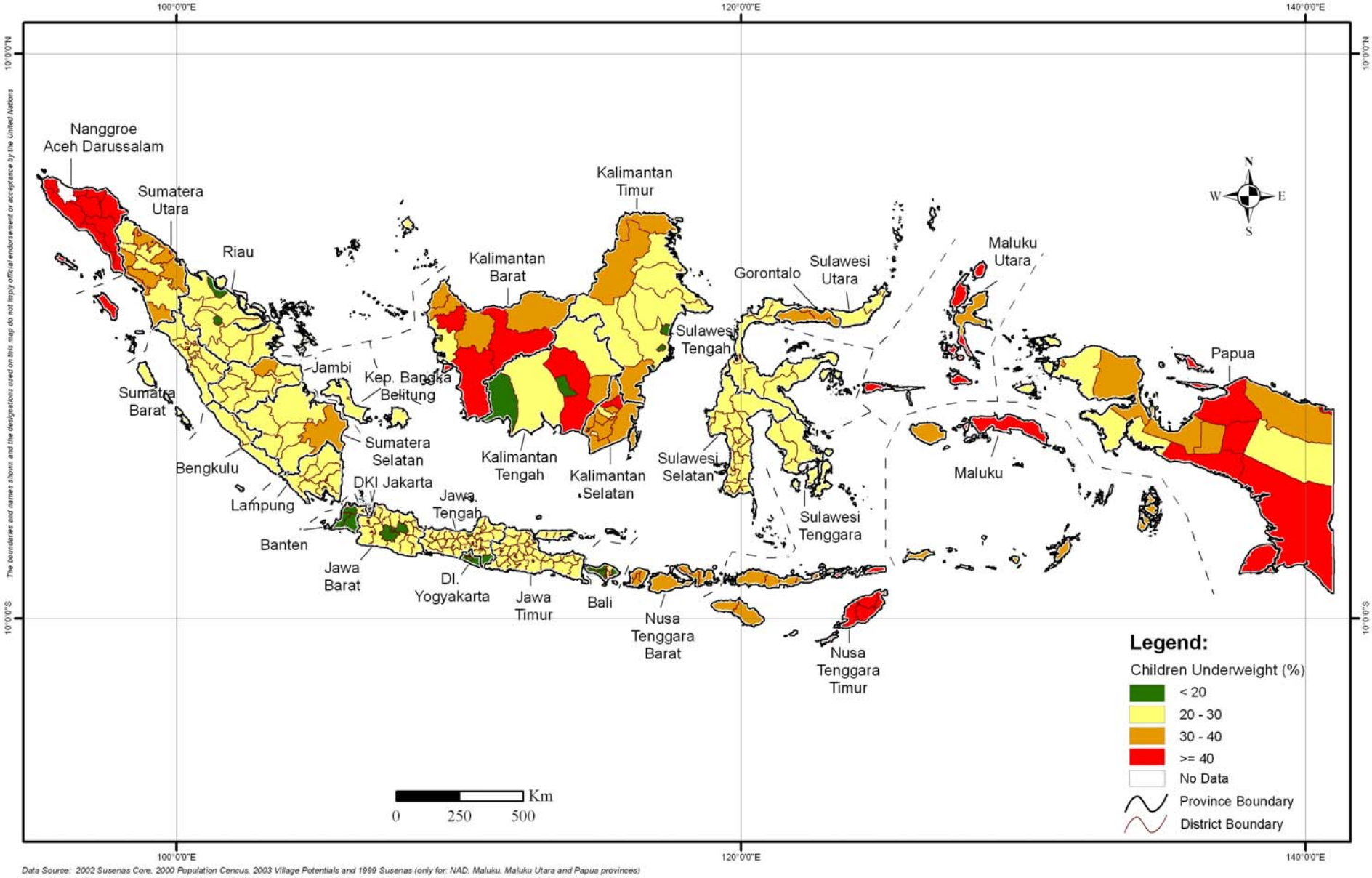
The analysis revealed that at the sub-district level, there are 772 sub-districts with more than 30 per cent of their children underweight. A high prevalence of underweight children is particularly found in North Sumatra, West Sumatra, South Sumatra, Jambi, East Java, NTB, NTT and West Kalimantan.

Similarly, 1,079 districts have an IMR of more than 55 per 1,000 live births and these are scattered almost throughout the country, particularly in Jambi, Bengkulu, West Sumatra, Banten, West Java, Central Java, NTB, NTT, West Kalimantan, South Kalimantan, Central Sulawesi, South Sulawesi and South East Sulawesi.

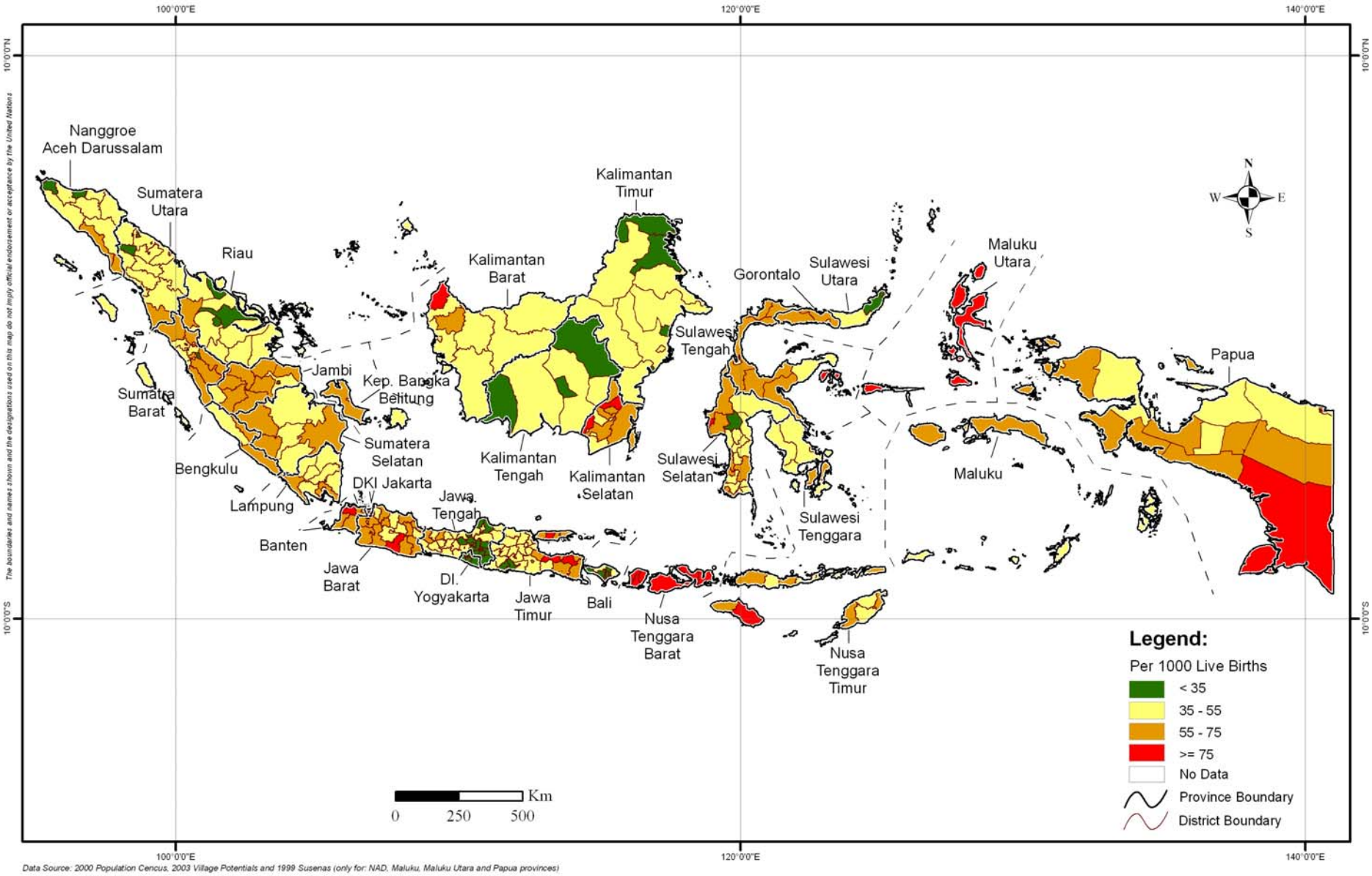
Around half of the sub-districts measured (1,859) have people consuming less than 1,700 kcal per capita per day. On the island of Sumatra, the provinces of South Sumatra, Bangka Belitung, Lampung and some pockets of Riau and North Sumatra have a higher percentage of people in the deficient calorie consumption category. In Java, almost 29 per cent of sub-districts have a high prevalence. NTT, West Kalimantan, East Kalimantan and South Sulawesi are the remaining provinces with a high percentage of people with a deficient calorie intake.

The report also made an attempt to analyze the link between poverty and underweight and poverty and IMR, thereby demonstrating the advantage of combining the Poverty Mapping and Nutrition Mapping results for appropriate targeting.

Underweight Children Under Five Years of Age by District

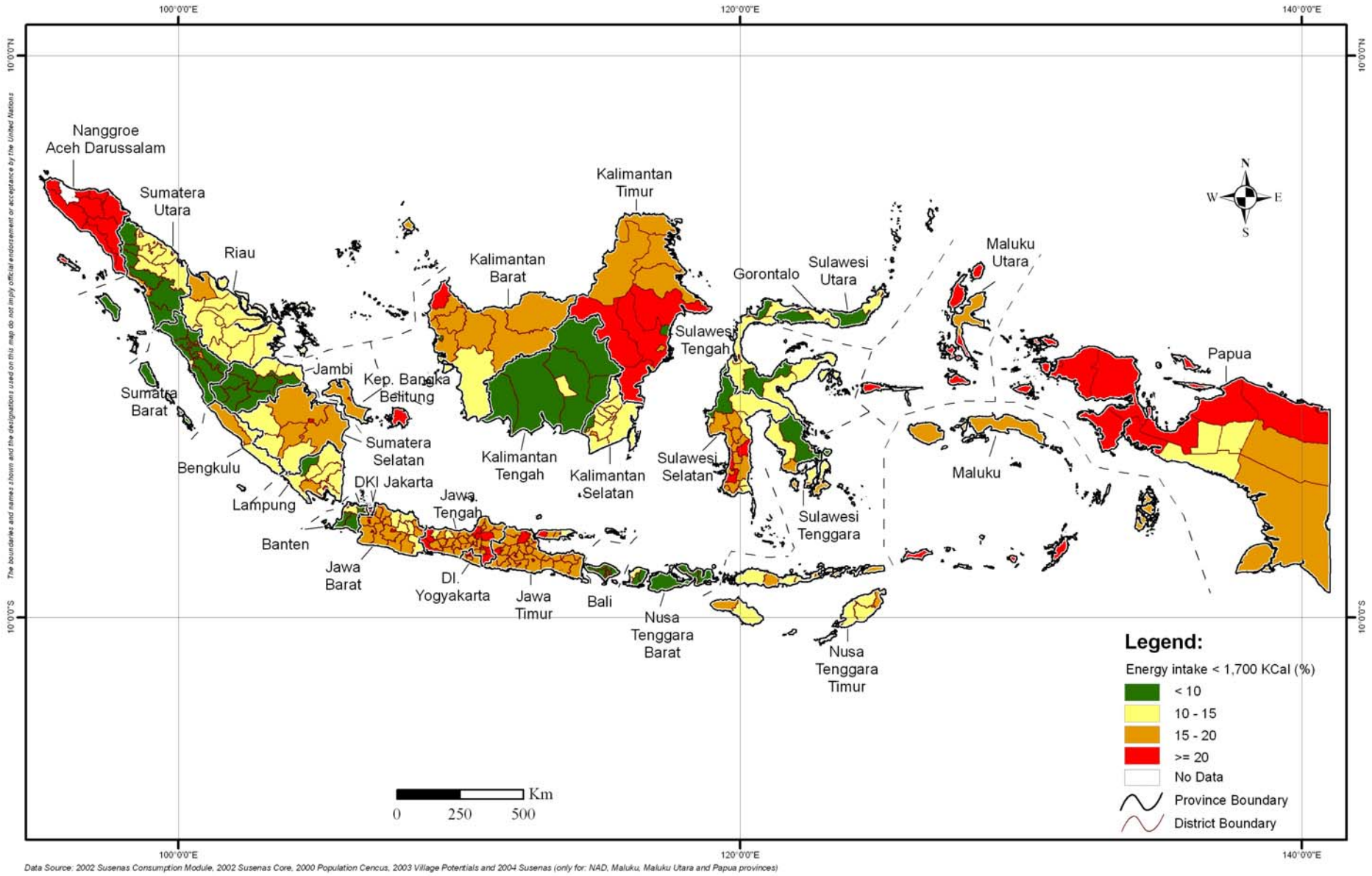


Infant Mortality Rate (IMR) by District



Data Source: 2000 Population Cencus, 2003 Village Potentials and 1999 Susenas (only for: NAD, Maluku, Maluku Utara and Papua provinces)

Population Living with Energy Intake less than 1700 Kilo Calories by District



Data Source: 2002 Susenas Consumption Module, 2002 Susenas Core, 2000 Population Cencus, 2003 Village Potentials and 2004 Susenas (only for: NAD, Maluku, Maluku Utara and Papua provinces)

1. INTRODUCTION

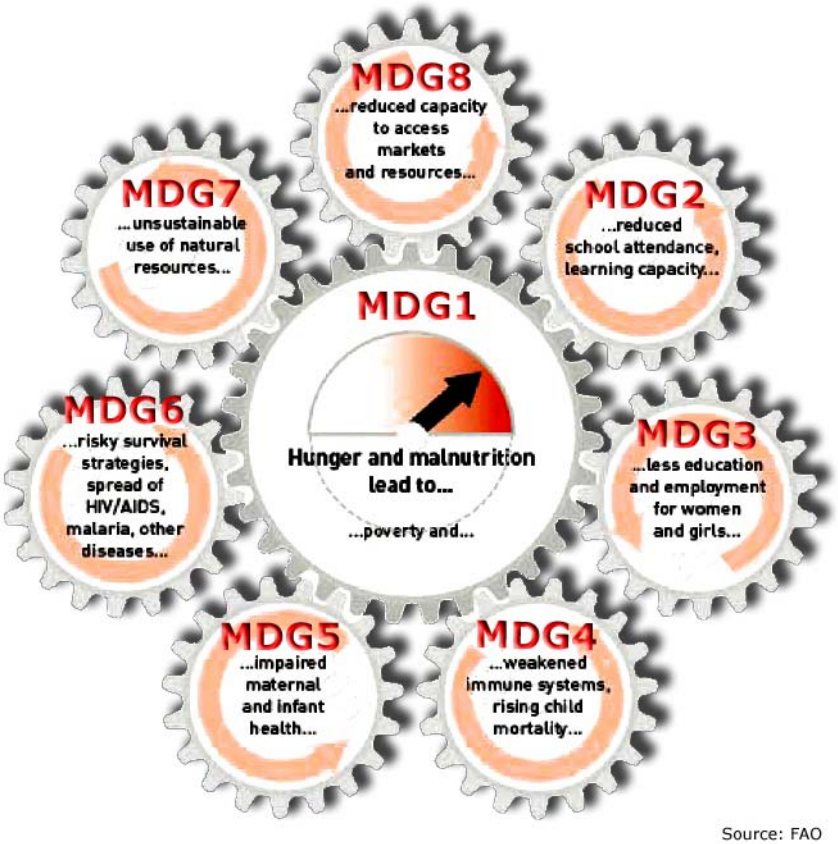
The Millennium Development Goals which were originally established in 2000 set a target of reducing the incidence of seven indicators by 50 per cent between the baseline year of 1990 and 2015. The target date is coming nearer but the targets themselves are not.

Globally, progress towards the MDG target for reducing hunger has been made in Southeast Asia as well as three other sub-regions; North Africa, East Asia, and Latin America/Caribbean. In order to achieve the target to cut the proportion of hungry people by fifty per cent, as well as improving education and achieving health and environmental sustainability, the signatories of the Millennium Declaration should intensify their efforts with a stronger commitment. Indonesia itself is on track to achieving some goals, but the prospects across provinces are uneven.

Among all indicators set by the MDG, hunger and malnutrition are the key issues. Having enough food and a healthy life are a fundamental human need. Hunger and malnutrition are among the root causes of poverty, illiteracy, disease and mortality of millions of people in developing countries. Thus, without rapid progress in reducing hunger and malnutrition, achieving all of the other MDGs will be difficult.

The chart below shows how hunger and malnutrition issues hinder progress towards other Millennium Development Goals (The State of Food Insecurity Status in the World, FAO 2005).

Figure 1 Hunger and malnutrition issues hinder progress towards other Millennium Development Goals



Source: FAO

- Hungry children start school later, if at all, drop out sooner and learn less while they do attend, stalling progress towards universal primary and secondary education (MDG 2).
- Poor nutrition for women is one of the most damaging outcomes of gender inequality. It undermines women's health, stunts their opportunities for education and employment and impedes progress towards gender equality and empowerment of women (MDG 3).
- As the underlying cause of more than half of all child deaths, hunger and malnutrition are the greatest obstacles to reducing child mortality (MDG 4).
- Hunger and malnutrition increase both the incidence and the mortality rate of conditions that cause a majority of maternal deaths during pregnancy and childbirth (MDG 5).
- Hunger and poverty compromise people's immune systems, force them to adopt risky survival strategies, and greatly increase the risk of infection and death from HIV/AIDS, malaria and other infectious diseases (MDG 6).
- Under the burden of chronic poverty and hunger, livestock herders, subsistence farmers, forest dwellers and fisherfolk may use their natural environment in unsustainable ways, leading to further deterioration of their livelihood conditions. Empowering the poor and hungry as custodians of land, waters, forests and biodiversity can advance both food security and environmental sustainability (MDG 7).

(The State of Food Insecurity Status In the World, FAO, 2005)

1.1 Overview of nutritional and food security status in Indonesia

Despite increasing production of major staple food items over the last three years and general improvements in health and social services; malnutrition, hunger and poverty still remain a major problem in Indonesia. According to SUSENAS 2003 data, 27.82 per cent of pre-school children were moderately underweight and 8.81 per cent severely underweight, as measured by the weight-for-age indicator. In absolute numbers this constitutes eight million Indonesian children under five years of age whose cognitive and behavioral functioning will be threatened by the malnutrition problem during their childhood. SUSENAS data for the three-year period 2000-2003 shows that the national prevalence of severely and moderately underweight children increased about 2, 21 per cent over this period (see Table 1 below).

Table 1: Trend of National Prevalence of Underweight Children Under Five Years of Age (2000-2003)

	2000	2002	2003
severe underweight Z-score < -3SD	7.85	8.18	8.81
moderate underweight Z-score < -2SD	16.8	19.04	19.01

The Infant Mortality Rate (IMR) has been used widely as an indicator for health outcomes. IMR is defined as the number of infants out of every 1,000 live births in a particular year who die before attaining 12 months of age. This is an indicator of the availability and quality of health service provided to the expectant mothers. The national IMR for 2002 was 43.5 deaths per 1,000 live births, and there were 15 provinces with an IMR rate higher than the national average. The disparity in the inter-provincial IMR is also still high; NTB had the highest IMR of 78 deaths per 1,000 live births[2], while DKI Jakarta had the lowest rate of 21.8 (SUSENAS 2002, BPS).

The prevalence of underweight population reflects food deprivation in one country. The level of 2,100 kcal is an international standard for the minimum energy required to adequately sustain an average adult. In Indonesia it is estimated that around 12 million of the population consumes less than the minimum energy and protein requirement[3].

In addition to the three indicators explained above, other nutritional indicators, such as the incidence of anemia among children and women and micronutrient deficiencies remain high. These all show that attention needs to be given to health and nutrition components as well as to food security.

1.2 Data availability in Indonesia

In order to improve the targeting of nutrition intervention as well as other interventions for poverty alleviation and food security, we therefore need to identify the hotspots of malnourished children and also food insecurity at the lowest possible level so that the resources can be appropriately utilized for those areas and maximum returns can be expected in terms of the results.

In Indonesia, reliable nutritional data is available only up to the district level. With a total of 33 provinces, 349 districts, 91 municipalities, 5,570 sub-districts and 71,634 villages in the country (BPS, 2005); conducting a household survey to collect information on developmental parameters with a sample that is representative of all districts and sub-districts in the country is prohibitively huge and expensive.

Identification of hotspots of food insecurity at the lowest possible administrative level and designing appropriate policy measures for geographic targeting of the poor are thus extremely difficult below the provincial level, especially at the sub-district level. This also has a negative bearing on result-based monitoring of ongoing programs and schemes. As the focus on nutritional status and investment in food-based interventions will continue to be a priority for Indonesia, there is a clear need for sophisticated tools for more effective geographic and socio-economic targeting than those that have been used in the past. Ideally, geographic targeting should be based on a description of nutritional intake as well as conventional outcome measures of nutrition like underweight, stunting, wasting and body mass index.

In 2005, WFP in collaboration with the National Food Security Council, Ministry of Agriculture undertook a district level analysis of the Food Insecurity status of Indonesia. The composite food security index was based on 10 indicators, reflecting food availability, food access and livelihood and nutritional and health indicators. This Food Insecurity Atlas indeed provides a better tool for targeting areas across Indonesia for food security and nutrition intervention. A combination of the district level analysis of Food Insecurity and a sub-district level Nutritional Analysis and Mapping will provide a sophisticated tool for geographic targeting of nutrition and food security intervention programs. Both maps analyzed the major key indicators of food security and nutrition at the lowest administrative level possible.

1.3 Overview of Small Area Estimation Technique (SAE)

In recent advances in research techniques, a new methodology has been developed to make estimates at a micro-level from census-based secondary data that are normally available on a whole country basis. The core of the method is to identify the predictive indicators from the census survey information that could explain the information obtained from household surveys. A household survey usually collects very detailed information on household characteristics, including consumption level, but the sample coverage is generally limited and only representative over a relatively large geographical area. On the other hand, a population census has a complete coverage of all households, but usually collects very limited information on household characteristics. Hence, this method tries to combine the advantages of detailed information on household characteristics obtained from household surveys with the complete coverage of a population census.

1.4 Objectives of the Nutritional Analysis and Mapping

The objectives of the nutritional analysis and mapping project are:

1. to establish models showing the relationship between the nutritional and socio-economic status of the population concerned;
2. to estimate the nutritional status of the population at a sub-district level based on the models;
3. to estimate the prevalence of underweight children under-five at a sub-district level; and
4. to estimate the Infant Mortality Rate at the sub-district level.

1.5 Reliability of the Results

One component of this exercise is the calculation of standard errors for the provincial estimation to give an indication of the reliability of the indicator estimates. The standard error measures the level of uncertainty associated with an estimate. The estimates that have small standard errors will be likely to provide more accurate results. Our analysis on the calculated standard errors of the indicators on underweight children under-five and the population with an energy intake of less than 1,700 kilo calories, shows that the rate in most cases is low, thus showing that our results are reliable for this exercise.

We also compared the SAE result with other reference data. The comparison of the underweight children indicator of the SAE result with the provincial level figure given by SUSENAS 2002 shows that the two sets of results were very similar to each other, with the exception of the results of underweight estimates for NAD, Maluku, North Maluku and Papua provinces. Those areas were not fully covered in SUSENAS 2002.

The comparison of the IMR between the SAE result and district level estimate provided by BPS special tabulation for National HDR 2004 gives the same picture of pockets with a high prevalence of IMR at the district level for the entire country.

The reference dates may, however, differ with those of IMRs reported by other publications such as in the series of National Human Development Reports published by BPS-UNDP. The IMRs reported in those publications are basically the extrapolation of past trends using a number of data sources. In such cases the IMRs are extrapolated to a specific year as a reference date such as 2002 or 2004.

The data source used in this exercise is the 2000 population census. Since the calculation used the indirect technique, the reference dates for IMRs is mid-1996, not 2000. Thus, the IMR estimation given by the SAE is dissimilar to the other publication due to the different reference dates used. The SAE result is consistently higher, but it shows the same pattern of areas of high IMRs in the country.

1.6 Scope of Work and Challenges

This is the first application of the Small Areas Estimation technique to measure the prevalence of malnutrition at the sub-district level in the country. A total of 30 provinces, 341 districts and cities, and 3,688 sub districts were included in this analysis.

We used three indicators to describe malnutrition and food security status at the sub-district level, hence three different data sets have to be prepared for each model of the population living with an energy intake of less than 1,700 kcal, underweight children under five and the Infant Mortality Rate.

This has to be done for each province, separated by urban and rural areas, and by type of data set (i.e., data set-1, for modeling and data set-2 for simulation). Thus, in total, for the population living with an energy intake of less than 1,700 kcal and underweight children under five, 26 x 2 x 2 x 2 = 208 data sets have been constructed to execute this exercise.

Obviously, a major effort and significant resources have been invested in undertaking this challenging exercise. As was also mentioned above, this is the first exercise to measure the prevalence of malnutrition and food security indicators using SAE. The methodology used and results obtained should be seen as preliminary results, until such time as they can be validated.

2. METHODOLOGY

2.1 Indicators, Nutrition Map Model, and Data Used

The Nutritional Map (NutMap) model as reported here enables the estimation of some indices of nutritional status down to the lowest administrative level allowed by the data (here sub-district). This is made possible because the model, like the Poverty Mapping (PovMap) model, combines the strength of both survey and census data. The survey, even though it is unable to estimate nutritional status at lower than the provincial level, provides data on the consumption required for estimating nutritional measures. The census, on the other hand, although it does not collect data on consumption, provides data on basic characteristics of individuals in the population that enables an estimation to the lowest level of administrative areas.

2.1.1 Definition of Nutritional Status

The term nutritional status used here is loosely measured by energy intake, weight-by-age of children under-five, and infant mortality rates. Table 2 shows the measures and their indicators.

Table 2: Measurement and Indicators of Nutritional Analysis and Mapping

Area of concern	Measurement	Indicator	Notes
Food security	Energy intake	Proportion of population with per capita energy intake less than 1,700 kilo calories per day	Adjusted for age-sex structure by Amsterdam scale
Nutrition and health outcome	Children under-five who are less than -2 Standard Deviation (-2 SD) from the age and gender specific normal weights (WHO-NCHS Standard).	Proportion of children with weight-by-age less than 2 Z_{score}	
	Number of infants who die before attaining 12 months of age (out of every 1,000 live births in a particular year).	Infant mortality rate	2000 population census data

2.1.1.1 Energy Intake

Basic data on energy intake is obtained from food consumption collected regularly every three years through SUSENAS Consumption Module, a recall-based survey with a one week reference period. This survey collects food consumption data for about 225 food items during the reference period. The conversion of food into energy level, a table published by the Ministry of Health (*Departemen Kesehatan*), is utilized. The table is used for food that is both prepared and consumed in the observed households. For those households consuming prepared food (i.e., not prepared in the household), a similar conversion table, published by the Centre for Research and Development of Nutrition, *IPB* (*Puslitbang Gizi*) is utilized. Close examination of actual data shows that consumption data of SUSENAS includes consumption of food prepared in both observed households and outer unobserved households.

In the modeling, age-sex composition of the observed households is taken into account and the concept of a so-called equivalized household is adopted. Here, each household member is scored or "weighted" to accommodate a so-called "economic scale" and differential in the energy requirement of person by age-sex. Two scaling systems, the modified-OECD scale (Verma, 1999) and Amsterdam scale, have been tried and the results suggest that the Amsterdam scale is more appropriate for the SUSENAS data.

2.1.1.2 Nutritional Status of Children

The 2002 SUSENAS collected data on weight (by age) of children under the age of five years using a portable balance scale (*timbangan dacin*). The data is used to measure the nutritional status of the children, based on a modified anthropometric Harvard (NCHS-WHO) standard, as recommended by *DepKes*. Under this standard, children are considered to be underweight (i.e., below "normal"), if their weight-to-age, in standardized form, is lower than minus 2 standard deviation (=Zscore < - 2SD).

2.1.1.3 Infant Mortality Rate

The 2000 population census was probably the only source that can be used for estimating infant mortality rates at the lowest administrative level. The census, for the first time in BPS history, has collected data on all children ever born and still surviving for every woman of reproductive age (10+). The data can be used to estimate IMRs by applying an indirect technique of estimation as proposed by the United Nations (i.e., Manual X). The technique basically transforms the proportion of deceased to ever-born children for age-specific women (=D(i)) provided by the census or the other typical survey data, into the probability of child mortality (=q(x)), based on the following equation:

$$q(x) = k(i).\ D(i)$$

where q(x): probability of dying at age x (x=1,2,3,5,10,15,20)

k(i): multiplying factor for a given model of life table for age group of women i (i=1-7, i=1 for age group 15-19, 2=2 for 20-29, …i=7: for 45-49).

D(i): proportion of children who have died for age group i (based on census or survey-based data).

Based on a given model of live table, q(x) is then transformed into IMRs. The whole process of computation can be handled by Mortpack-litle package.

2.1.2 Data Sets

The Nutrition Map model is basically a predictive model for small administrative areas by combining the strength of both survey and census data. The survey, even though it is unable to estimate nutritional indices at lower than provincial level, provides data required for estimating the indices. The census, on the other hand, although it does not collect the required data in a direct way, provides data on basic characteristics of the individual population that enables estimation to the lowest level of administrative areas. As applied here, the model uses the following six data sources extensively:

- 2002 SUSENAS Consumption Module is to provide data on energy intake served as target variables. The total sample of the survey is about 65,000 households throughout the country; the sample varies proportionately by province.

- 2002 SUSENAS Core is to provide data on individual and household characteristics utilized as explanatory variables, to be used in running the models. The total sample is about 200,000 households; the sample also varies by province. Estimation is possible to the district level.
- Specific 2002 SUSENAS for children under five years of age, to provide data on the nutritional status of these children as measured by weight-by-age. The sample is about 65,000 children throughout the country. Estimation is possible to the district level.
- 2000 Population Census is to provide data on individual (from L2 schedule) and household (from L1 schedule) characteristics, to be used in simulation to estimate nutritional indices. The data is also used to provide community variables by disaggregating to the village level.
- 2003 Village Potentials (*Podes*) is to provide community (i.e., village) data, used to identify so-called locational effects. *Podes* covers all villages throughout the country.

Datasets for the estimations of NAD, Maluku, Maluku Utara and Papua provinces

SUSENAS 2002 are not available for provinces of Aceh, Maluku Utara, Maluku and Papua. For these provinces, SUSENAS 2004 are used for the estimation of energy intake and SUSENAS 1999 for the estimation of underweight children. However, the coverage of these two SUSENAS in these provinces is limited only in the capital cities of the provinces.

2.1.3 Procedures

The process for running the Nutrition Mapping model is carried out in accordance with the following nine steps:

1. Developing Beta model (see equation (2));
2. Calculating locational effects (3);
3. Calculating variance of estimators (4);
4. Preparing e_{ch} term residual to run Alpha model (6);
5. Developing GLS estimate model;
6. Using decomposition value singular to decompose the variance-covariance matrix as provided by the previous step, to be used to establish vectors that are randomly and normally distributed;
7. Reading data census, eliminating missing values, and providing variables required by Beta and Alpha models;
8. Storing all data sets required for simulation; and
9. Running povmap.exe package program to obtain malnutrition headcount index and inequality measures allowed by the package, including their standard errors.

In equation (2), the nutritional status of household (=ln Y_{ch}) as provided by 2002 SUSENAS Consumption Module serves as the dependent variable. For the explanatory variable (=X_{ch}), all common variables found in both the 2002 SUSENAS Core and 2000 population data sets (both L1 and L2 schedules) can serve as candidate variables to be included in the model. However, to be meaningful, the distribution and the summary statistics of each candidate variable are to be checked. The variable with very different distribution as shown by its summary statistics is excluded from the model. Checking distribution and summary statistics is done for every stratum (urban and rural province) and its corresponding attributes and scores used in the construction of an urban score.

In addition to common variables that passed t-test as just mentioned above, the model allows one to include interaction variables and higher order of variables (until 3rd order) derived from two or more well-tested single variables. The NutMap model is basically a prediction model and hence the so-called endogeneity problems here can be ignored.

In the model reported here, nutritional status is estimated based on the following model:

1. $\ln y_{ch} = E[\ln y_{ch} | x_{ch}] + \mu_{ch}$

where c : *cluster c* (village)

ch : household h in cluster c

y_{ch} : nutritional status for household h and cluster c

x_{ch} : socio-economic characteristic of household h in cluster c

The linear approximation of model (1) can be expressed as follows:

2. $\ln y_{ch} = x_{ch}\hat{a} + \mu_{ch}$ (*Beta* model)

where ¤$_{ch}$ is disturbance terms.

SUSENAS data does not provide locational information. In other words, disturbance terms as shown in equation (2), includes locational variables needing to be identified. The following formula is used to estimate locational effects:

3. $\mu_{ch} = \eta_c + \varepsilon_{ch}$

Here η_c is *cluster* components and ε_{ch} is household components. On the average at village level, distribution terms can be expressed as follows:

4. $\mu_{c.} = \eta_c + \varepsilon_{c.}$, and then

$$E[\mu_c{}^2] = \sigma_\eta{}^2 + \mathrm{var}(\varepsilon_{c.}) = \sigma_\eta{}^2 + \tau_c{}^2$$

In the above equation η_c and ε_{ch} are assumed to be normally distributed and independent of each other. Following Elbers *et al* (2002), the estimated variance of locational effects can be expressed as follows:

5. $$\mathrm{var}(\hat{\sigma}_\eta{}^2) = \sum_c [a_c{}^2 \ \mathrm{var}(\mu_{c.}{}^2) + b_c{}^2 \ \mathrm{var}(\hat{\tau}_c{}^2)]$$

In the absence of locational effect, η_c, equation (3) becomes simpler, $\mu_{ch} = +\varepsilon_{ch}$. However, this is normally an unrealistic assumption. Following Elbers *et al* (2002) residual ε_{ch} can be explained by a logistic model that regresses transformed ε_{ch} with household characteristics:

6. $$\ln\left[\frac{e^2{}_{ch}}{A - e^2{}_{ch}}\right] = Z_{ch}^T \hat{\alpha} + r_{ch}$$ (*Alpha* model)

Here A is set as A= 1.05*max{$\varepsilon_{ch}{}^2$}.

Estimated variance of ε_{ch} can be calculated using the following equation:

$$7. \quad \hat{\sigma}^2_{\varepsilon,ch} = \left[\frac{AB}{1+B}\right] + \frac{1}{2}\hat{\mathrm{Var}}(r)\left[\frac{AB(1-B)}{(1+B)^3}\right]$$

Equation (7) suggests that the OLS model cannot be applied in equation (2); and hence the GLS model is applied instead.

Using a number of common variables found in the census and the survey data sets, and the variables that come from a tertiary data set (i.e., *Podes*) that can be linked to census and survey, a consumption regression is run to estimate the distribution of coefficients and residual terms. Here the dependent variable is individual household nutritional status as provided by the 2002 SUSENAS Consumption Module. The regression is run for all provinces and separated between urban and rural areas.

Running regression models as just described is the first major step in the application of the Nutrition Mapping method. The second major step is to estimate the nutritional status of the household using the coefficients and residual terms randomly drawn from the estimated distribution as provided by the first step. The imputed nutritional status in turn is used to estimate malnutrition and inequality measures at the level of small administrative areas. The imputation is repeated many times to arrive at a point estimate and robust standard error. (See Elbers, Lanjou and Lanjou, 2002 and 2003, for a more detailed description of the methodology.) Processes of imputation as well as estimation of nutritional status and inequality measures is run using a program package designed by Qinghua Zhao of DECRG World Bank (2002).

3. RESULTS AND DISCUSSION

The result of this analysis is structured as follows: we will start the analysis by describing the provincial analysis of the indicators, followed by a district analysis and finally sub-district analysis. Due to the large number of sub-districts in Indonesia, presenting the sub-district results across the country will not be visible on one map. Therefore the sub-district map will be presented by island groups; namely Sumatera, Jawa, Nusatenggara, Kalimantan, Sulawesi and Maluku-Papua. The estimations are computed for national analysis. Using the SUSENAS 2002 as a main data source, 30 provinces, 341 districts and cities, and 3,688 sub-districts were included in this analysis. The estimation of Nanggroe Aceh Darussalam, Maluku, Maluku Utara and Papua could be done down to the district level because SUSENAS 2002 only covered the capital cities in those four provinces.

3.1 Relative Standard Errors

One of the major outputs of the Nutrition Map model is the head count index, i.e., the prevalence of underweight children under five years of age and the percentage of the population living with an energy intake less than 1,700 kilo calories and their corresponding standard errors of the provincial estimation.

The sample estimate and its standard error allow us to construct an interval estimate with a prescribed level of confidence that the interval will include the mean value of the estimates from all possible samples. For example, an estimate of the population living with an energy intake less than 1,700 kilo calories in the urban areas of Sumatera Utara is 14.77 per cent and its standard error is 2.16 per cent. It means at 90-percent confidence, the interval of estimation for urban areas of Sumatera Utara is (14.77 ± 3.54) or (11.23 to 18.31). The value 3.54 derived from 2.16 (the standard error) x 1.64. The value of 1.64 is the standard error of normal distribution at 90 per cent level of confidence.

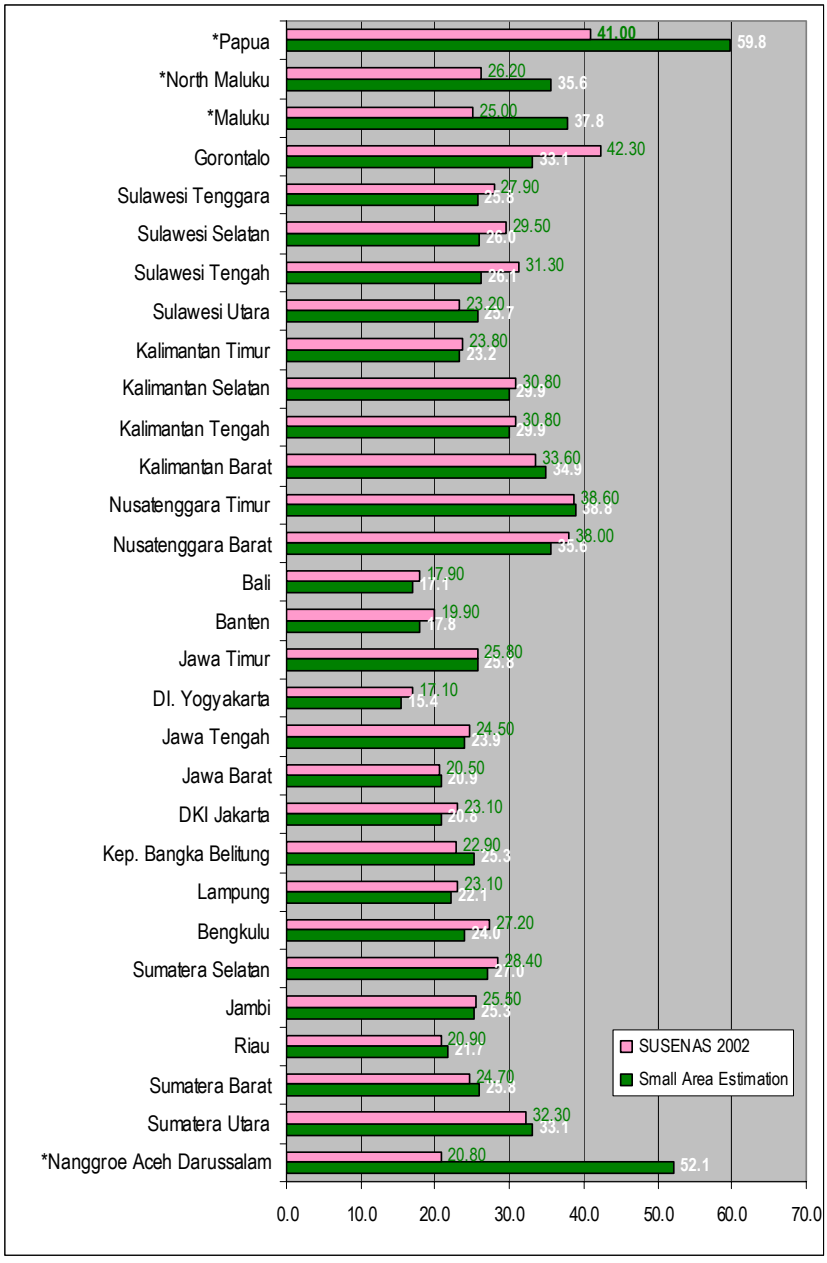
3.2 Underweight Children Under Five Years of Age

3.2.1 Provincial Estimates

Map 1 depicts the estimation of underweight children under five years of age across provinces using the SAE technique. Using this method, the estimation has determined the national average of underweight children under five of 28.7 per cent, and this figure is close to the national average using direct estimation of SUSENAS 2002, which is 27.22 per cent. This shows that the result of the SAE is reliable.

The provincial figure shows that the underweight prevalence in nine provinces out of 30 provinces was classified as high or, in other words, where the rate was above 30 per cent. The estimation for Nanggroe Aceh Darussalam and Papua are the worst, i.e., 52.1 per cent and 59.8 per cent respectively. According to the WHO classification, a prevalence of underweight children under five years of age of greater than 30 per cent shows a serious condition of malnutrition in a certain region. The nine worst provinces in terms of underweight children are Nanggroe Aceh Darussalam, Sumatera Utara, Kalimantan Barat, Kalimantan Timur, NTB, NTT, Gorontalo, Maluku, Maluku Utara and Papua. Only three provinces have a prevalence of underweight children under five years of age below 20 per cent, namely Banten, Yogyakarta and Bali.

Figure 2: A Comparison of SAE Result and SUSENAS Data 2002 of the Prevalence of Underweight Children (By Province)



Note: The high variation between the SAE result and SUSENAS 2002 of NAD and Papua should be interpreted wisely, since SUSENAS 2002 in NAD, Maluku, Maluku Utara and Papua provinces were done only in the capital cities.

3.2.2 District Estimates

Map 2 presents the distribution of underweight children under five at a lower administrative level i.e., at the district level. The trend is consistent with the Provincial Estimates as can be seen in the map. The distribution of a high prevalence of underweight children (>30 per cent) at the district level is consistently found at districts in those nine worst-off provinces. The district level figure reflects the seriousness of the nutritional problems in Indonesia. Only 56 districts/cities out of 341 districts/cities have an underweight rate of below 20 per cent and the remaining 285 districts/cities fall below the cut-off point. Furthermore, the regional disparity is also very high; the prevalence of underweight varies from 10.86 per cent, found in Kota Balikpapan, Kalimantan Barat to 81.74 per cent in Sorong, Papua (details of the district level estimation are available in the annex 2).

3.2.3 Sub-district Estimates

3.2.3.1 Sub-district Analysis of Sumatera

The starting point for the sub-district analysis is the presentation of the estimation of underweight children under five in Sumatera Island (Map 3). NAD province is excluded from the analysis due to data unavailability. At the sub-district level, the extent of under-nutrition is much higher than what is revealed at the provincial and district level. More pockets of a high to very high prevalence in Sumatera are shown in this map. Out of 771 sub-districts, 198 have an underweight prevalence of more than 30 per cent. It means 26 per cent of sub-districts in Sumatera Island are classified as having a high prevalence of under-nutrition. Furthermore, those clusters of sub-districts that have a high prevalence of underweight are found in Sumatera Utara, Sumatera Barat, Sumatera Selatan and Jambi. The nutritional problem in Nias Island is of concern as all sub-districts have a very high prevalence of above 40 per cent. In absolute numbers, there are 40,013 preschool children in Nias whose cognitive and behavioral function are threatened during their childhood. Similarly, a few hotspots of very high prevalence are found in sub-districts in the mainland provinces of Sumatera Utara and Sumatera Selatan (the list of the sub-district estimations are available in the CD).

Likewise, despite the impression that all areas in Sumatera have a high prevalence rate (> 30 per cent) as shown in the district map, there are a few better off sub-districts (shown as green on the map). Those sub-districts are located in Riau, Jambi and Lampung provinces.

We can see that a sub-district analysis allows us to precisely identify the areas for targeting. The maps will help us to better allocate the limited resources to the pockets with a high prevalence of underweight.

3.2.3.2 Sub-district Analysis of Jawa-Bali

Map 4 depicts the distribution of underweight children under five years of age in Jawa and Bali. A regional comparison shows that the high prevalence of underweight in Jawa-Bali is lower than in Sumatera (about five times lower). This shows that Jawa, the centre of economic and development in Indonesia, has better health infrastructure and services as well as access to the facilities and this is reflected in a better nutritional status.

The sub-district analysis, however, allows us to pull out pockets of serious nutritional problems in sub-districts, mainly in Jawa Timur, which cannot be seen in the district level map. Out of 1,874 sub-districts in Jawa-Bali, 107 have a prevalence of greater than 30 per cent. And it is worth noting that 68.2 per cent (or 74 sub-districts) of those 107 sub-districts are scattered across Java Timur. It is also interesting to highlight the fact that in this Jawa-Bali analysis, the highest rate of underweight is found in Tambora sub-district, Jakarta Barat (41.27 per cent).

3.2.3.3 Sub-district Analysis of Nusatenggara Islands

As is already well-known, the nutritional status in NTB and NTT provinces is very poor. Our SAE estimation also produces the same picture. Map 5 shows 93 per cent of sub-districts in NTB and NTT have a prevalence of greater than 30 per cent. The sub-districts which have a figure greater than 50 per cent are located in Amanuban Timur of Timor Tengah Selatan (TTS) district, Kie in TTS district, Insana in Timor Tengah Utara district, Lamaknen of Belu district and Mollo Selatan of TTS district. All are found in Nusatenggara Timur. The underlying causes are food insecurity, extreme weather condition (prolonged drought), low education, lack of nutritional awareness as well as poor health services. The lowest rate of underweight is found in Jereweh sub-district in Sumbawa island of NTB (25 per cent).

3.2.3.4 Sub-district Analysis of Kalimantan

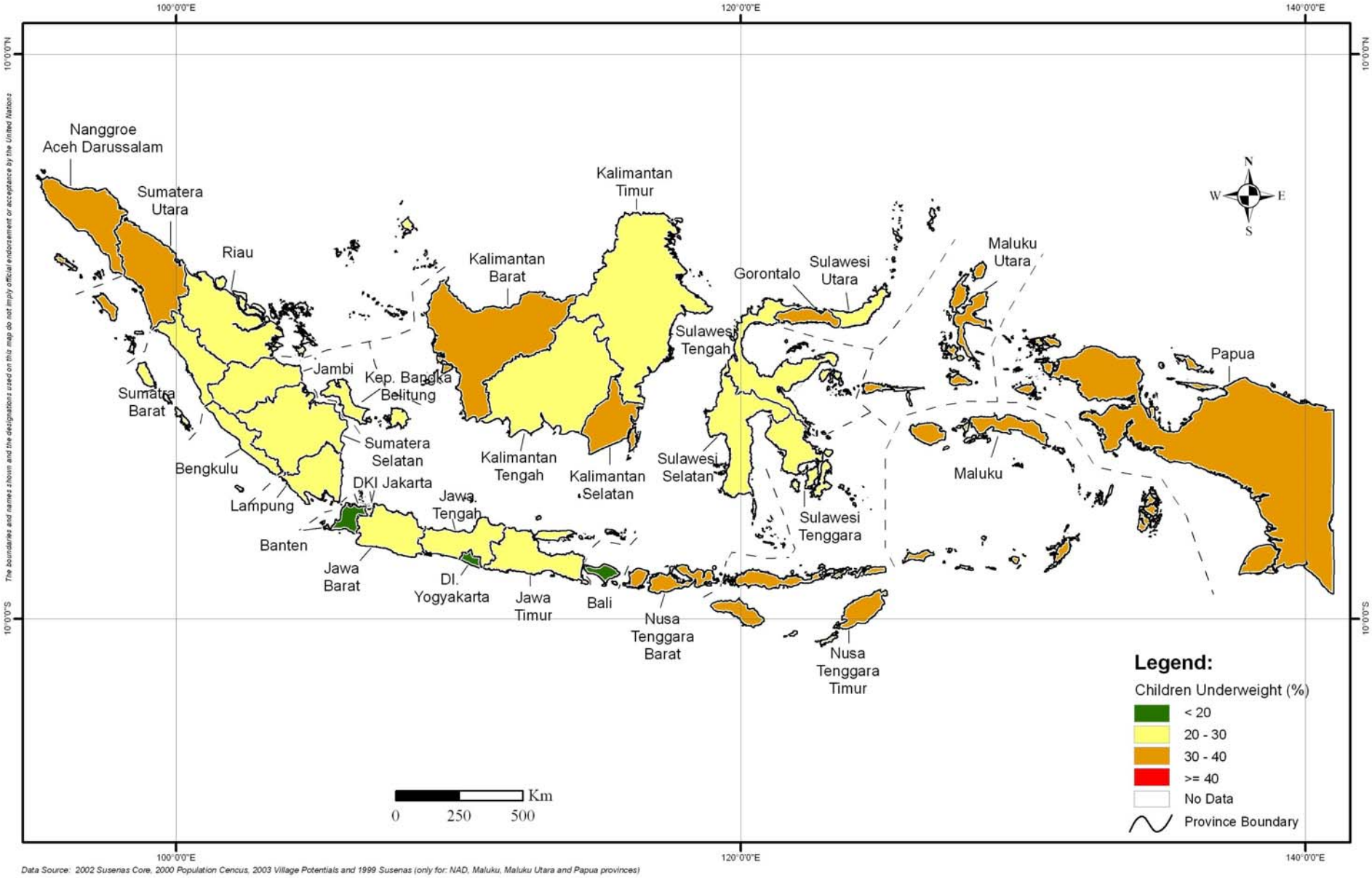
57.3 per cent of sub-districts in Kalimantan have a prevalence above 30 per cent, and it means 234,000 children under five in Kalimantan need immediate attention to protect them from an ongoing malnutrition problem. In addition, some 71 sub-districts out of 417 sub-districts in Kalimantan have a prevalence of more than 50 per cent (Map 6).

Kalimantan has the second highest distribution of high prevalence of underweight after the Nusatenggara islands with the majority to be found in Kalimantan Barat. Only three sub-districts in Kalimantan Barat have a low prevalence. The regional disparity is also very high in Kalimantan.

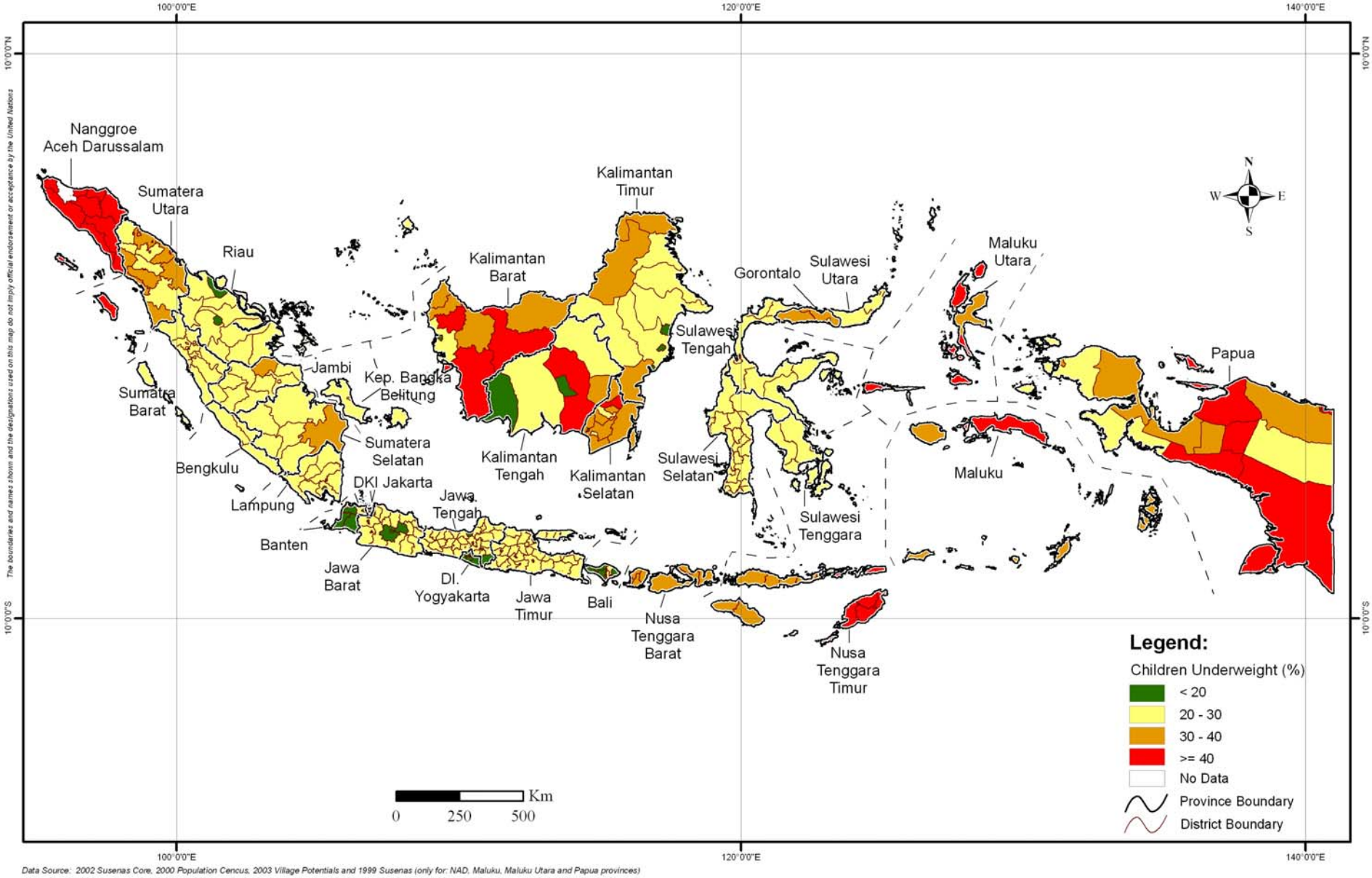
3.2.3.5 Sub-district Analysis of Sulawesi

The nutritional status of pre-school children in Sulawesi, measured by underweight, is relatively better, compared to the other four island groups. There is only one red hotspot found in Tibawa sub-district in Gorontalo. Out of 426 sub-districts, 54 have a prevalence above 30 per cent.

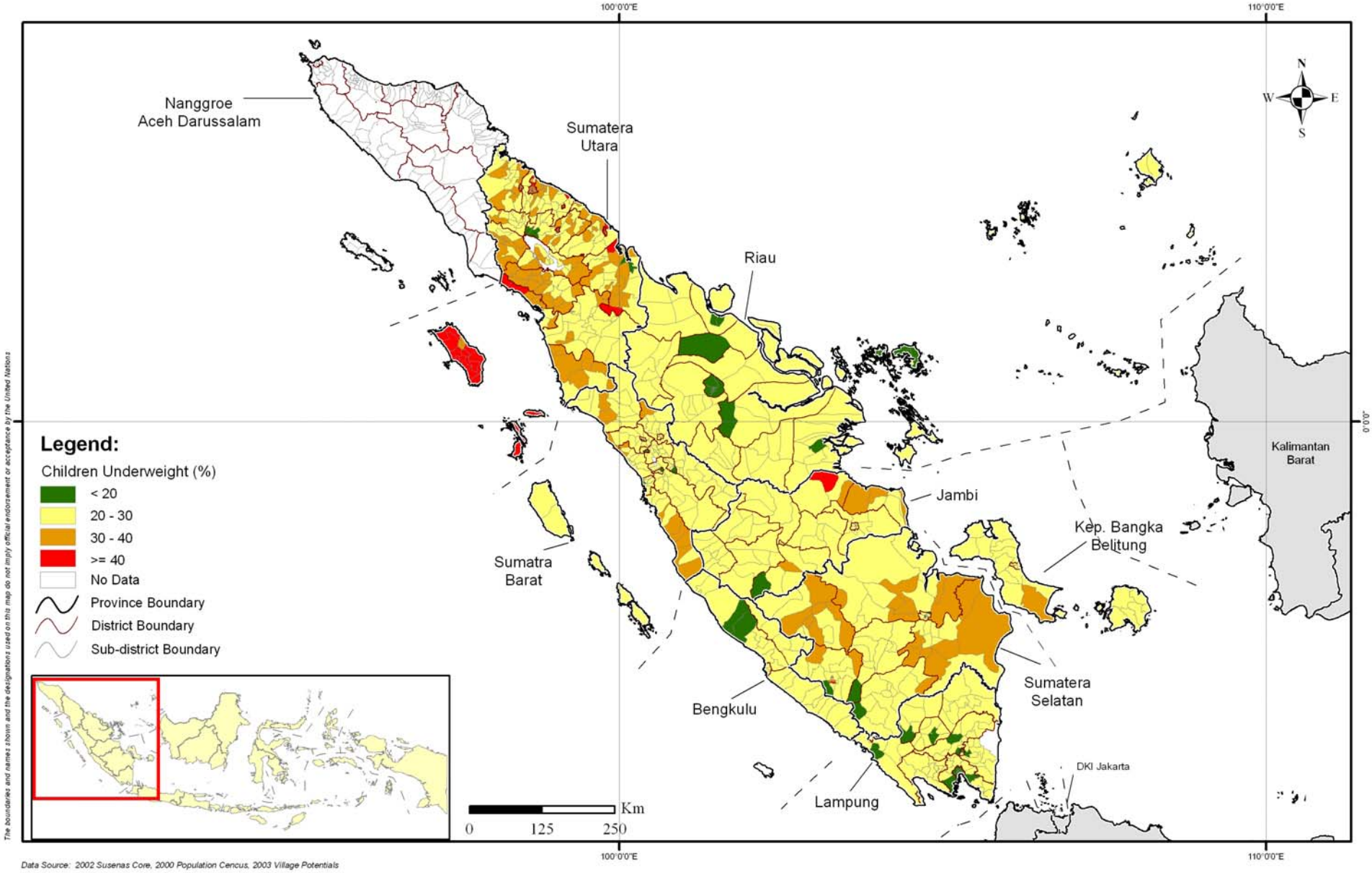
Map 1 Underweight Children Under Five Years of Age by Province



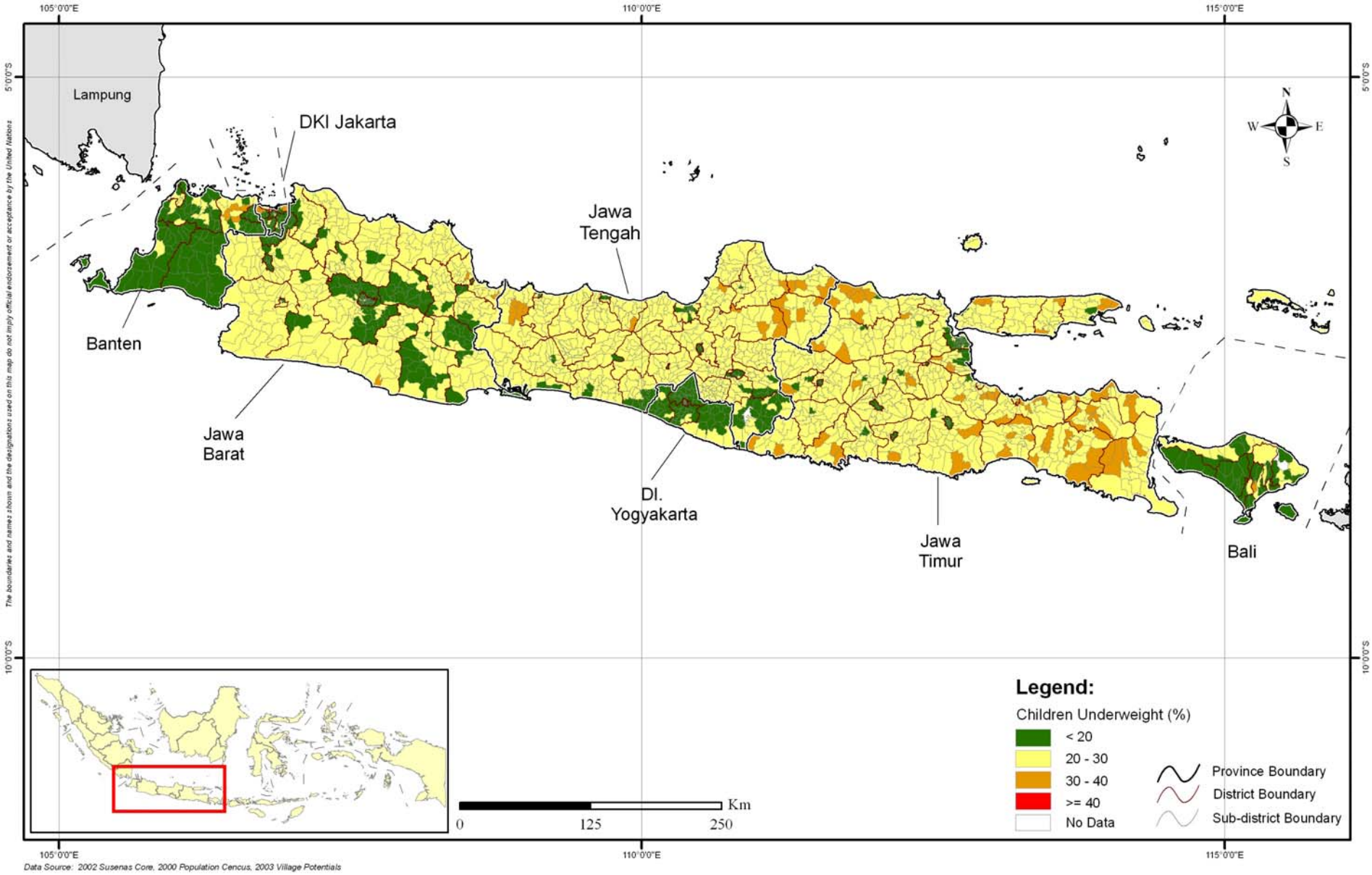
Map 2 Underweight Children Under Five Years of Age by District



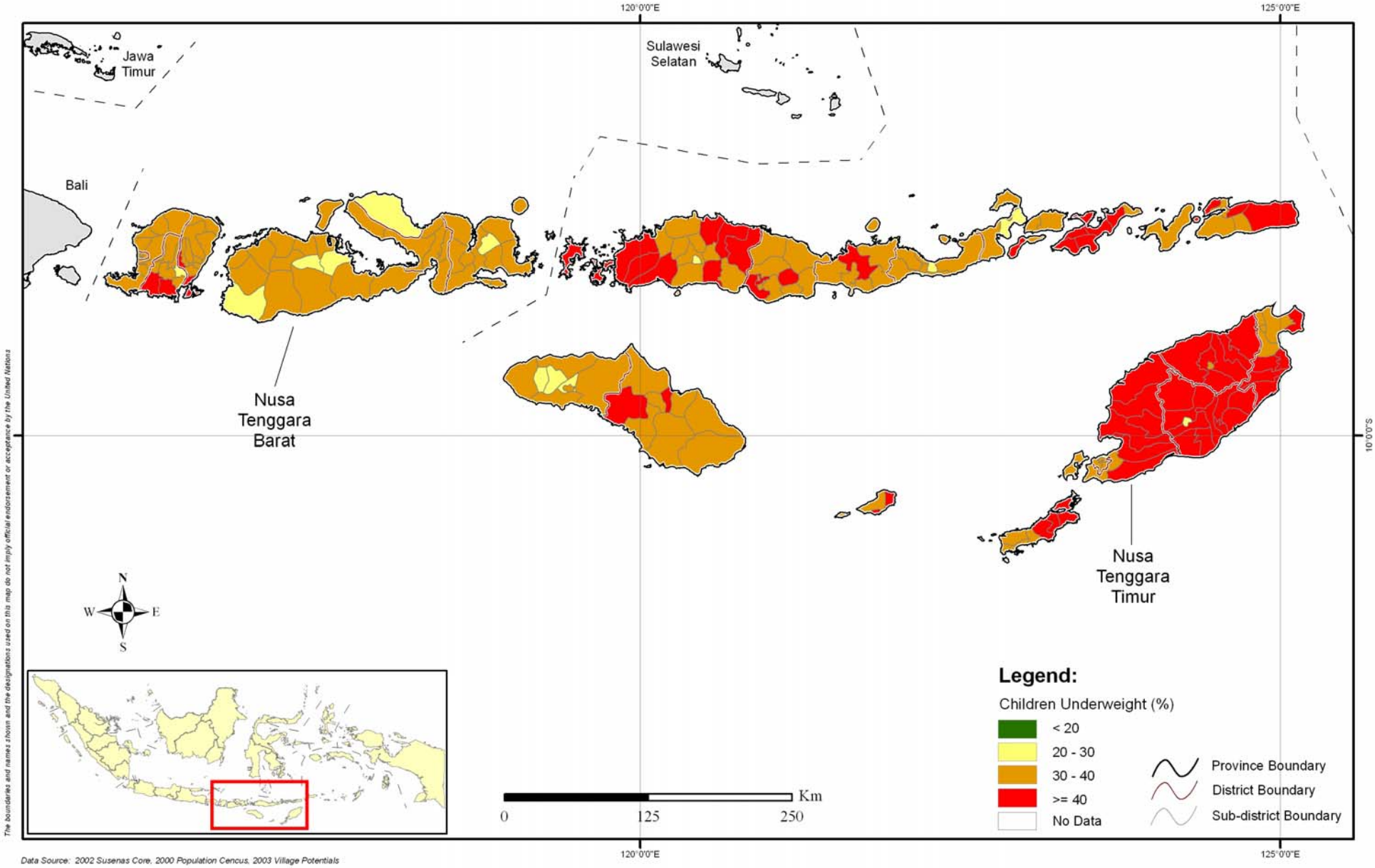
Map 3 Underweight Children Under Five Years of Age of Sumatera by Sub-district



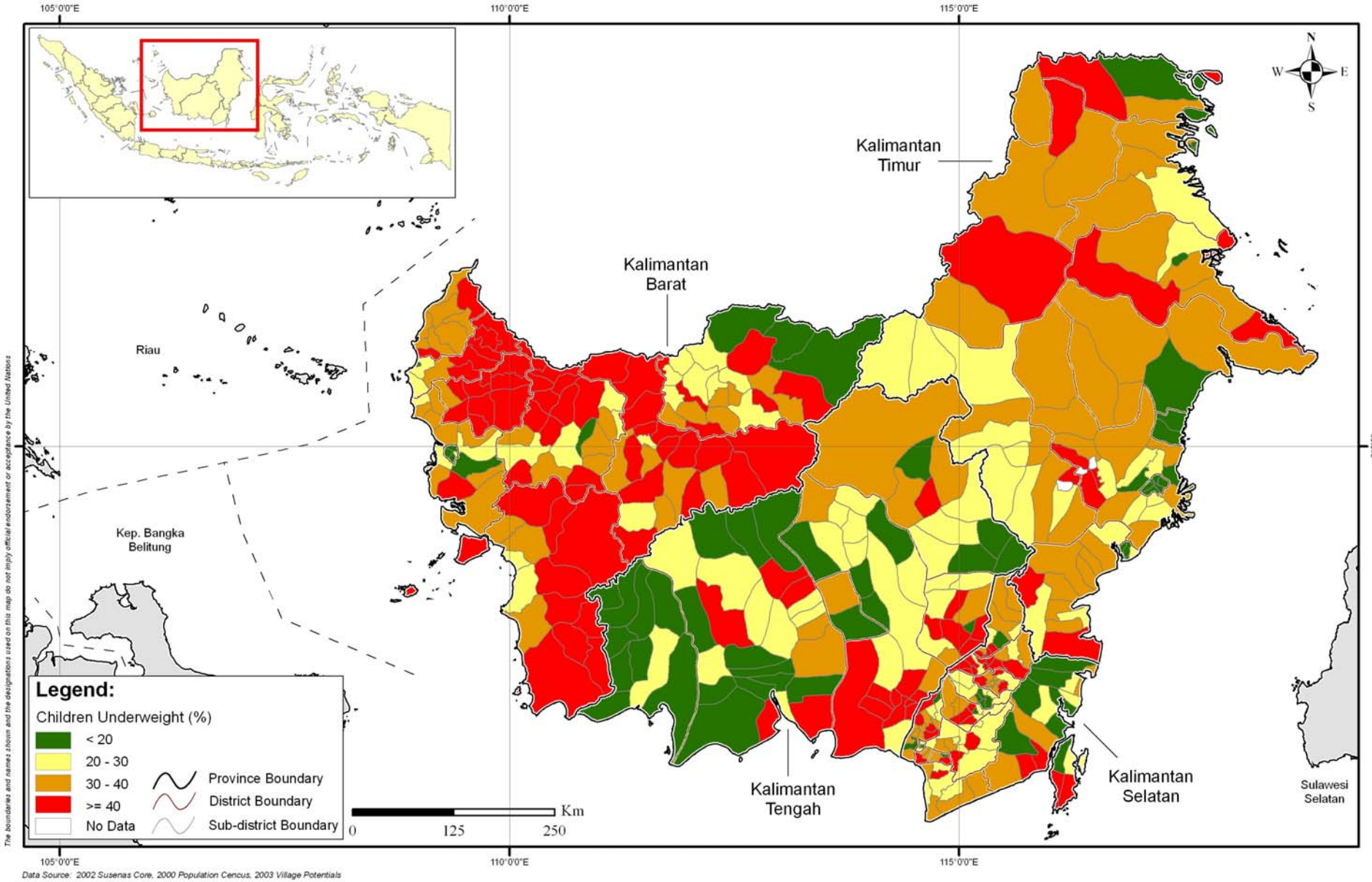
Map 4 Underweight Children Under Five Years of Age of Jawa by Sub-district



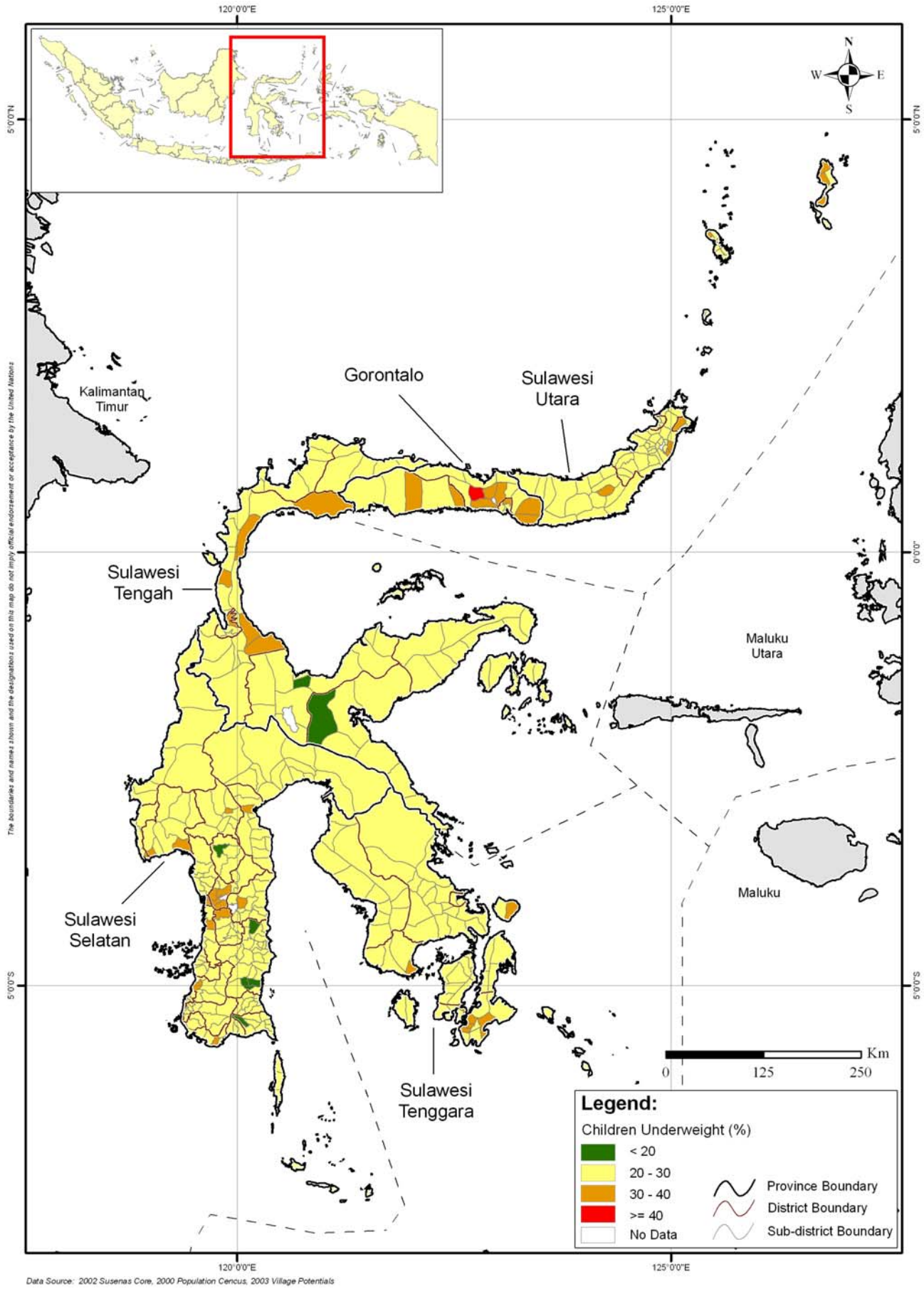
Map 5 Underweight Children Under Five Years of Age of Nusatenggara by Sub-district



Map 6 Underweight Children Under Five Years of Age of Kalimantan by Sub-district



Map 7 Underweight Children Under Five Years of Age of Sulawesi by Sub-district



3.3 Infant Mortality Rate (IMR)

The IMRs results are based on the averages of estimates q2, q3, and q5 (i.e., for age groups of women 20-24, 25-29, and 30-34). The extremely high or low qx are excluded from the calculation.

3.3.1 Provincial Estimates

Map 8 depicts the result of IMR provincial estimation using SAE. Indonesia has made significant progress in reducing the IMR over the last few decades but the regional disparity is still very high. As was the case with the Census estimation, NTB has the highest IMR, and the next cluster of provinces with high IMRs are Banten, Java Barat, Kalimantan Barat, Kalimantan Selatan, NTT, Sulawesi Selatan, Sulawesi Tengah, Maluku Utara, and Papua. Nevertheless, 18 out of 30 provinces have an IMR above the national average. Thus, health protection and services for the poor and vulnerable groups living in villages in the remote areas should be intensified, particularly in those provinces classified as having high to very high IMRs (see Figure 3).

3.3.2 District Estimates

The district analysis shows the distribution of IMR across the districts and cities in Indonesia (Map 9). The district estimation allows us to pick up pockets with a high IMR in districts in Sumatera Island, Java Timur and Kalimantan Selatan which cannot be seen in the provincial map. In general, the clusters of high IMR (>55 per 1,000 live births) are consistently found in districts in those provinces mentioned in the previous section as well as pockets of districts in NAD, Sumatera Barat, Bengkulu, Lampung and Bangka-Belitung. Out of 341 districts and cities analyzed, 146 districts (42.8 per cent) have an IMR above the national average. This shows that more effort should be given to address the infant mortality problem across districts in Indonesia. The distribution of districts with a high IMR can be seen in Map 9.

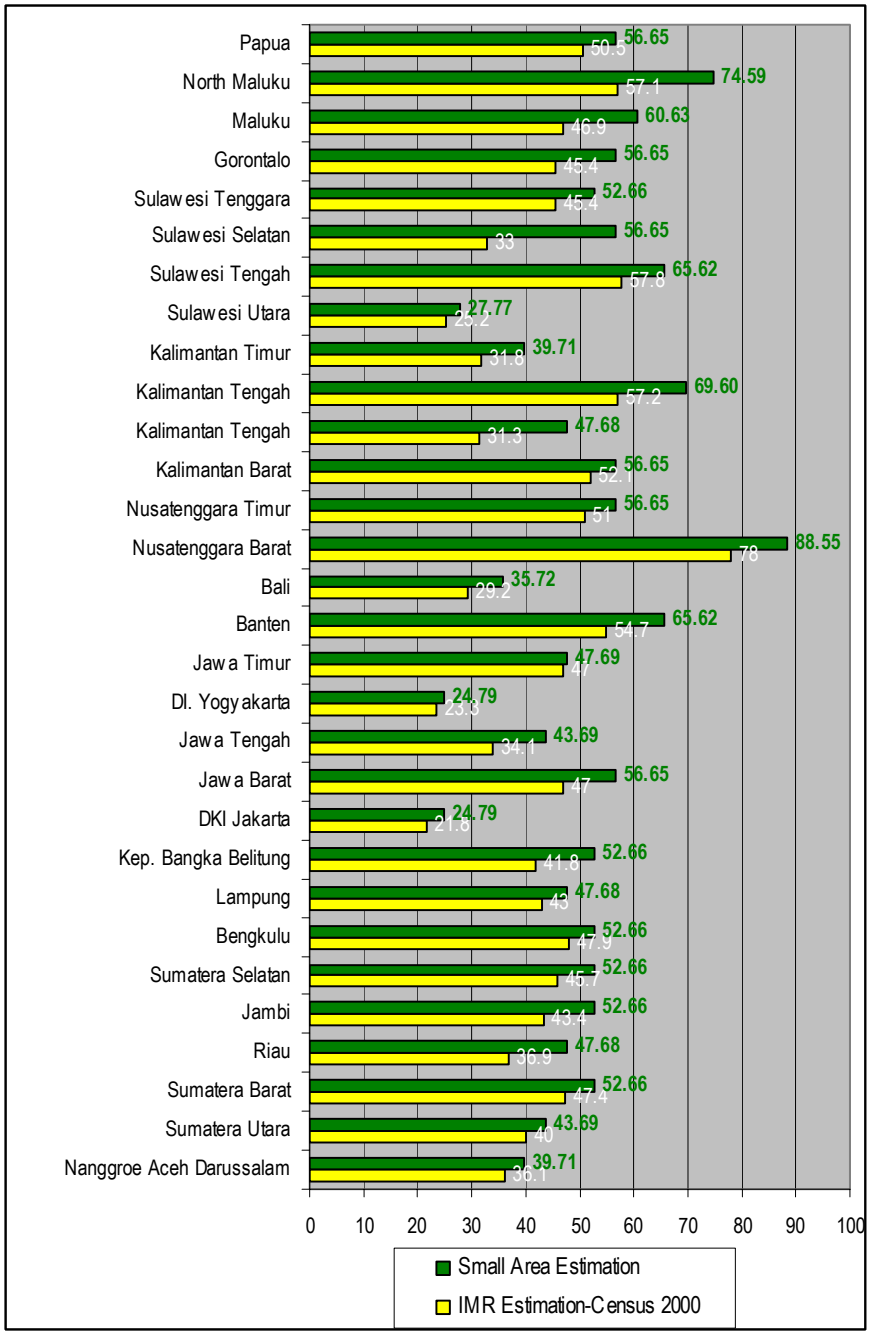
3.3.3 Sub-district Estimates

3.3.3.1 Sub-district Analysis of Sumatera

NAD was excluded from the sub-district analysis due to data unavailability. Map 10 depicts the prevalence of IMR across districts in the provinces in Sumatera. The map shows that the pockets of high IMR (above the national average) are found particularly in sub-districts in Jambi, Bengkulu, Lampung, Sumatera Barat as well as some pockets in Sumatera Utara and Riau. Furthermore, 41 sub-districts have a very high IMR, shown as red hotspots on the map. Out of 771 sub-districts analyzed, 251 are above the national average. It is also worth noting that out of all provinces on Sumatera, Jambi has the most sub-districts having a very high prevalence (the sub-district estimation is available in the CD).

This sub-district level analysis also allows us to see more pockets of better-off sub-districts in terms of the IMR. In particular, those sub-districts are found in Sumatera Utara, Sumatera Barat and Riau as well as a few clusters in Jambi, Lampung and Bangka-Belitung.

Figure 3: A Comparison of SAE Result and Census 2000 Estimation of Infant Mortality Rate (By Province)



3.3.3.2 Sub-district Analysis of Jawa-Bali

In contrast with the Sumatera analysis which shows a high IMR scattered almost everywhere; Java-Bali depicts a different picture, high IMRs are clustered in the western part of Jawa, namely in Banten, Java Barat and Java Tengah, with the exception of DKI Jakarta. Sub-districts in Java Timur, on the other hand, show a better position in terms of IMR, with the exception of sub-districts in the eastern part of Java Timur and Madura. In Bali, there are two hotspots of high IMRs, namely in sub-districts in Karang Asem and Bangli districts. Out of 1,874 sub-districts analyzed, 536 sub-districts (or 28.7 per cent) are above the national average (Map 11).

3.3.3.3 Sub-district Analysis of Nusatenggara Islands

Sub-district level analysis of NTB and NTT shows only a few sub-districts have a more favorable IMR prevalence. The remaining sub-districts (or 80 per cent of the total) have a very high prevalence. All sub-districts in NTB are above the national average (Map 12). This IMR figure has a similar pattern as the underweight figure in the Nusatenggara islands. It shows serious public health problems in these two provinces.

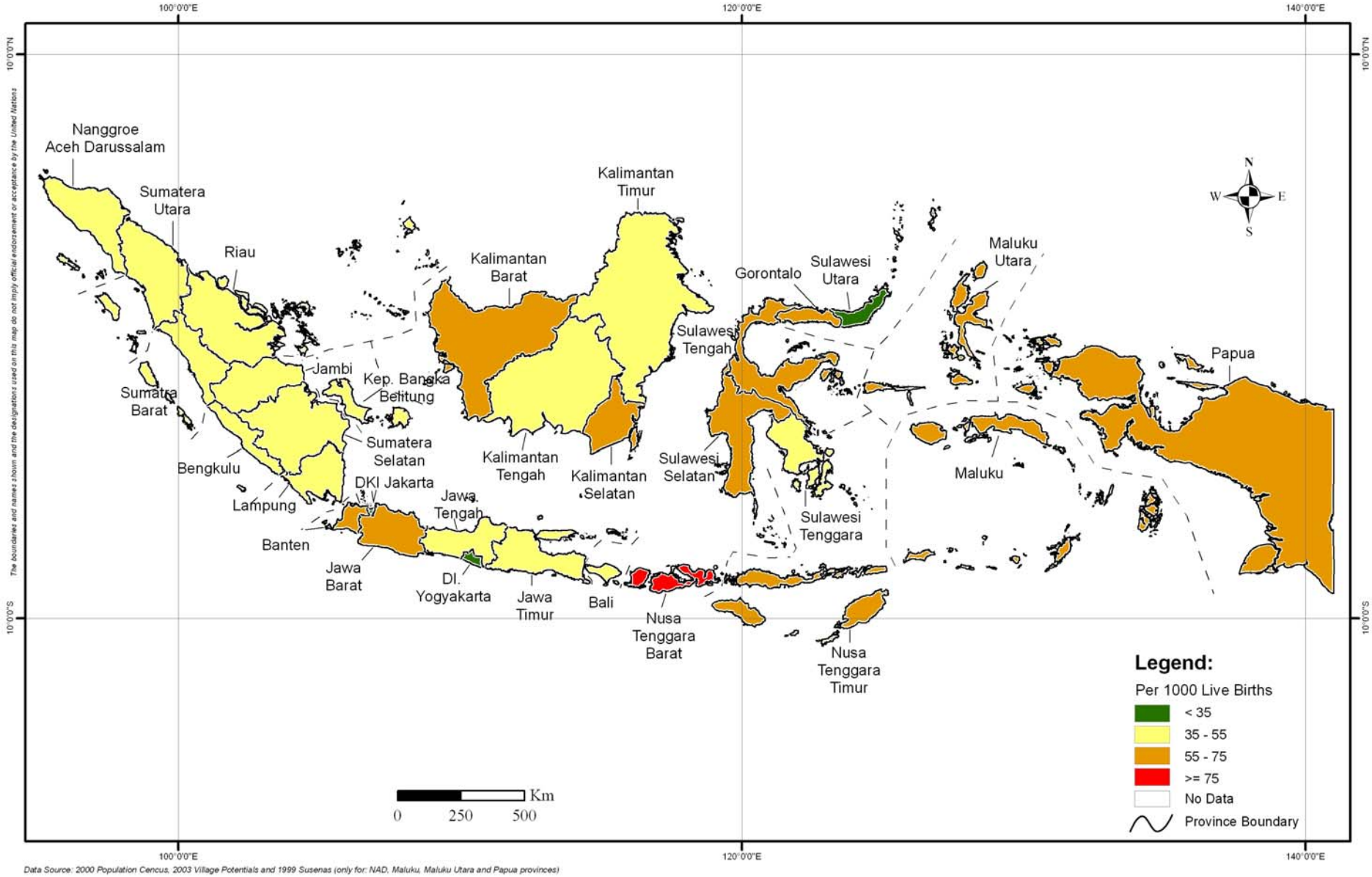
3.3.3.4 Sub-district Analysis of Kalimantan

Out of 417 sub-districts in Kalimantan, 209 have a high to very high prevalence of IMR and they are scattered across the island, with major clusters found in Kalimantan Barat and Kalimantan Selatan (Map 13). In Kalimantan Barat, 55.1 per cent of sub-districts have a high IMR, while in Kalimantan Selatan, 64.5 per cent of all sub-districts or 75 in total have a high prevalence rate. In Kalimantan, the IMR varies from 16 to 90 per 1,000 live births.

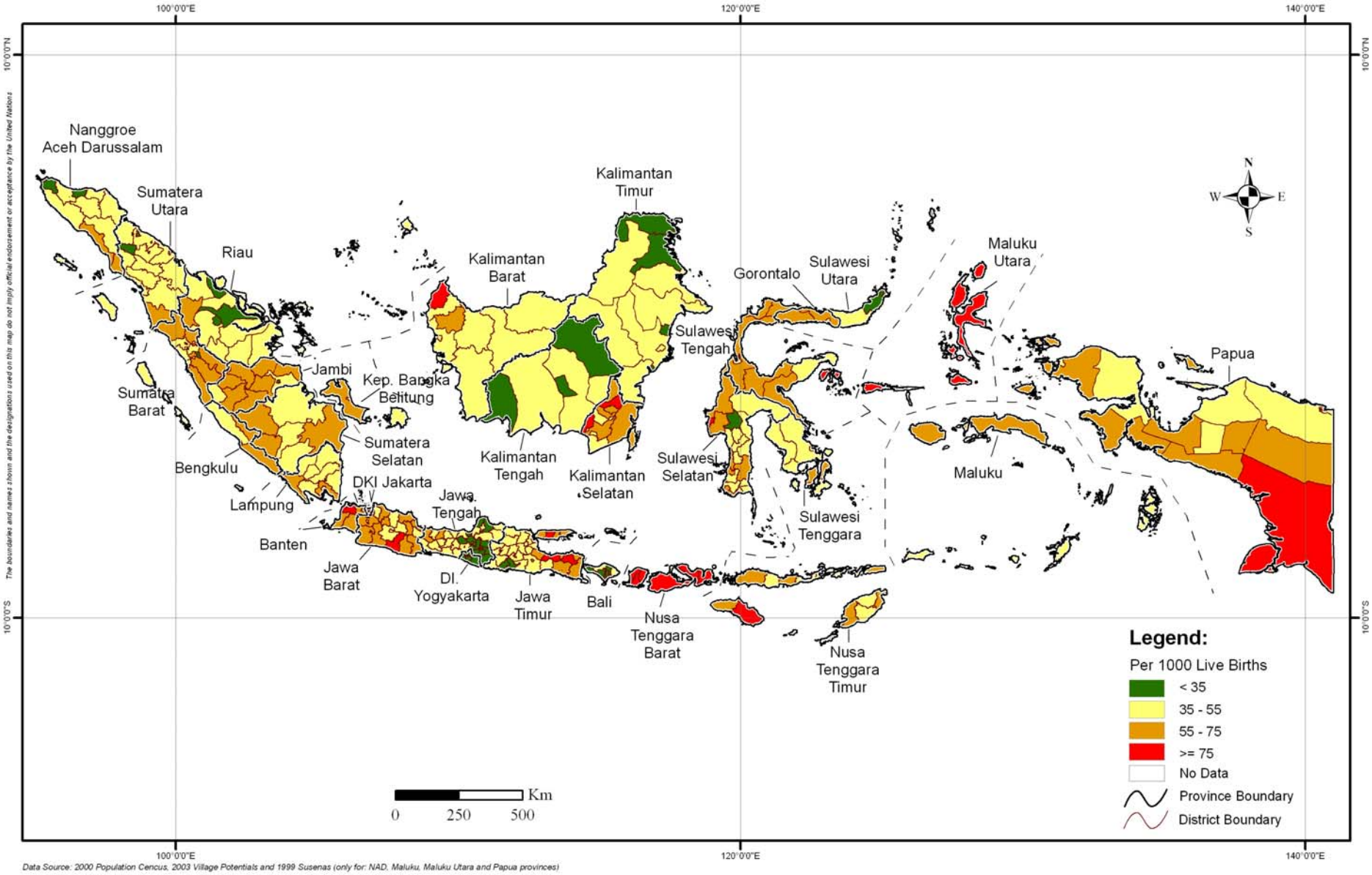
3.3.3.5 Sub-district Analysis of Sulawesi

The sub-district level analysis of Sulawesi depicts a high IMR across the island, except in Sulawesi Utara. Out of 426 sub-districts in the island, 226 are classified as having a high prevalence. Major pockets of high prevalence are found in sub-districts in Sulawesi Tengah, Sulawesi Selatan and Sulawesi Tenggara (Map 14).

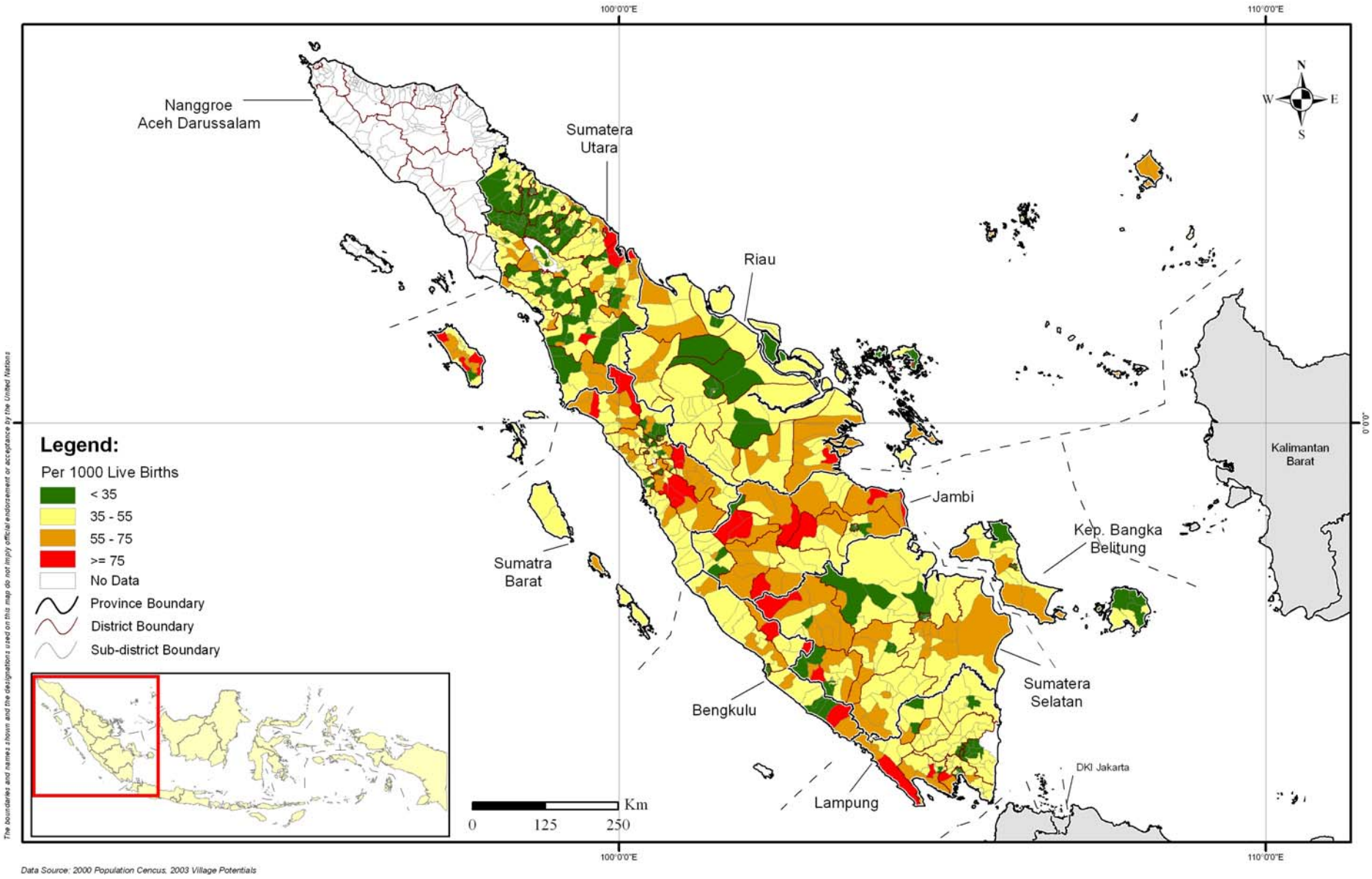
Map 8 Infant Mortality Rate (IMR) by Province



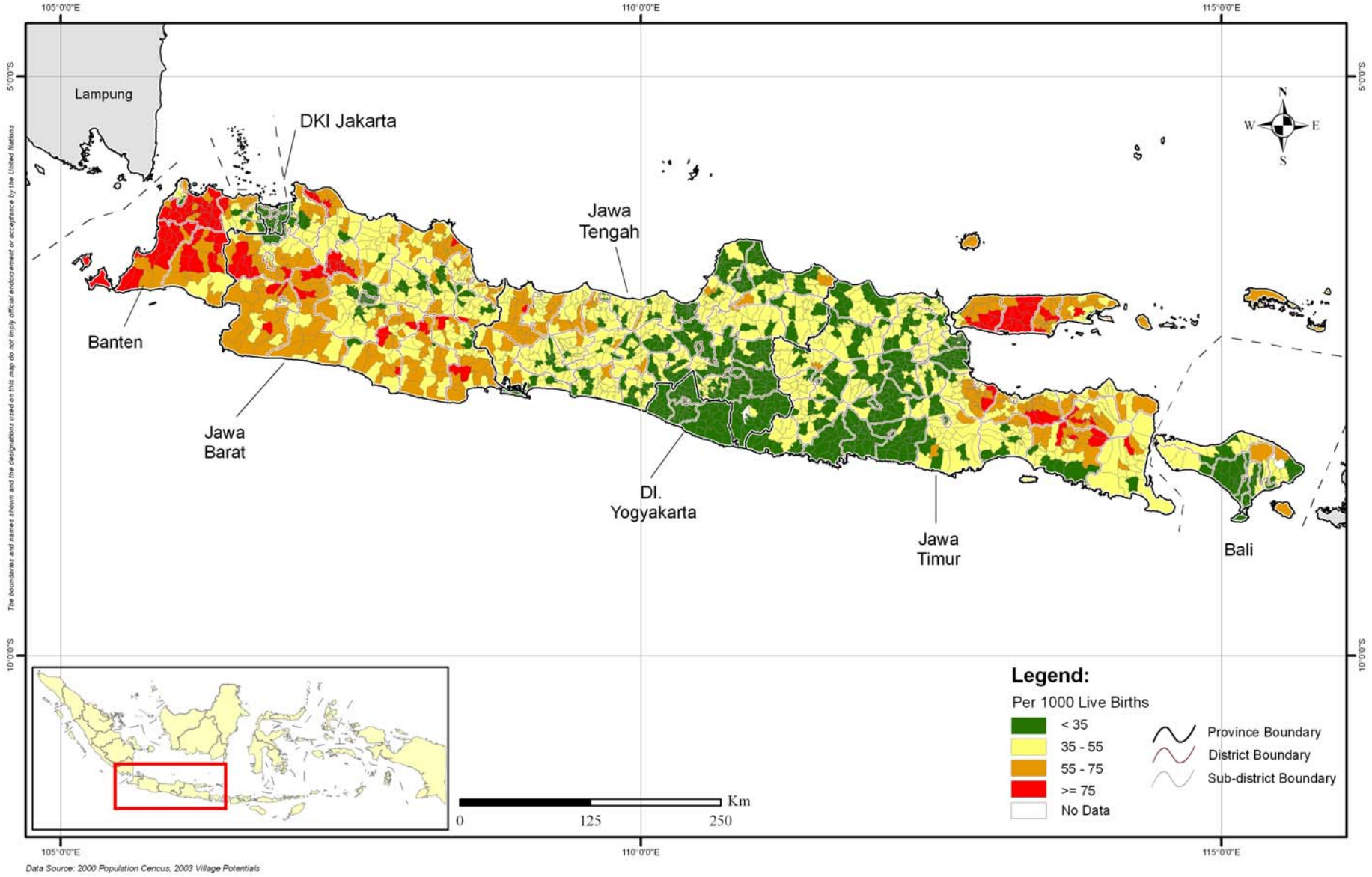
Map 9 Infant Mortality Rate (IMR) by District



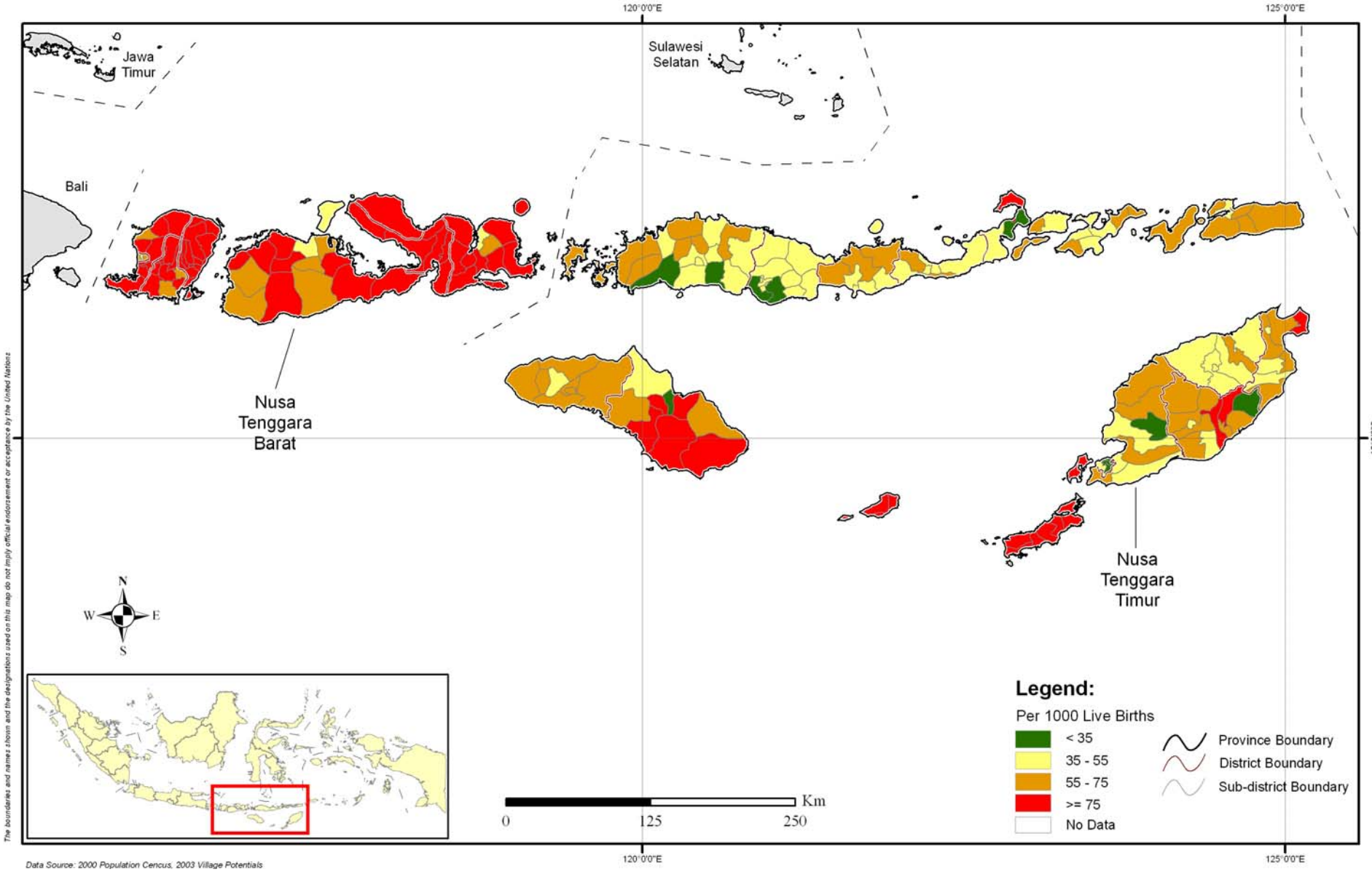
Map 10 Infant Mortality Rate (IMR) of Sumatera by Sub-district



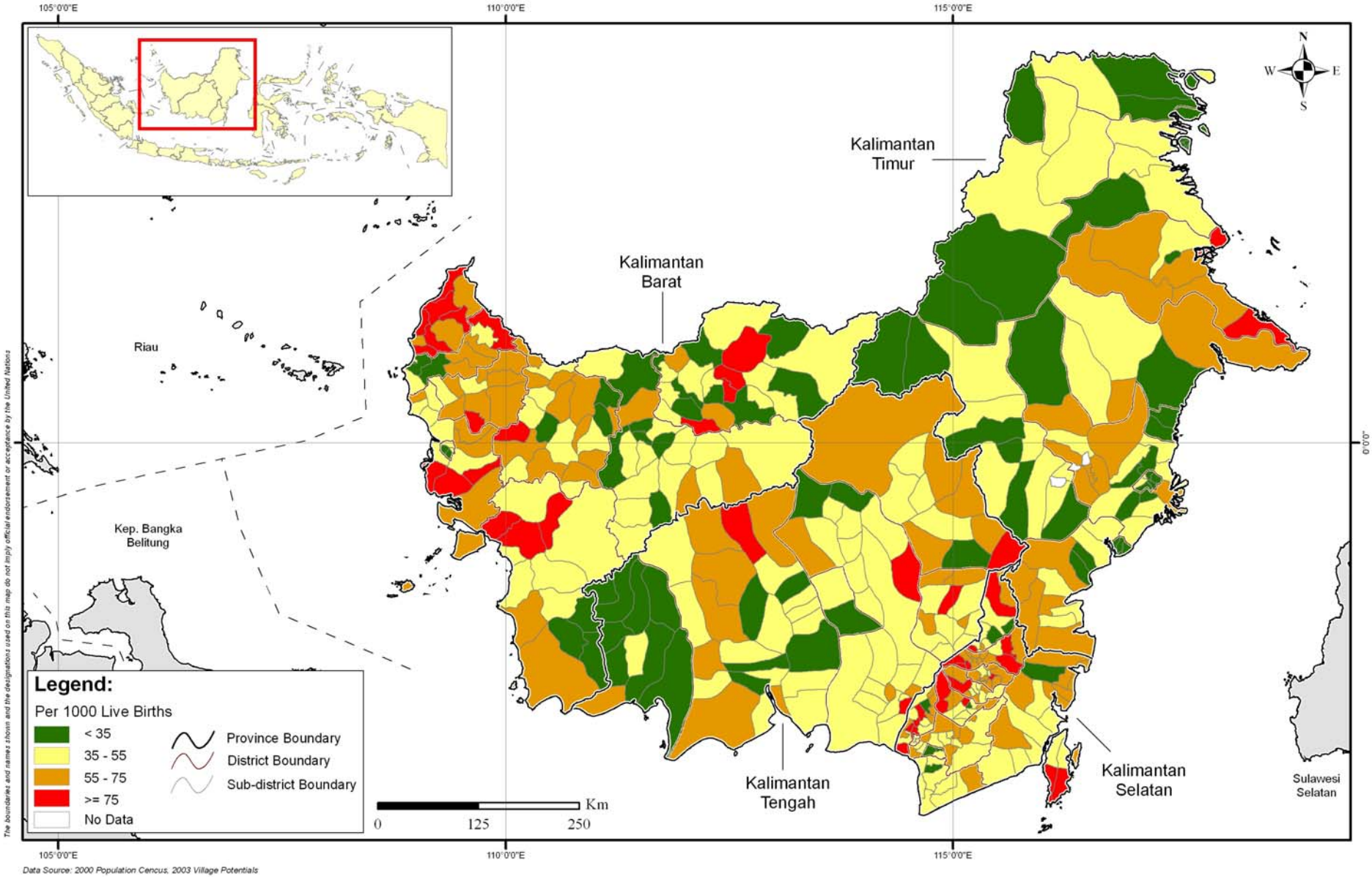
Map 11 Infant Mortality Rate (IMR) of Jawa by Sub-district



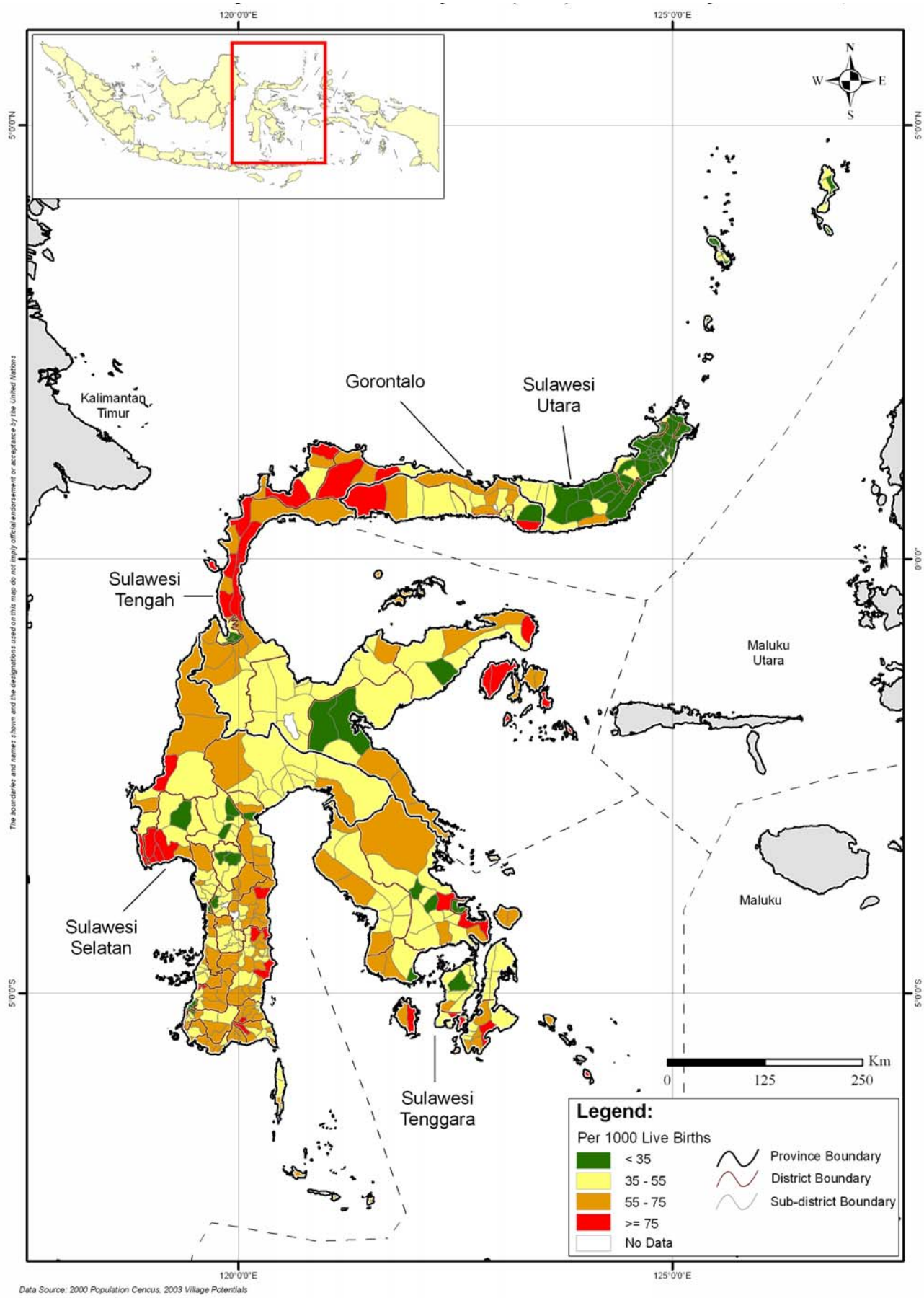
Map 12 Infant Mortality Rate (IMR) of Nusatenggara by Sub-district



Map 13 Infant Mortality Rate (IMR) of Kalimantan by Sub-district



Map 14 Infant Mortality Rate (IMR) of Sulawesi by Sub-district



3.4 Population with Energy Intake Less Than 1,700 kilocalories per capita per day

The prevalence of underweight people reflects food deprivation in the country. The caloric threshold was set at 2,100 kilocalories per capita per day, the level recommended for maintaining a healthy and productive life. The study looked at the 'percentage of people consuming less than 1,700 kcal per capita per day'. This value is approximately 80 per cent of the normative kcal consumption of 2,100 per day.

Sources of calorie analyzed in this exercise are food cooked at home and ready to eat foods. In urban areas the portion of ready to eat foods to total calorie consumption is 13.14 per cent, while in rural areas the portion is 7.51 per cent. On average, the portion of prepared food (urban and rural) contributed 11 per cent to total calorie consumption (SUSENAS 2002, Buku 2). The major source of energy from food consumption comes from cereal (the food consumption pattern in Indonesia shows that nearly 50 per cent of the total calorie requirement comes from cereals).

3.4.1 Provincial Estimates

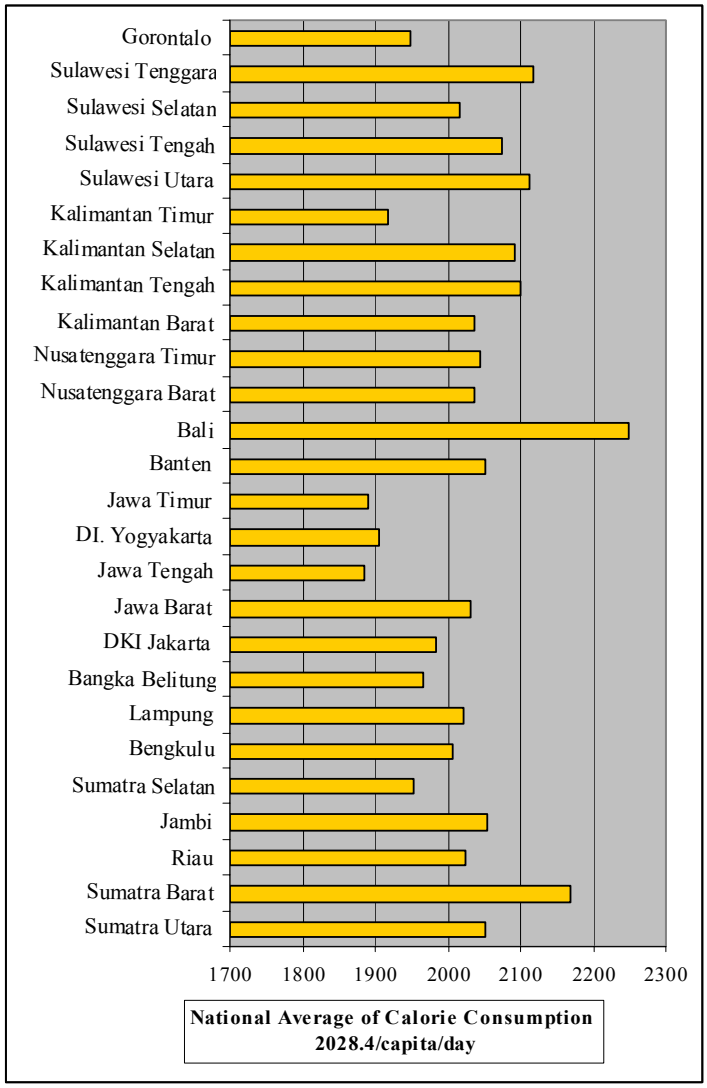
In order to determine the calorie consumption pattern across provinces, we first analyzed the pattern of calorie consumption in Indonesia. Figure 3 presents an average of daily calorie consumption per capita per day, without distinguishing between urban and rural areas (SUSENAS 2002). The calorie consumption varies from province to province, and in most of the provinces the calorie consumption falls below the standard adequacy requirement. The calorie consumption levels in Sumatera Selatan, Bangka Belitung, DKI Jakarta, Jawa Tengah, DIY Yogyakarta, Jawa Timur, Kalimantan Timur and Gorontalo were below the standard requirement. The highest calorie consumption was found in Bali, i.e., 2,249.51 kcal, while Jawa Tengah had the lowest calorie consumption, i.e., 1,885.5 kcal (see Figure 4).

It is expected that the result of this analysis would follow a similar trend with the pattern of provincial calorie consumption in terms of identifying pockets of population living with an energy intake less than 1,700 kcal per day.

The study tells us that in 2002, 16.92 per cent of the population of Indonesia had an energy intake of less than 1,700 kcal or in absolute terms there were more than 35 million people consuming 400 kcal less than the normative consumption of 2100 kcal (Map 15). The provinces with a high prevalence (>15 per cent) are found in NAD, Sumatera Selatan, Bangka Belitung, DKI Jakarta, Jawa Barat, Jawa Tengah, Jawa Timur, Kalimantan Barat, Kalimantan Timur, Sulawesi Selatan, Maluku Utara and Papua.

Without considering NAD, Maluku, Maluku Utara and Papua, as the estimations in those provinces have been done using a different reference year, Bangka Belitung and DI Yogyakarta have the highest percentage at 22.9 per cent and 20 per cent respectively.

Figure 4: An Average of Calorie Consumption per Capita per Day across Provinces (SUSENAS 2002)



Note: NAD, Maluku, Maluku Utara and Papua were not covered in the SUSENAS 2002

3.4.2 District Estimates

Out of 341 districts and cities analyzed, 186 have more than 15 per cent of their population living with an energy intake below 1,700 kcal per day (Map 16).

In Jawa, 84.5 per cent of districts have populations consuming less than 1,700 kcal per day. Only the Province of Banten has a low prevalence of less than 10 per cent. The highest percentages are found in cities, as generally in urban areas the level of calorie consumption is lower than in rural areas. This consistently lower calorie consumption in Jawa could possibly be due more to changes in the consumption pattern.

3.4.3 Sub-district Estimates

3.4.3.1 Sub-district Analysis of Sumatera Island

Map 17 presents the distribution of population consuming less than 1,700 kcal at sub-district level in Sumatera Island. Major pockets are found in Sumatera Selatan, Bangka Belitung, Lampung as well as some pockets in Riau and Sumatera Utara.

Without considering the cities, the highest prevalence in Sumatera Island is found in sub-districts of Bangka Belitung province, which is 48.89 per cent and the lowest prevalence is found in the sub-district of Dairi, Sumatera Utara.

The province of Sumatera Selatan has the most sub-districts whose population is consuming less than 1,700 kcal per day (24 sub-districts out of 88 sub-districts or 24 per cent).

3.4.3.2 Sub-district Analysis of Jawa-Bali

In Jawa-Bali, 29 per cent of sub-districts have a very high prevalence (>20 per cent) of calorie consumption below standard requirements; while the highest prevalence (45.18 per cent) is found in a sub-district in Malang, Jawa Timur.

In Jawa, the provinces of Banten and Jawa Barat show a relatively better picture, as the most pockets of low prevalence (<10 per cent) are scattered in those two provinces. In Bali, none of the sub-districts have a high prevalence (Map 18).

3.4.3.3 Sub-district Analysis of the Nusatenggara Islands

Nusatenggara Barat (NTB) shows a better situation compared to its neighboring province of Nusatenggara Timur (NTT). In NTB, only one sub-district has a very high prevalence (24.81 per cent) while in NTT, the clusters of high prevalence of population consuming less than 1,700 kcal per day are scattered across the provinces. The highest prevalence (34.95 per cent) is found in Insana sub-district of Timor Tengah Utara (Map 19).

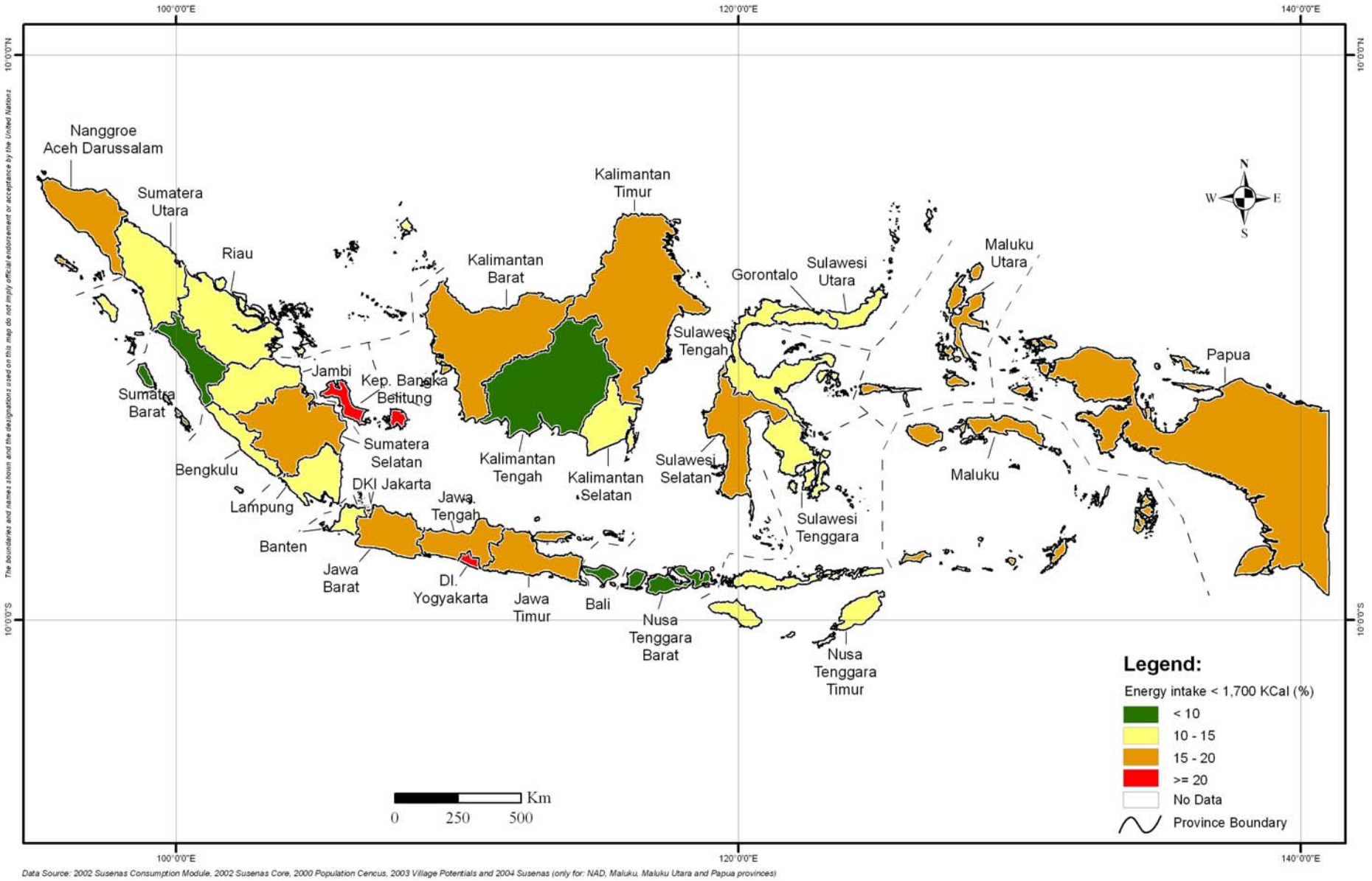
3.4.3.4 Sub-district Analysis of Kalimantan

Map 20 depicts the distribution of energy intake indicator of less than 1,700 kcal across the provinces of Kalimantan. The best situation is found in Kalimantan Tengah, where none of the sub-districts have a high prevalence. All sub-districts indicate a prevalence of less than 10 per cent. In contrast to its neighboring province, in Kalimantan Barat 22 out of 126 sub-districts have a prevalence of more than 20 per cent, while in Kalimantan Timur, 22 out of 89 sub-districts have a prevalence over 20 per cent.

3.4.3.5 Sub-district Analysis of Sulawesi

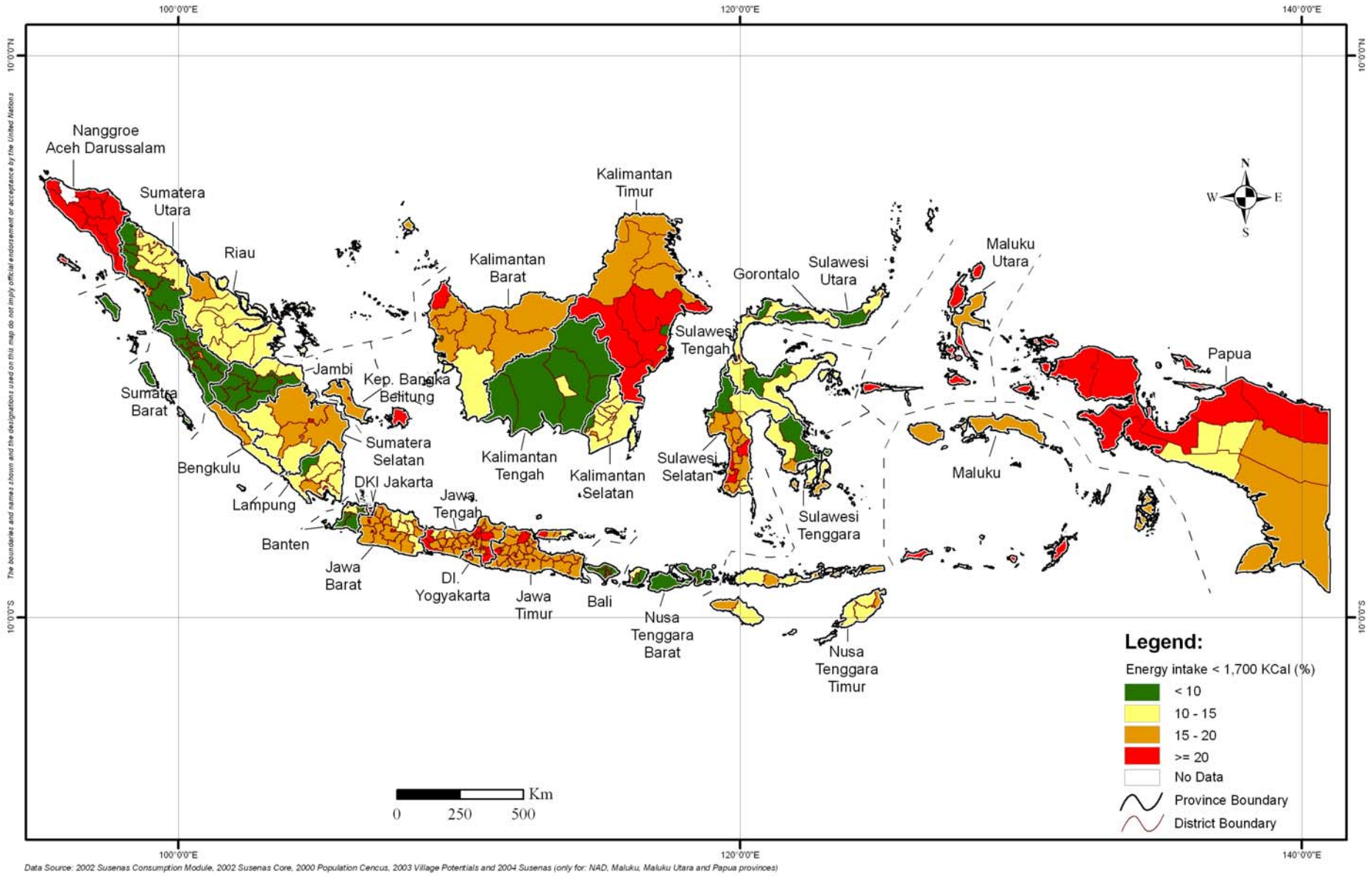
In Sulawesi, the majority of the pockets of high prevalence are found in Sulawesi Selatan. Some pockets are also scattered across the sub-districts of other provinces. Without considering the cities, the highest prevalence in Indonesia is found in Wolio sub-district in Buton, Sulawesi Tenggara (49 per cent).

Map 15 Population Living with Energy Intake less than 1700 Kilo Calories by Province

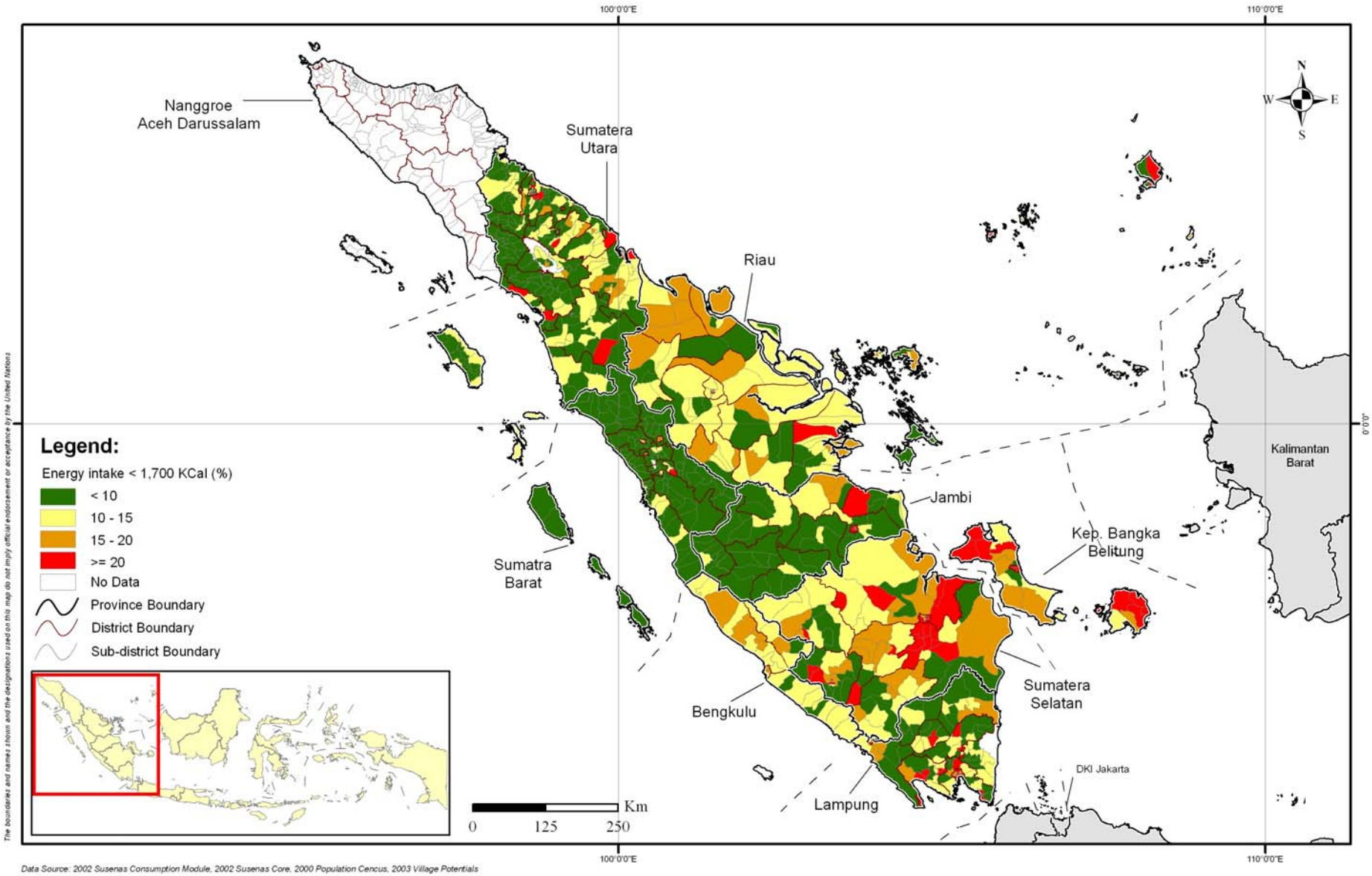


Data Source: 2002 Susenas Consumption Module, 2002 Susenas Core, 2000 Population Cencus, 2003 Village Potentials and 2004 Susenas (only for: NAD, Maluku, Maluku Utara and Papua provinces)

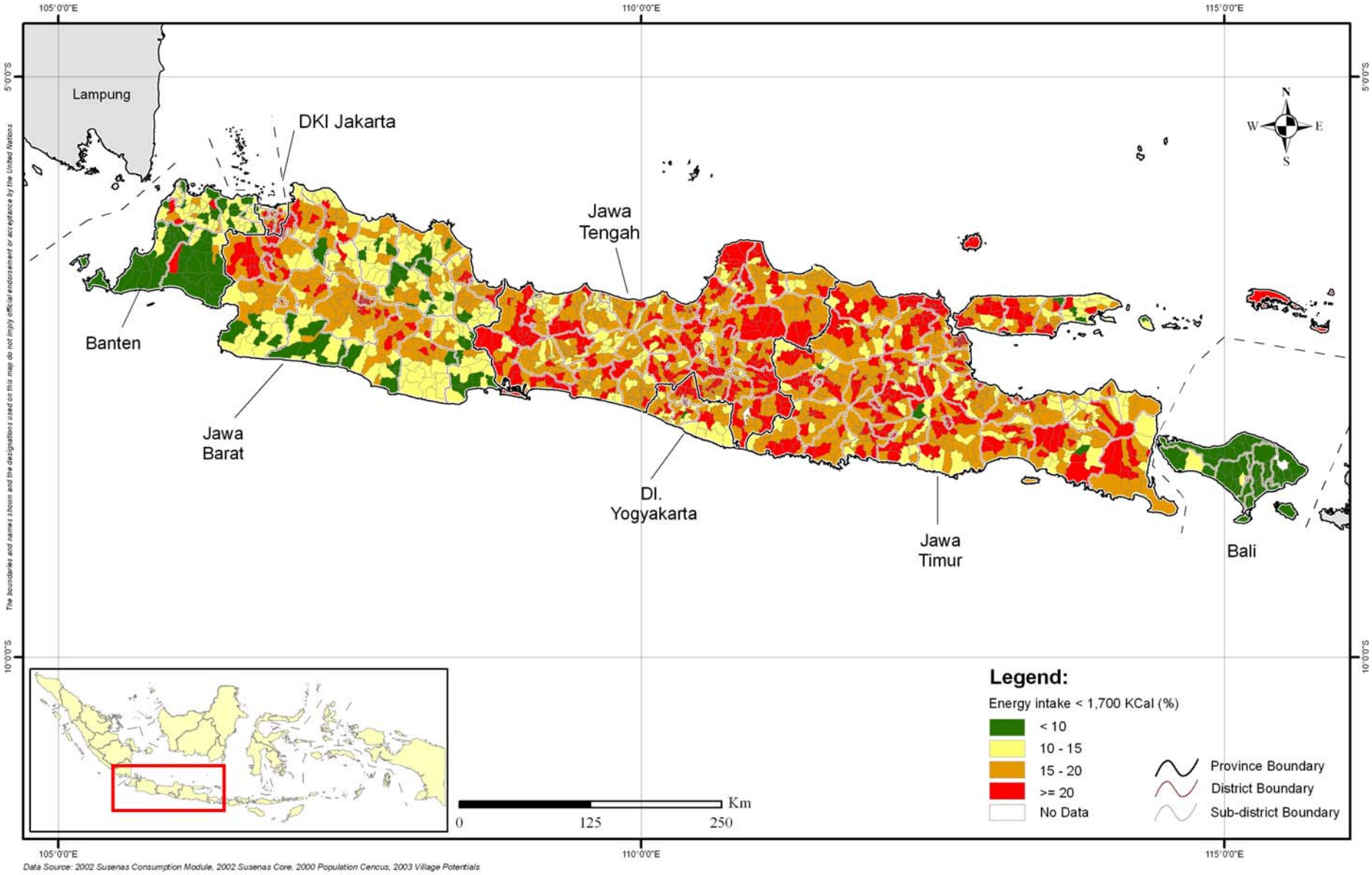
Map 16 Population Living with Energy Intake less than 1700 Kilo Calories by District



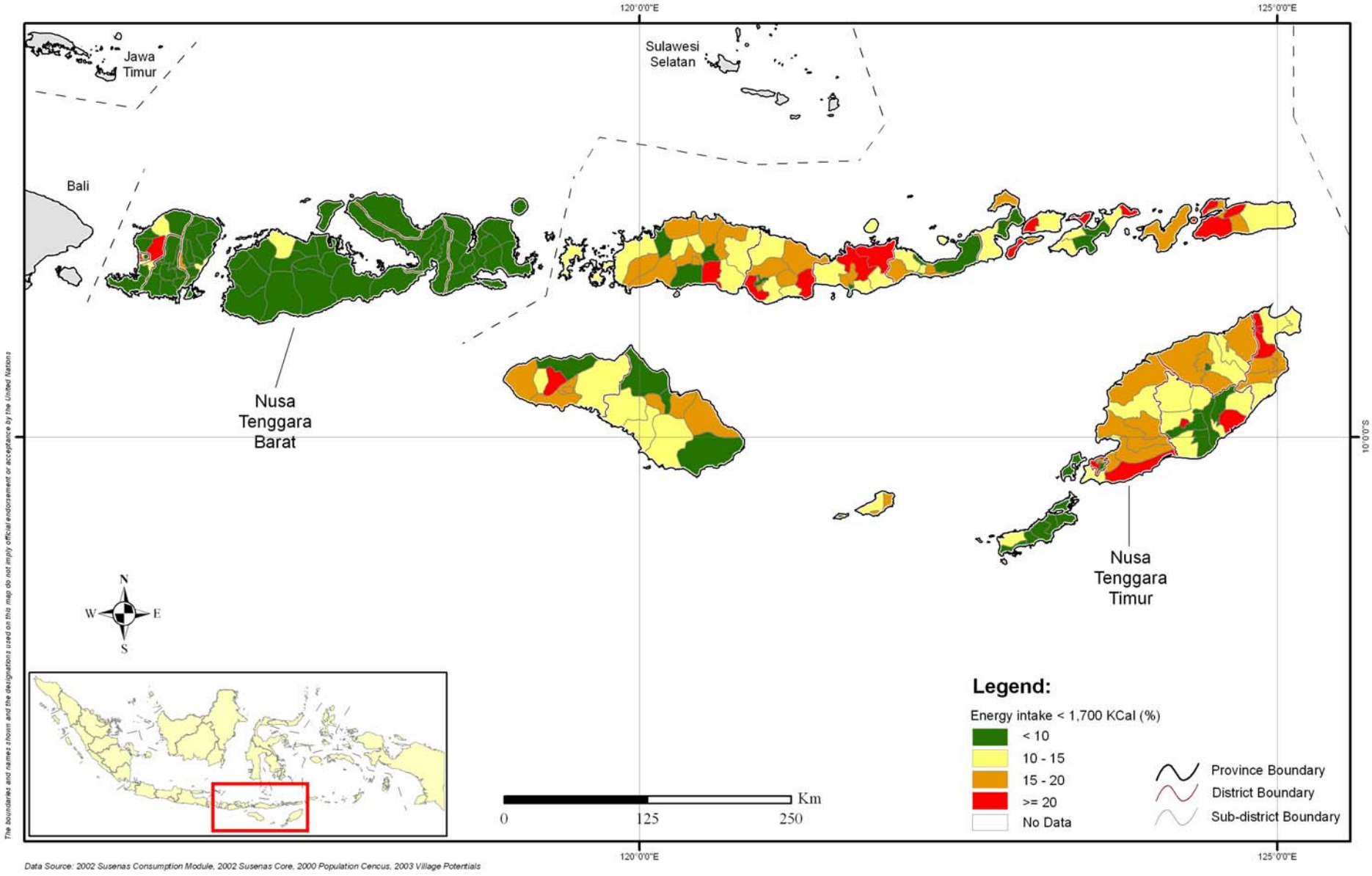
Map 17 Population Living with Energy Intake less than 1700 Kilo Calories of Sumatera by Sub-district



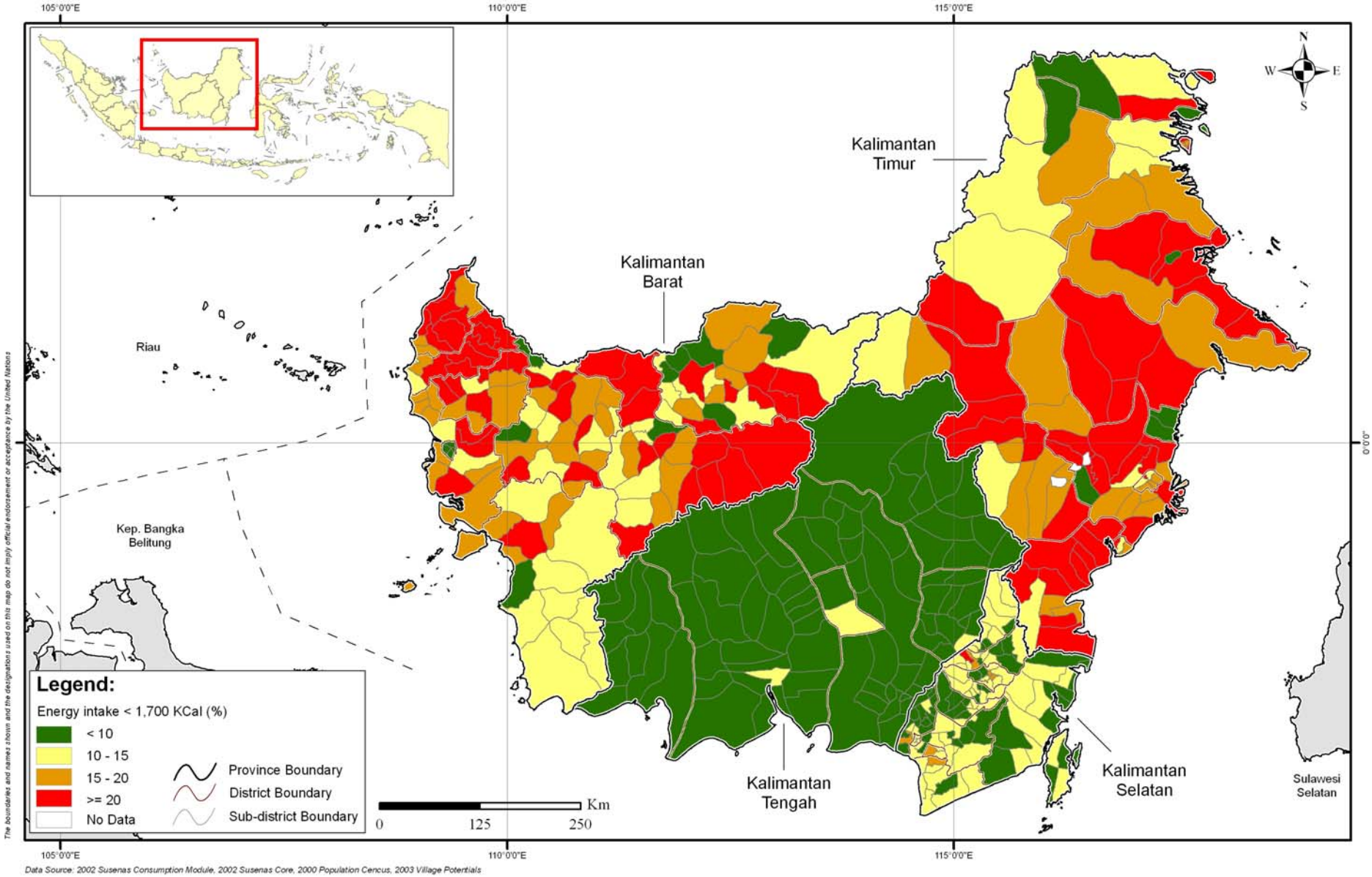
Map 18 Population Living with Energy Intake less than 1700 Kilo Calories of Jawa by Sub-district



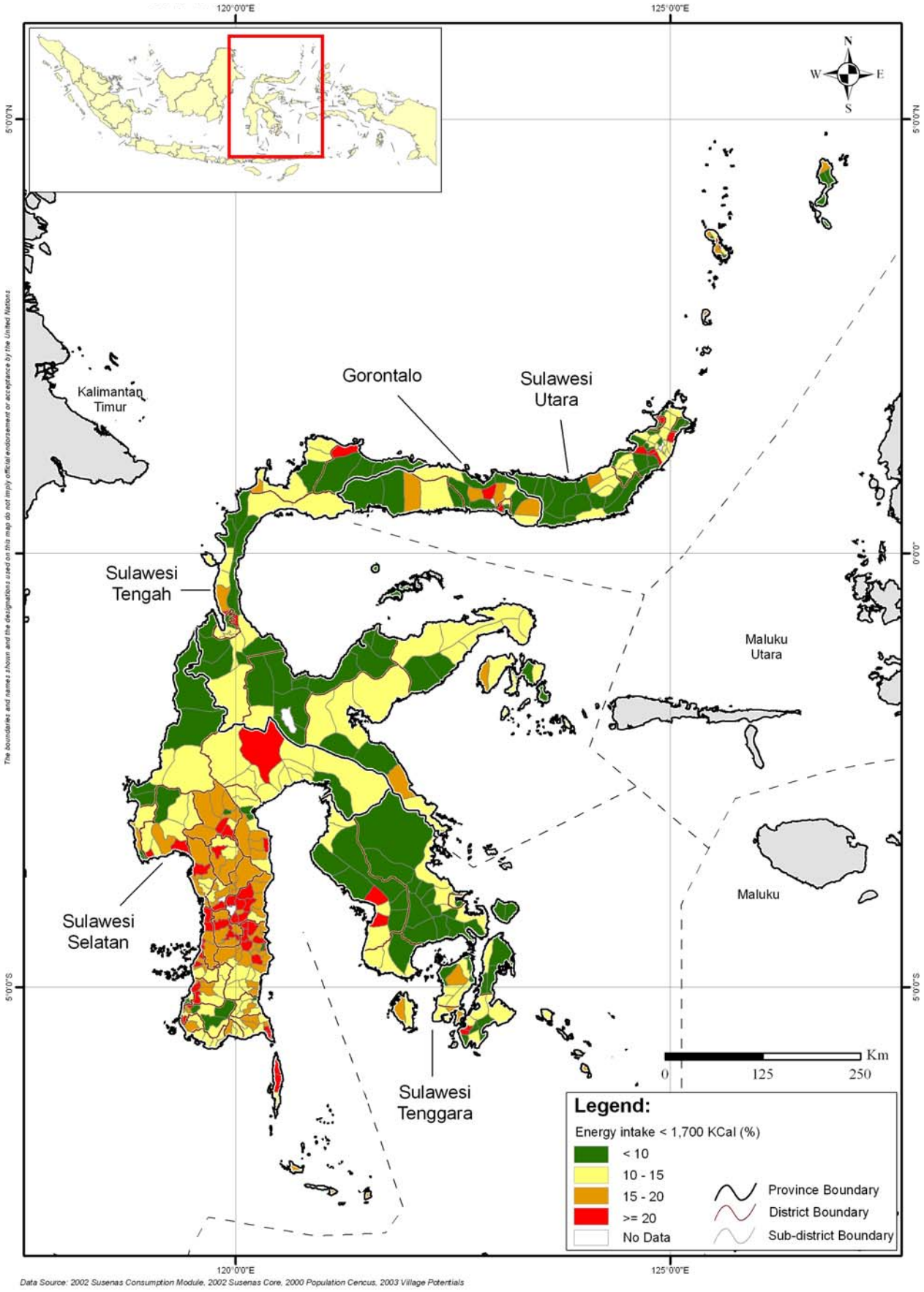
Map 19 Population Living with Energy Intake less than 1700 Kilo Calories of Nusatenggara by Sub-district



Map 20 Population Living with Energy Intake less than 1700 Kilo Calories of Kalimantan by Sub-district



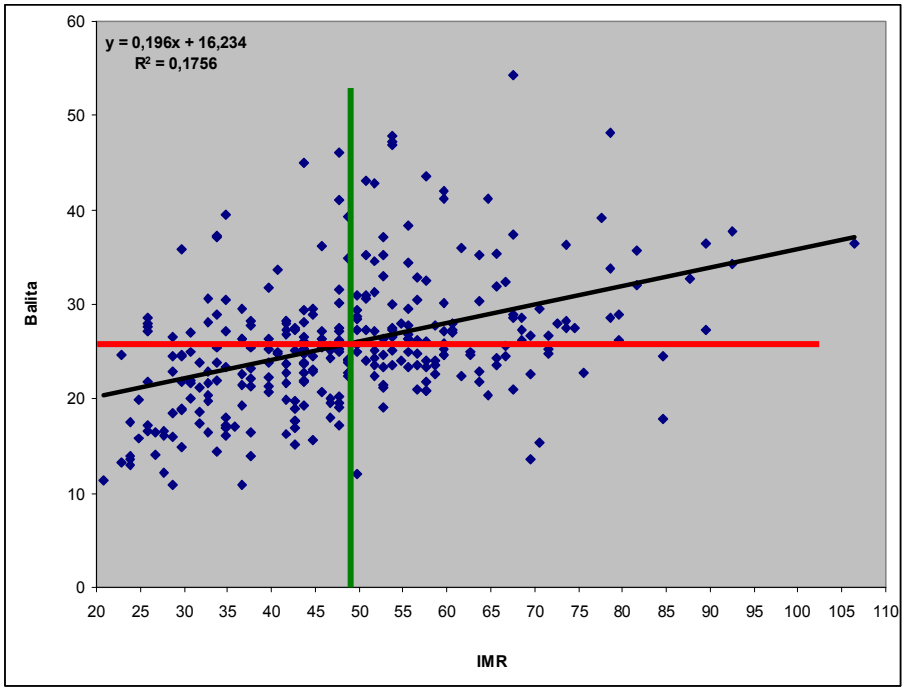
Map 21 Population Living with Energy Intake less than 1700 Kilo Calories of Sulawesi by Sub-district



3.5 Combining the Results of Underweight Children Under Five and IMR

The correlation between two indicators (IMR and children underweight) is analyzed through a quadrant analysis and absolute distance function measurement. The regression coefficient indicates that an increase of one unit of IMR will result in an increase of 0.196 units of underweight children. In other words, the contribution of IMR to presence of underweight children is around 20 per cent. The red line on Figure 5 indicates the average of the presence of underweight children at the district level in Indonesia, while the green line represents the average of IMR.

Figure 5: IMR vs Underweight Children Under Five Years of Age



The result is presented in the table 3, showing the ten worst/best districts in each quadrant analysis.

Priority should be given particularly to those districts in quadrant 1, where the underweight and IMR prevalences are high.

Table 3: IMR vs Underweight Children Under Five Years of Age: A Comparison across Districts at National Level

Quadrant 2 **(Low Per Cent of underweight, high prevalence of IMR)** consists of 54 districts/cities	Quadrant 1 **(High Per Cent of underweight, high prevalence of IMR)** consists of 86 districts/cities
Ten worst districts: Sintang Sibolga Kapuas Sanggau Barito Selatan Malinau Tanah Laut Deli Serdang Sidenreng Rappang Ogan komering ulu	**Ten worst districts:** Lombok Timur Lombok Barat Dompu Lombok Tengah Sampang Sumbawa Hulu Sungai Utara Sambas Barito Kuala Sumba Timur
Quadrant 3 **(Low prevalence of underweight and IMR)** consist of 116 districts/cities	Quadrant 4 **(High Per Cent of underweight, low prevalence of IMR)** consists of 50 districts/cities
Ten best districts: Kota Jakarta Selatan Kota Bontang Kota Palangkaraya Kota Metro Kota Jakarta Timur Depok Tabanan Kota Denpasar Sleman Kota Yogyakarta	**Ten worst districts:** Banggai Kepulauan Serang Garut Sawahlunto/Sijunjung Bungo Buol Pandeglang Jeneponto Poso Lebak

3.6 Combining Poverty Mapping and Nutrition Analysis and Mapping Results

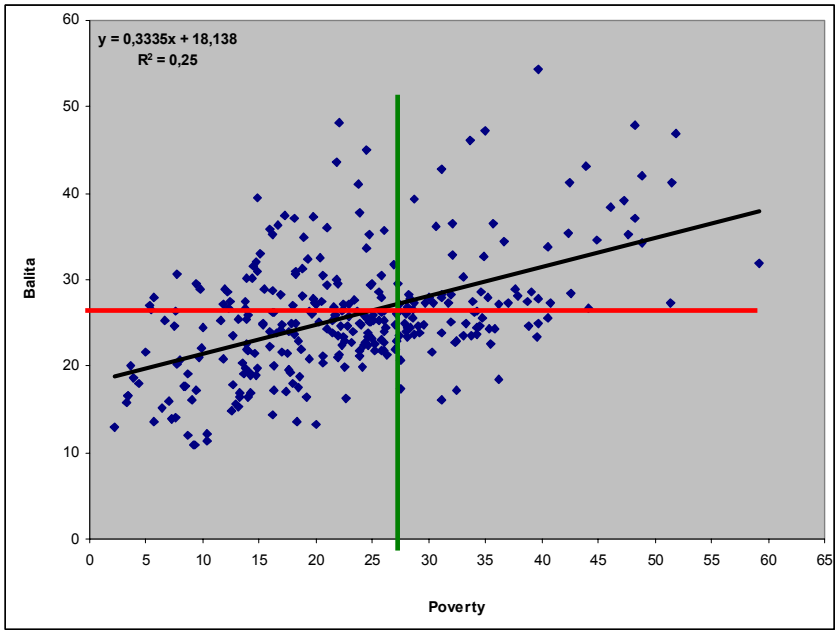
The Poverty Mapping exercise was completed in 2004 and was based on SUSENAS 1999. This was the first exercise using Small Areas Estimation applied in Indonesia. A poverty estimation was done down to the village level across the country. In this section, we will try to obtain the benefit of these two sources of information and will analyze the linkage between poverty incidence and malnutrition prevalence.

The correlation between two indicators (poverty and underweight children) is analyzed through a quadrant analysis and absolute distance function measurement. The national level analysis of some districts shows that there is a strong positive correlation, which is evident from the high rate of poverty incidence and prevalence of underweight in selected districts. In this exercise we will examine the correlation between indicators: poverty incidence and prevalence of underweight children; poverty incidence versus Infant Mortality Rate; and poverty incidence versus population with energy intake less than 1,700 kcal.

3.6.1 Poverty Incidence versus Prevalence of Underweight Children Under Five

Figure 6 shows a positive correlation between poverty incidence and the presence of underweight children under five years of age at the district level in Indonesia. The regression coefficient indicates that an increase of one unit of poverty incidence will result in an increase of 0.3335 units of underweight children under five.

Figure 6: Underweight Children Under Five vs Poverty



The green line in Figure 6 shows the average of poverty incidence at the district level in Indonesia, while the red line represents the average of the presence of underweight children under five years of age at the district level in Indonesia. Each quadrant on the graph represents a comparison between each indicator with its average value as follows:

- The first quadrant reflects the condition of districts with above average poverty and a high prevalence of underweight children.

- The second quadrant represents condition of the district with below average poverty but that still has a high prevalence of underweight children.

- The third quadrant, as the ideal quadrant, represents the condition where these districts enjoy low rate of underweight children and below average incidence of poverty.

- The fourth quadrant reflects the condition of districts where the incidence of poverty is above average while the number of underweight children under five is low.

As is the case with the quadrant analysis, an absolute distance function measurement is often used as an analytical tool to measure the severity of the district. The absolute distance is used to rank each district with its ideal district. The rankings are based on the absolute distance that they achieve from their condition point (Xi,Yi) to initial/ideal point (0,0), by using the formulae $(Xi^2+Yi^2)^{1/2}$.

Table 4 shows the district grouping corresponding to the four quadrants explained in Figure 5 (NAD, Maluku, Maluku Utara and Papua were excluded from the analysis due to technical reasons).

Table 4: Poverty vs Underweight Children Under Five Years of Age: A Comparison across Districts at National Level

Quadrant 2 (**Low percentage of poverty, high percentage of underweight**) consists of 62 districts/cities	Quadrant 1 (**High percentage of poverty, high percentage of underweight**) consists of 78 districts/cities
Ten worst districts: Hulu Sungai Utara Tanjung Balai Medan Tebing Tinggi Kota Mataram Binjai Hulu Sungai Tengah Tabalong Barito Selatan Pematang Siantar	**Ten worst districts:** Timor Tengah Selatan Timor Tengah Utara Landak Sumba Barat Kupang Belu Lembata Sumba Timur Ngada Manggarai
Quadrant 3 (**Low percentage of poverty, low percentage of underweight**) consist of 100 districts/cities	Quadrant 4 (**High percentage of poverty, low percentage of underweight**) consists of 66 districts/cities
Ten best districts: Kota Bontang Kota Palangkaraya Kota Bandung Kota Depok Kota Yogyakarta Kota Pontianak Tabanan Kota Samarinda Kota Balikpapan Kota Denpasar	**Ten worst districts:** Jeneponto Muna Pemalang Kendari Banjarnegara Batang Tegal Pekalongan Banggai Kepulauan Buol

As shown in Table 4, the main focus should be given to the first quadrant where the incidence of poverty and presence of underweight children under five years of age are very high.

3.6.2 Poverty Incidence versus IMR

Figure 7 shows the relationship between poverty incidence and IMR. As can be seen from the regression coefficient, an increase of one unit in poverty will result in an increase of 0.588 units of Infant Mortality Rate. The linkage between poverty incidence and IMR can be seen in the table 5.

Figure 7: Infant Mortality Rate vs Poverty

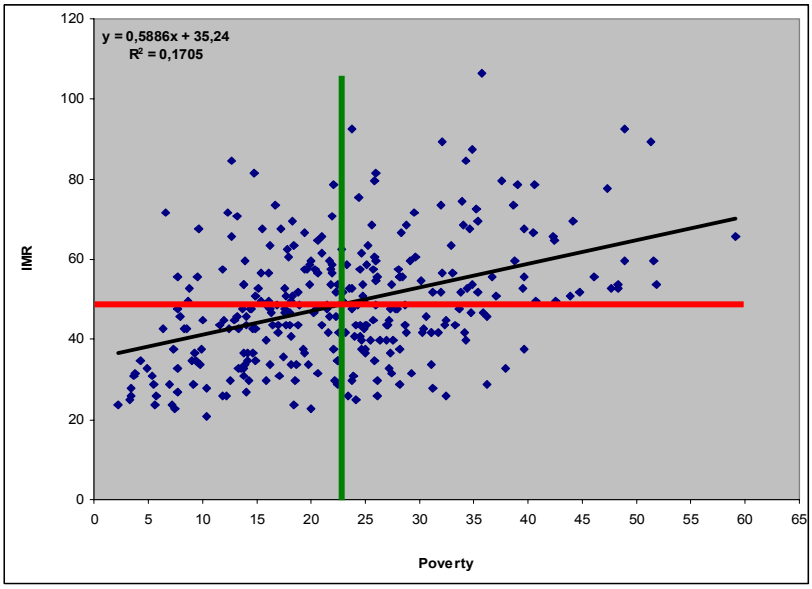


Table 5: IMR vs Poverty: A Comparison Across Districts at National Level

Quadrant 2 (**High prevalence of IMR, low percentage of poverty**) consists of 57 districts/cities	Quadrant 1 (**High prevalence of IMR, high percentage of poverty**) consists of 79 districts/cities
Ten worst districts: Serang Barito Kuala Hulu Sungai Utara Tabalong Tanjung Jabung Timur Solok Lebak Sawahlunto/Sijunjung Padeglang Hulu Sungai Tengah	**Ten worst districts:** Lombok Timur Dompu Sampang Lombok Barat Lombik Tengah Sumbawa Banggai Kepulauan Sumba Timur Bima Sumba Barat
Quadrant 3 (**Low prevalence of IMR, low percentage of poverty**) consist of 105 districts/cities	Quadrant 4 (**Low prevalence of IMR, high percentage of poverty**) consists of 65 districts/cities
Ten best districts: Kuantan Sengingi Berau Barito Selatan Sidenreng Rappang Indragiri Hulu Natuna Muaro Jambi Kota Sukabumi Kutai Timur Kota Palu	**Ten worst districts:** Banjarnegara Sintang Lamongan Batang Sanggau Malang Way Kanan Cilacap Banggai Malinau

3.6.3 Poverty Incidence versus Population with Energy Intake Less Than 1,700 kcal

Figure 8 presents the relationship between the incidence of poverty and the prevalence of the population consuming less than 1,700 kcal per day at the district level in Indonesia. The regression coefficient indicates that an increase of one unit of poverty will result in an increase of 0.0854 units of population consuming less than 1,700 kcal. As was the case with Figure 6, the red line on Figure 7 indicates the presence of a population with energy intake less than 1,700 kcal, while the green line represents the average poverty incidence. Each quadrant on the graph represents a comparison between each indicator and its average value.

- The first quadrant reflects the condition of districts with an above average number of people consuming less than 1,700 kcal and a high rate of poverty;
- The second quadrant represents conditions of the district with above average number of people consuming less than 1,700 kcal per day and a low prevalence of poverty;

- The third quadrant, as the ideal quadrant, represents the condition where these districts enjoy a low number of people consuming less than 1,700 kcal and a below average incidence of poverty;

- The fourth quadrant reflects the condition of districts where the population consuming less than 1,700 kcal is low while its poverty rate is above average.

Figure 8: Energy Intake < 1,700 kcal vs Poverty

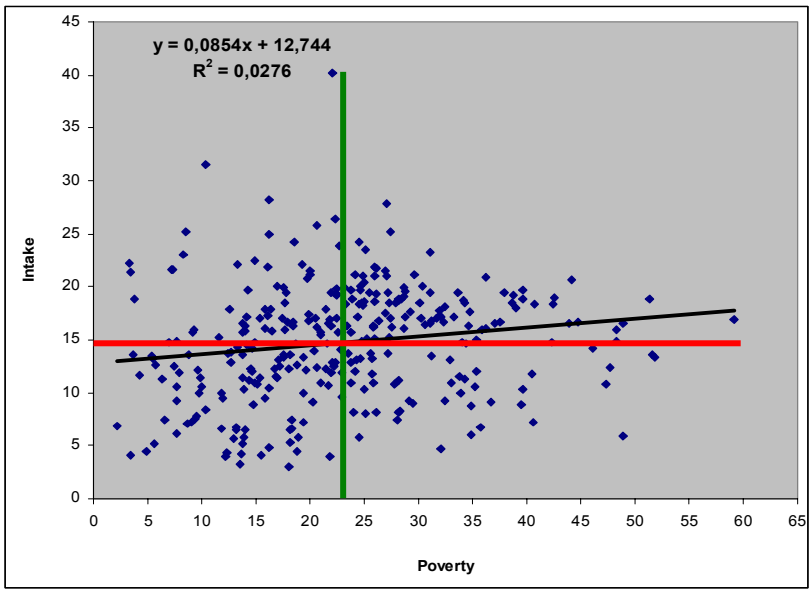


Table 6: Energy Intake < 1,700 kcal vs Poverty: A Comparison across Districts at National Level

Quadrant 2 (**High percentage of energy intake < 1,700 kcal, low percentage of poverty**) consists of 66 districts/cities	Quadrant 1 (**High percentage of energy intake < 1,700 kcal, high percentage of poverty**) consists of 98 districts/cities
Ten worst districts: Kota Pangkal Pinang Kutai Timur Kota Yogyakarta Kota Jambi Kota Bandar Lampung Kota Malang Kota Mojokerto Semarang Kota Madiun Muara Enim	**Ten worst districts:** Sumba Barat Sampang Belu Ngada Timor Tengah Utara Bangkalan Flores Timur Lembata Tuban Alor
Quadrant 3 (**Low percentage of energy intake < 1,700 kcal, low percentage of poverty**) consist of 96 districts/cities	Quadrant 4 (**Low percentage of energy intake < 1,700 kcal, high percentage of poverty**) consists of 48 districts/cities
Ten best districts: Indramanyu Bantaeng Sinjai Luwu Utara Hulu Sungai Utara Minahasa Tanjung Jabung Timur Tapanuli Selatan Kuantan Sengingi Tanjung Jabung Barat	**Ten worst districts:** Timor Tengah Selatan Kupang Sikka Dompu Sumba Timur Manggarai Jeneponto Bima Muna Kendari

3.6.4 More Evidence from Jawa Tengah Province: Analysis at Provincial Level of Underweight Children Under Five, IMR and Poverty Head Count

Recognized as the second and third largest provinces respectively in terms of population, Jawa Timur and Jawa Tengah provinces have contrasting experiences. With a gross domestic regional product per capita (GDRP) ranking of 19 in 2002, Jawa Timur is ranked 25 in terms of its Human Development Index (HDI). This means that one of its most important development tasks, to convert economic growth into improvements in human development, could not easily be achieved. The province of Jawa Tengah is ranked 24 in terms of GDRP, however in terms of HDI is ranked 13. In other words people in the province of Jawa Tengah benefited from its achievement in economic growth (Indonesia Human Development Report 2004).

Some empirical evidence from Jawa Tengah below explains further the relationship between the Incidence of Poverty and IMR.

Figure 9 shows a strong positive correlation between poverty incidence and IMR at district level in the Province of Jawa Tengah where, based on the regression coefficient, an increase of one unit of poverty incidence will result in an increase of 0.9833 units of IMR. The blue line on

Figure 9 shows the average of poverty incidence at district level in Province of Jawa Tengah, while the brown line represents the average of IMR. Each quadrant on the graph represents a comparison between each indicator with its average value. For instance, the first quadrant reflects the condition of the district with an above average rate of poverty and high IMR. The second quadrant represents condition of the district with below average of poverty but that still has a high IMR. The third quadrant, as the ideal quadrant, represents the condition where these districts enjoy low IMR and below average poverty incidence. The fourth quadrant reflects the condition of districts where the incidence of poverty is above average while its IMR is low.

Figure 9: Poverty vs IMR of Jawa Tengah Province

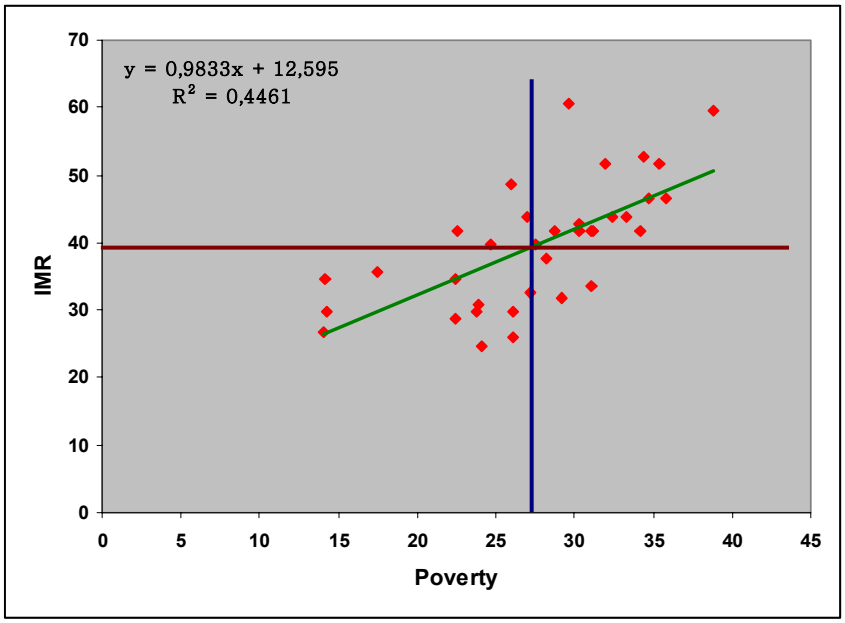


Table 7: Poverty vs IMR of Jawa Tengah Province

Quadrant 2 **(Low percentage of poverty, high prevalence of IMR)**	Quadrant 1 (**High percentage of poverty, high prevalence of IMR**)
Cilacap Kebumen Kota Pekalongan Kota Tegal Kudus	Pemalang Brebes Pekalongan Tegal Kendal Banjarnegara Batang Wonosobo Banyumas Purbalingga Demak Rembang Grobogan Purworejo Magelang
Quadrant 3 (**Low percentage of poverty, low prevalence of IMR**)	Quadrant 4 (**High percentage of poverty, low prevalence of IMR**)
Sragen Klaten Kota Salatiga Pati Jepara Sukoharjo Kota Magelang Karanganyar Semarang wonogiri Kota Semarang Kota Surakarta	Blora Boyolali Temanggung

Table 7 provides the rank of each district in the Province of Jawa Tengah in relation to its quadrant. The main focus should be on the first quadrant where the incidence of Poverty and IMR are very high. In the case of Jawa Tengah, for instance, there are 15 districts with high poverty and high IMR prevalence.

Similar exercises can be applied to other indicators, such as poverty vs under-nourished children under 5 years of age (Figure 10).

Figure 10: Poverty vs Underweight Children Under Five Years of Age

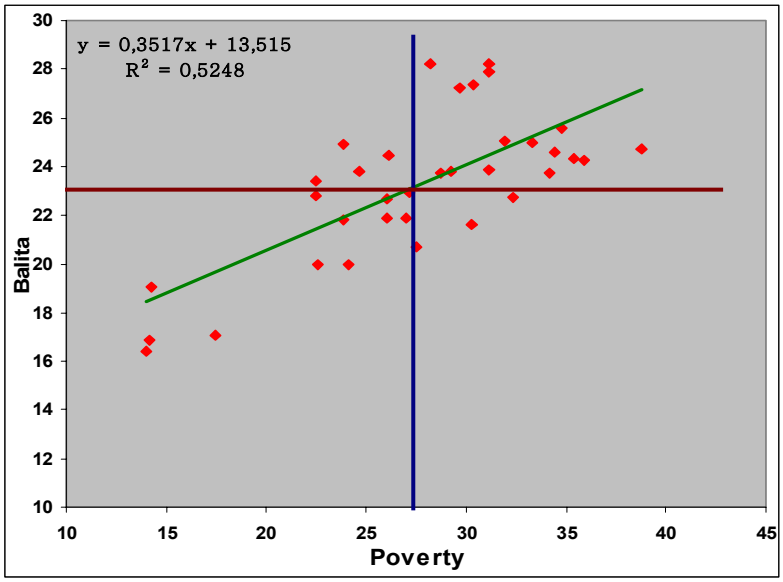


Table 8: Poverty vs Underweight Children Under Five Years of Age

Quadrant 2 **(Low percentage of Poverty, high percentage of underweight)**	Quadrant 1 **(High percentage of Poverty, high percentage of underweight)**
Pati Jepara Kudus Klaten	Pemalang Banjarnegara Batang Tegal Pekalongan Rembang Grobogan Purbalingga Wonosobo Demak Kendal Brebes Blora Boyolali Temanggung Magelang
Quadrant 3 **(Low percentage of Poverty, low percentage of underweight)**	Quadrant 4 **(High percentage of Poverty, low percentage of underweight)**
Kota Tegal Kota Salatiga Kota Semarang Kota Magelang Kota Surakarta Sragen Kebumen Cilacap Kota Pekalongan Karanganyar Sukoharjo Semarang Wonogiri	Banyumas Purworejo

From Table 8 we can see that 16 out of 35 districts and cities in Jawa Tengah are clustered in quadrant 1, which have a high percentage of poverty as well as underweight prevalence. Those districts should get immediate attention to address nutritional problems resulting from poverty and other factors.

There are 13 districts and cities belonging to quadrant 3, where all cities are in the group, showing that cities provide better access to economic conditions, health services and facilities to its people.

4. CONCLUSION

The Small Area Estimation technique enables us to overcome the problem of limited data on child malnutrition in the country. Using the SAE the prevalence of underweight children under five years of age, the percentage of the population living with an energy intake less than 1,700 kcal and Infant Mortality Rate have been estimated up to district level.

The calculations of standard errors for the provincial estimation as well as the comparison with reference data have given an indication of the reliability of the indicator estimates.

The analysis revealed that at the sub-district level, there are 772 sub-districts with more than 30 per cent of their children underweight. A high prevalence of underweight children is particularly found in Sumatra Utara, Sumatra Barat, Sumatra Selatan, Jambi, Jawa Timur, NTB, NTT and Kalimantan Barat.

Similarly, 1,079 districts have an IMR of more than 55 per 1,000 live births and these are scattered almost throughout the country, particularly in Jambi, Bengkulu, Sumatra Barat, Banten, Jawa Barat, Jawa Tengah, NTB, NTT, Kalimantan Barat, Kalimantan Selatan, Sulawesi Tengah, Sulawesi Selatan and Sulawesi Tenggara.

Around half of the sub-districts measured (1,859) have people consuming less than 1,700 kcal per capita per day. On the island of Sumatra, the provinces of Sumatra Selatan, Bangka Belitung, Lampung and some pockets of Riau and Sumatra Utara have a higher percentage of people in the deficient calorie consumption category. In Java, almost 29 per cent of sub-districts have a high prevalence. NTT, Kalimantan Barat, Kalimantan Timur and Sulawesi Selatan are the remaining provinces with a high percentage of people with a deficient calorie intake.

In a country as big as Indonesia, the Nutrition Map is one of the alternative data and information sources that can be used to appropriately address the malnutrition problem. The increase in unemployment and poverty will result in the further deterioration of the food security and nutrition of vulnerable groups, i.e., children under five years of age and women. Thus the nutrition map combined with other relevant information will provide such a sophisticated tool for more effective geographic targeting for various socio-economic intervention programs.

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LIST OF ANNEXURE

ANNEX 1

TECHNICAL NOTES OF SMALL AREA ESTIMATION

TECHNICAL NOTES

This exercise is an application of Small Areas Estimation technique to measure malnutrition prevalence at sub district level. The study utilizes the model of poverty mapping (PovMap) as developed by Elbers, Lanjou and Lanjou (2002). The Poverty Mapping model is a regression-type model of estimation that are integrating individual, household and location effects of explanatory variables on the dependent or a specified target variable. The model of nutrition mapping (NutMap) as reported here is similar with the Poverty Mapping model. Both models are concerned with the estimation at the lower level of administration. The only difference between the two lies in the dependent variables(s) or the final target of estimation: the PovMap sets income (or expenditure) as the target of estimation while the NutMap sets some indices of nutritional status (discussed below) for the same purpose.

1. The Nutritional Mapping (NutMap) Model

The NutMap model as reported here enables one to estimate some indices of nutritional status until the lowest administrative level allowed by the data (here sub-district). This is made possible because the model, like PovMap model, combines the strength of both survey and census data. The survey, even though it is unable to estimate nutritional status at lower than provincial level, provides data on consumption required for estimating nutritional measures. The census, on the other hand, although it does not collect data on consumption, provides data on basic characteristics of individual population that enables estimation until the lowest level of administrative areas.

Using the NutMap model, nutritional status is estimated using the following equation:

1. $\ln y_{ch} = E[\ln y_{ch} | x_{ch}] + \mu_{ch}$

where c : *cluster c* (village)

ch : household h in cluster c

y_{ch} : nutritional status for household h and cluster c

x_{ch} : socio-economic characteristic of household h in cluster c

Linear approximation of model 1 can be expressed as follows:

2. $\ln y_{ch} = x_{ch} \hat{a} + \mu_{ch}$ (*Beta* model)

where μ_{ch} is disturbance terms.

SUSENAS data do not provide locational information. In the other words, disturbance terms as shown in equation 2, includes locational variables need to be identified. The following formula is used to estimate locational effects:

3. $\mu_{ch} = \eta_c + \varepsilon_{ch}$

Here η_c is *cluster* components and ε_{ch} is household components. On the average at village level, distribution terms can be expressed as follows:

4. $\mu_{c.} = \eta_c + \varepsilon_{c.}$, and then

$$E[\mu_c{}^2] = \sigma_\eta{}^2 + \mathrm{var}(\varepsilon_{c.}) = \sigma_\eta{}^2 + \tau_c{}^2$$

In the above equation η_c and ε_{ch} are assumed to be normally distributed and independent each other. Following Elbers *et al*(2002), the estimated variance of locational effects can be expressed as follows:

5. $$\mathrm{var}(\hat{\sigma}_{\eta}^{2}) = \sum_{c}[a_c^{2}\ \mathrm{var}(\mu_{c.}^{2}) + b_c^{2}\ \mathrm{var}(\hat{\tau}_c^{2})]$$

In the absence of locational effect, η_c, equation 3 becomes simpler, $\mu_{ch} = +\varepsilon_{ch}$. However, this is normally an unrealistic assumption. Following Elbers *et all* (2002) residual ε_{ch} can be explained by a logistic model that regresses transformed ε_{ch} with household characteristics:

6. $$\ln\left[\frac{e^{2}_{ch}}{A - e^{2}_{ch}}\right] = Z_{ch}^{T}\hat{\alpha} + r_{ch} \qquad \text{(}\textit{Alpha}\text{ model)}$$

Here A is set as A= 1.05*max{ε_{ch}^2}.

Estimated variance of ε_{ch} can be calculated using the following equation:

7. $$\hat{\sigma}^{2}_{\varepsilon,ch} = \left[\frac{AB}{1+B}\right] + \frac{1}{2}\hat{V}ar(r)\left[\frac{AB(1-B)}{(1+B)^{3}}\right]$$

Equation 7 suggests that OLS model cannot be applied in equation 2; and hence GLS model is applied instead.

Using a number of common variables found in the census and the survey data sets, and the variables that come from a tertiary data set (i.e., *Podes*) that can be linked to census and survey, consumption regression is run to estimate the distribution of coefficients and residual terms. Here the dependent variable is per household nutritional status and as provided by 2002 *SUSENAS* Consumption Module. The regression is run for all provinces and separated between urban and rural areas.

Running regression models as just described is the first major step in the application of Nutrition Mapping method. The second major step is to estimate nutritional status of the household using the coefficients and residual terms randomly drawn from the estimated distribution as provided by the first step. The imputed nutritional status in turn is used to estimate malnutrition and inequality measures at the level of small administrative areas. Imputation is repeated many times to arrive at a point estimate and robust standard error. (See Elbers, Lanjou and Lanjou., 2002 and 2003, for more detailed description of the methodology.) Processes of imputation as well as estimation of nutritional status and inequality measures is run using a program package designed by Qinghua Zhao of DECRG World Bank (2002).

2. The Data Sets

The NutMap model uses extensively the following six data sources:

- 2002 SUSENAS Consumption Module is to provide data on energy intake served as target variables. The total sample of the survey is about 65,000 households throughout the country; the sample varies proportionately by province.
- 2002 SUSENAS Core is to provide data on individual and household characteristics utilized as explanatory variables, to be used in running the models. The total sample is about 200,000 households; the sample also varies by province. Estimation is possible to district level.

- Specific 2002 SUSENAS for children under five years of age, to provide data on nutritional status of these children as measured by weight-by-age. The sample is about 65,000 children throughout the country. Estimation is possible to district level.

- 2000 Population Census is to provide data on individual (from L2 schedule) and household (from L1 schedule) characteristics, to be used in simulation to estimate nutritional indices. The data is also used to provide community variables by disaggregating to the village level.

- 2003 Village Potentials (*Podes*) is to provide community (i.e., village) data, used to identify so-called locational effects. *Podes* covers all villages throughout the country.

2.1 Dataset for the estimations of NAD, Maluku, Maluku Utara and Papua provinces

SUSENAS 2002 are not available for provinces of Aceh, Maluku Utara, Maluku and Papua. For these provinces, SUSENAS *2004* are used for the estimation of energy intake and SUSENAS 1999 for estimation of underweight children. However, the coverage of these two SUSENAS in these provinces is limited only in the capital cities of the provinces. An extra cautious are then necessary in interpreting the results for these four provinces.

Scope of Work

Based on the above data sources, two types of data sets are constructed: data set-1 for modeling, and data set-2 for simulation or estimation. Data set-1 is constructed based on the matched data file of SUSENAS data (Core and Module), *Podes* and aggregate census (at village level). Data set-2 is based on census-type, matched with that of *Podes* and aggregate census data. To run the model, different data sets are to prepared for each province and for urban/rural areas. Different model for urban and rural areas is necessary because SUSENAS, one of the major source used in the modeling, is designed differently between urban and rural areas. In addition, a different model for urban and rural areas seems more realistic than that of a combined or polled model. Different data set is also required to estimate different indicator of nutritional status. As described below, there are three indicators used to measure nutritional status i.e., energy intake, under-weight children and IMR.

The procedure just discussed leads to an obvious consequence: to run the model for the whole country, hundred of data sets are in need. For energy intake alone, 104 data sets are required. The figure is the product of 26 (the number of provinces where 2002 SUSENAS data are available) and 2 (urban/rural) and (data set-1 and data set-2). The same number is required for estimation of under-weight children under five. For IMRs estimation, the required data sets are as many as the number sub-district in the whole country in 2000, 4000 data sets.

3. Definitions

The term of nutritional status used here is loosely measured by energy intake, weight-by-age of children, and infant mortality rates. Table 1 shows the measurements and their indicators.

a. Energy intake

Basic data of energy intake is obtained from food consumption collected regularly every three years trough SUSENAS Consumption Module, a recall-based survey with a one week reference period. This survey collects food consumption data for about 225 food items during the reference period. The conversion of food into energy level, a table published by the Ministry of Health (*Departemen Kesehatan),* is utilized. The table is used for food that is both prepared and consumed in the observed households. For those households consuming prepared food (i.e., not

prepared in the household), a similar conversion table, published by the Centre for Research and Development of Nutrition, *IPB (*Puslitbang Gizi) is utilized. Close examination of actual data shows that consumption data of SUSENAS included consumption of food prepared in both observed households and outer unobserved households.

In the modeling, age-sex composition of the observed households is taken into account and the concept of a so-called equivalized household is adopted. Here, each household member is scored or "weighted" to accommodate a so-called "economic scale" and differential in the energy requirement of person by age-sex. Two scaling systems, the modified-OECD scale (Verma, 1999) and Amsterdam scale, have been tried and the results suggest that the Amsterdam scale is more appropriate for the SUSENAS data.

Table 1: Measurement and Indicators of Nutritional Status

Area of concern	Measurement	Indicator	Notes
Food security	Energy intake	Proportion of population with per capita energy intake less than 1,700 kilo calories per day	Adjusted for age-sex structure by Amsterdam scale
Nutrition and health outcome	Children under-five who are less than -2 Standard Deviation (-2 SD) from the age and gender specific normal weights (WHO-NCHS Standard)	Proportion of children with weight-by-age less than 2 Z_{score}	
	Number of infants who die before attaining 12 months of age (out of every 1,000 live births in a particular year).	Infant mortality rate	2000 population census data

b. Nutritional Status of Children

The 2002 SUSENAS collected data on weight (by age) of children under the age of five years using a portable balance scale (*timbangan dacin*). The data is used to measure the nutritional status of the children, based on a modified anthropometric Harvard (NCHS-WHO) standard, as recommended by *DepKes*. Under this standard, children are considered to be underweight (i.e., below "normal"), if their weight-to-age, in standardized form, is lower than minus 2 standard deviation (=Zscore < - 2SD).

c. Infant Mortality Rate

The 2000 population census was probably the only source that can be used for estimating infant mortality rates at the lowest administrative level. The census, for the first time in BPS history, has collected data on all children ever born and still surviving for every woman of reproductive age (10+). The data can be used to estimate IMRs by applying an indirect technique of estimation as proposed by the United Nations (i.e., Manual X). The technique basically transforms the proportion of deceased to ever-born children for age-specific women (=D(i)) provided by the census or the other typical survey data, into the probability of child mortality (=q(x)), based on the following equation:

q(x) = k(i). D(i)

where q(x) : probability of dying of age x (x=0,1, 5,10,15,20)

k(i) : multiplying factor for a given model of life table for age group of women i (i=1-7, i=1 for age group 15-19, 2=2 for 20-29, …i=7: for 45-49).

D(i) : proportion of children died for age group i (based on census- or survey-based data).

Based on a given model of live table, q(x) is then transformed into IMRs. The whole process of computation can be handled by Mortpack-litle package.

4. Procedures

The process for running the Nutrition Mapping model is carried out in accordance with the following nine steps:

1. Developing Beta model (see equation (2));
2. Calculating locational effects (3);
3. Calculating variance of estimators (4);
4. Preparing e_{ch} term residual to run Alpha model (6);
5. Developing GLS estimate model;
6. Using decomposition value singular to decompose variance-covariance matrix as provided by the previous step, to be used to establish vectors that are randomly and normally distributed;
7. Reading data census, eliminating missing values, and providing variables required by Beta and Alpha models;
8. Storing all data sets required for simulation; and
9. Running povmap.exe package program to obtain malnutrition headcount index and inequality measures allowed by the package, including their standard errors.

In equation (2), the nutritional status of household (=ln Ych) as provided by 2002 SUSENAS Consumption Module serves as the dependent variable. For the explanatory variable (=Xch), all common variables found in both the 2002 SUSENAS Core and 2000 population data sets (both L1 and L2 schedules) can serve as candidate variables to be included in the model. However, to be meaningful, the distribution and the summary statistics of each candidate variable are to be checked. The variable with very different distribution as shown by its summary statistics is excluded from the model. Checking distribution and summary statistics is done for every stratum (urban and rural province) and its corresponding attributes and scores used in the construction of an urban score.

In addition to common variables that passed t-test as just mentioned above, the model allows one to include interaction variables and higher order of variables (until 3rd order) derived from two or more well-tested single variables. The NutMap model is basically a prediction model and hence the so-called endogeneity problems here can be ignored.

In the model reported here, nutritional status is estimated based on the following model:

10. $$\ln y_{ch} = E[\ln y_{ch} | x_{ch}] + \mu_{ch}$$

where c : cluster c (village)
ch : household h in cluster c
ych : nutritional status for household h and cluster c
xch : socio-economic characteristic of household h in cluster c

The linear approximation of model (1) can be expressed as follows:

11. $\ln y_{ch} = x_{ch}\hat{a} + \mu_{ch}$ (*Beta model*)

where ▫ch is disturbance terms.

SUSENAS data does not provide locational information. In other words, disturbance terms as shown in equation (2), includes locational variables needing to be identified. The following formula is used to estimate locational effects:

12. $\mu_{ch} = \eta_c + \varepsilon_{ch}$

Here ηc is cluster components and εch is household components. On the average at village level, distribution terms can be expressed as follows:

13. $\mu_{c.} = \eta_c + \varepsilon_{c.}$, and then

$$E[\mu_c{}^2] = \sigma_\eta{}^2 + \mathrm{var}(\varepsilon_{c.}) = \sigma_\eta{}^2 + \tau_c{}^2$$

In the above equation ηc and εch are assumed to be normally distributed and independent of each other. Following Elbers et al (2002), the estimated variance of locational effects can be expressed as follows:

14. $$\mathrm{var}(\hat{\sigma}_\eta{}^2) = \sum_c [a_c{}^2\ \mathrm{var}(\mu_{c.}{}^2) + b_c{}^2\ \mathrm{var}(\hat{\tau}_c{}^2)]$$

In the absence of locational effect, ηc, equation (3) becomes simpler, $\mu_{ch} = +\varepsilon_{ch}$. However, this is normally an unrealistic assumption. Following Elbers et al (2002) residual εch can be explained by a logistic model that regresses transformed εch with household characteristics:

15. $$\ln\left[\frac{e^2{}_{ch}}{A - e^2{}_{ch}}\right] = Z_{ch}^T\hat{\alpha} + r_{ch}$$ (*Alpha model*)

Here A is set as A= 1.05*max{εch2}.

Estimated variance of εch can be calculated using the following equation:

16. $$\hat{\sigma}^2{}_{\varepsilon,ch} = \left[\frac{AB}{1+B}\right] + \frac{1}{2}\hat{\mathrm{V}}\mathrm{ar}(r)\left[\frac{AB(1-B)}{(1+B)^3}\right]$$

Equation (7) suggests that the OLS model cannot be applied in equation (2); and hence the GLS model is applied instead.

Using a number of common variables found in the census and the survey data sets, and the variables that come from a tertiary data set (i.e., *Podes*) that can be linked to census and survey, a consumption regression is run to estimate the distribution of coefficients and residual terms. Here the dependent variable is individual household nutritional status as provided by the 2002 SUSENAS Consumption Module. The regression is run for all provinces and separated between urban and rural areas.

Running regression models as just described is the first major step in the application of the Nutrition Mapping method. The second major step is to estimate the nutritional status of the

household using the coefficients and residual terms randomly drawn from the estimated distribution as provided by the first step. The imputed nutritional status in turn is used to estimate malnutrition and inequality measures at the level of small administrative areas. The imputation is repeated many times to arrive at a point estimate and robust standard error. (See Elbers, Lanjou and Lanjou, 2002 and 2003, for a more detailed description of the methodology.) Processes of imputation as well as estimation of nutritional status and inequality measures is run using a program package designed by Qinghua Zhao of DECRG World Bank (2002).

5. The Results and Reliability

The two major outputs the NutMap model are the proportion of population with energy intake less than 1,700 kcal per capita per day and the prevalence of underweight children under five (i.e., Zscore of weight-by-age less than 2SD or 3SD).

In technical perspective, what is desirable is obviously lower level of standard errors and lower level of aggregation at the same time. There is of course a trade-off between these two.

A close diagnostic shows that the NutMap model provide the expected results with high level of reliability as illustrated by Graph A-1. The graph exhibits a very close percentage distribution of underweight children under five of rural east Java. In addition, comparison between the results model and the official estimates suggests that the proportion of underweight children under five (here defined as Zscore <-2SD), are very close as shown by Table A-1. A minor different found (see the last column) in the comparison is understood due to missing cases. Table A-2 supports the previous statement: the reliability of the model as measured by standard errors is also within the acceptable ranges. Table A-3 leads to the similar conclusion with regards to the index of population with energy intake less than 1,700 kcal/day.

Graph A1: Percentage Distribution of Undernourished Under-5 Children Rural East Java.

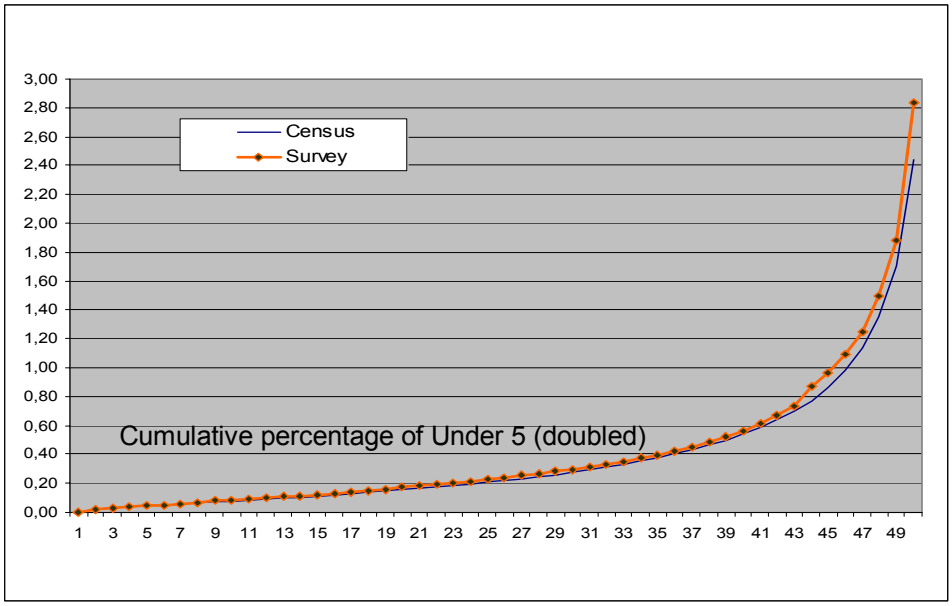

Table A-1
Proportion of Undernourished Under-5 Children (%)
Official V.S NutMap Model Estimates

	Province	Official(*)	NutMap Model	Diff. (%)
1	Sumatera Utara	33.1	33.1	0.1
2	Sumatera Barat	28.1	25.8	-2.3
3	Riau	18.4	21.7	3.3
4	Jambi	25.0	25.3	0.3
5	Sumatera Selatan	28.2	27.0	-1.2
6	Bengkulu	26.4	24.0	-2.4
7	Lampung	24.2	22.1	-2.1
8	Kep. Bangka Belitung	21.1	25.3	4.2
9	DKI Jakarta	23.2	20.8	-2.4
10	Jawa Barat	21.5	20.9	-0.6
11	Jawa Tengah	25.1	23.9	-1.2
12	DI Yogyakarta	16.9	15.4	-1.5
13	Jawa Timur	25.5	25.8	0.3
14	Banten	20.5	17.8	-2.7
15	Bali	18.7	17.1	-1.6
16	Nusa Tenggara Barat	37.8	35.6	-2.2
17	Nusa Tenggara Timur	38.8	38.8	0.0
18	Kalimantan Barat	33.2	34.9	1.7
19	Kalimantan Tengah	31.9	29.9	-2.0
20	Kalimantan Selatan	30.2	31.1	0.9
21	Kalimantan Timur	21.5	23.2	1.7
22	Sulawesi Utara	21.9	25.7	3.8
23	Sulawesi Tengah	29.6	26.1	-3.5
24	Sulawesi Selatan	29.1	26.0	-3.1
25	Sulawesi Tenggara	28.3	25.8	-2.5
26	Gorontalo	42.0	33.1	-8.9

Note: Undernourished children, Zscore<-2SD

(*) Laporan Hasil Survai Knsumsi Garam Yodium Rumahtangga 2002 (BPS, 2

Table A-2
Proportion of Undernourished Under-5 Children (%) and Standar Errors:
Comparison Betwwe Susenas and NutMap Model

No	Province	U/R	Susenas (**)		NutMap Model		
			Prop.	SE	Prop.	SE	SE Diff (%)
2	Sumatera Utara	U	31.0	1.7	35.8	4.9	-4.8
		R	33.4	1.5	28.6	2.4	4.8
3	Sumatera Barat	U	20.5	1.4	20.9	1.4	-0.4
		R	27.1	1.5	27.7	1.8	-0.6
4	Riau	U	16.0	3.3	16.1	3.7	-0.2
		R	25.5	3.6	25.7	5.8	-0.2
5	Jambi	U	24.3	2.5	24.0	3.1	0.3
		R	25.9	1.7	25.8	6.3	0.1
6	Sumatera Selatan	U	26.5	2.3	24.1	2.4	2.4
		R	29.3	2.1	28.5	1.9	0.8
7	Bengkulu	U	29.0	3.6	30.2	9.1	-1.2
		R	25.1	2.5	24.4	2.0	0.7
8	Lampung	U	20.9	2.9	16.3	4.1	4.6
		R	24.1	1.8	23.6	1.9	0.4
9	Kep. Bangka Belitung	U	20.2	3.1	24.7	3.0	-4.5
		R	24.7	4.3	25.6	6.1	-0.9
10	DKI Jakarta	Total	22.9	1.5	25.7	1.0	-2.8
11	Jawa Barat	U	19.3	1.0	21.0	1.3	-1.7
		R	22.1	1.1	20.8	4.9	1.3
12	Jawa Tengah	U	23.0	0.9	23.0	1.7	0.0
		R	25.4	0.8	24.5	0.9	0.9
13	DI Yogyakarta	Total	17.8	2.1	15.4	2.1	2.4
14	Jawa Timur	U	23.0	0.9	25.3	0.6	-2.3
		R	28.1	1.0	29.9	0.5	-1.8
15	Banten	Total	19.4	2.4	17.8	4.8	1.6
16	Bali	U	19.2	1.9	15.7	3.0	3.5
		R	17.2	1.3	18.4	5.2	-1.2
17	Nusa Tenggara Barat	U	36.2	2.6	35.4	3.1	0.8
		R	39.2	2.2	35.7	2.2	3.6
18	Nusa Tenggara Timur	U	35.2	2.8	34.8	6.0	0.4
		R	39.0	1.3	39.4	1.6	-0.4
19	Kalimantan Barat	U	24.1	2.4	26.7	3.2	-2.7
		R	37.3	2.2	39.0	1.6	-1.7
20	Kalimantan Tengah	U	31.2	5.8	21.8	4.0	9.4
		R	29.0	3.0	34.0	1.5	-5.0
21	Kalimantan Selatan	U	31.3	2.3	19.9	2.9	11.4
		R	30.1	1.8	36.8	1.1	-6.8
22	Kalimantan Timur	U	21.6	2.1	16.0	1.9	5.6
		R	26.6	2.1	26.8	3.3	-0.2
23	Sulawesi Utara	U	22.7	3.5	26.0	1.0	-3.3
		R	22.9	2.8	25.5	0.8	-2.6
24	Sulawesi Tengah	U	28.4	2.9	26.4	0.8	1.9
		R	31.8	1.6	26.0	0.9	5.8
25	Sulawesi Selatan	U	30.1	1.5	29.3	0.9	0.8
		R	28.9	1.0	24.7	0.9	4.2
26	Sulawesi Tenggara	U	25.9	2.8	29.5	1.2	-3.6
		R	28.1	2.0	25.0	1.0	3.1
27	Gorontalo	U	37.7	4.5	28.7	1.2	9.0
		R	45.7	3.7	34.4	1.5	11.3

Note: Undernourished children, Zscore of weight-by-age less than 2SD

Table A-3
Proportion of Undernourished Population (%) and Standard Errors (%)
Comparison Betwwe Susenas and NutMap Model

No	Provinsi	U/R	Susenas (**)		NutMap Model		SE Diff
			Proportion	SE	Proportion	SE	(4)-(6)
2	Sumatera Utara	U	14.8	2.2	12.5	1.7	2.3
		R	7.7	1.2	9.9	4.1	-2.2
3	Sumatera Barat	U	11.1	4.6	11.2	2.2	-0.1
		R	4.6	1.5	5.6	2.1	-1.0
4	Riau	U	12.6	2.9	14.6	5.0	-2.0
		R	8.7	2.0	12.0	2.2	-3.3
5	Jambi	U	25.5	4.8	23.9	4.6	1.6
		R	7.7	2.2	7.4	1.4	0.3
6	Sumatera Selatan	U	17.3	4.1	20.8	5.6	-3.6
		R	12.8	2.6	15.3	1.5	-2.5
7	Bengkulu	U	13.9	3.8	17.5	4.3	-3.6
		R	9.5	3.2	12.5	1.8	-3.0
8	Lampung	U	25.2	5.1	27.3	5.1	-2.1
		R	10.3	1.7	10.1	1.7	0.2
9	Kep. Bangka Belitung	U	15.6	5.7	14.4	3.3	1.2
		R	12.7	4.8	13.0	2.9	-0.3
10	DKI Jakarta	U+R	19.3	1.2	16.9	0.3	2.4
11	Jawa Barat	U	16.8	1.6	20.5	1.6	-3.7
		R	11.6	1.5	14.4	1.4	-2.8
12	Jawa Tengah	U	21.5	1.7	18.2	2.1	3.3
		R	17.5	1.3	19.2	1.7	-1.7
13	DI Yogyakarta	Total	21.8	2.4	20.0	6.4	1.8
14	Jawa Timur	U	22.1	1.4	15.9	1.3	6.2
		R	18.6	1.2	5.9	3.1	12.7
15	Banten	U	13.3	2.7	12.3	2.5	1.0
		R	7.3	1.9	7.8	1.8	-0.5
16	Bali	U	8.3	1.7	7.5	0.6	0.8
		R	3.9	1.4	2.5	0.8	1.4
17	Nusa Tenggara Barat	U	14.7	3.9	10.2	1.2	4.5
		R	7.3	1.8	6.4	1.1	0.9
18	Nusa Tenggara Timur	U	14.7	5.2	14.7	6.5	0.0
		R	15.4	2.6	14.9	4.5	0.5
19	Kalimantan Barat	U	21.9	4.9	19.6	5.2	2.3
		R	7.2	1.6	7.5	2.5	-0.3
20	Kalimantan Tengah	U	9.3	3.2	8.4	2.7	0.9
		R	5.9	3.4	5.9	1.1	0.0
21	Kalimantan Selatan	U	12.1	2.9	13.9	2.2	-1.8
		R	9.9	2.5	10.6	1.3	-0.7
22	Kalimantan Timur	U	14.3	3.0	14.5	2.6	-0.2
		R	22.7	5.4	23.0	3.8	-0.3
23	Sulawesi Utara	U	9.3	3.9	13.6	3.6	-4.3
		R	12.4	3.6	10.2	6.3	2.2
24	Sulawesi Tengah	U	25.1	6.9	10.7	2.8	14.4
		R	8.5	2.3	10.4	4.9	-1.9
25	Sulawesi Selatan	U	10.2	2.7	16.1	4.1	-5.9
		R	13.6	2.0	14.8	6.6	-1.2
26	Sulawesi Tenggara	U	10.0	4.7	22.3	5.1	-12.3
		R	11.4	2.6	10.3	5.1	1.1
27	Gorontalo	U	9.4	3.5	20.2	5.2	-10.8
		R	12.1	3.5	9.0	4.8	3.1

Note: Undernourished population, energy intake less than 1700 kcal/day

ANNEX 2

STANDARD ERROR OF PROVINCIAL ESTIMATION OF CHILDREN UNDER-FIVE UNDERWEIGHT

STANDARD ERROR OF PROVINCIAL ESTIMATION OF CHILDREN UNDER-FIVE UNDERWEIGHT

Province		Urban/Rural	Standard	Children Under-Five Underweight	Confidence Interval (%), α=10%	
			Error (%)	WAZ < -2 SD (%)	Lower Value (%)	Upper Value (%)
12.	Sumatra Utara	Urban	1.74	30.97	28.11	33.83
		Rural	1.51	33.39	30.91	35.87
13.	Sumatra Barat	Urban	1.41	20.50	18.19	22.81
		Rural	1.48	27.10	24.67	29.53
14.	Riau	Urban	3.30	15.95	10.54	21.36
		Rural	3.57	25.49	19.64	31.34
15.	Jambi	Urban	2.50	24.25	20.15	28.35
		Rural	1.65	25.87	23.16	28.58
16.	Sumatra Selatan	Urban	2.27	26.47	22.74	30.20
		Rural	2.14	29.29	25.78	32.80
17.	Bengkulu	Urban	3.59	28.98	23.10	34.86
		Rural	2.55	25.13	20.95	29.31
18.	Lampung	Urban	2.94	20.87	16.05	25.69
		Rural	1.80	24.05	21.10	27.00
19.	Bangka-Belitung	Urban	3.09	20.21	15.15	25.27
		Rural	4.34	24.73	17.61	31.85
31.	DKI Jakarta	Urban	1.52	22.91	20.42	25.40
32.	Jawa Barat	Urban	1.01	19.33	17.67	20.99
		Rural	1.12	22.09	20.25	23.93
33.	Jawa Tengah	Urban	0.90	22.98	21.50	24.46
		Rural	0.83	25.40	24.04	26.76
34.	DI Yogyakarta	Urban	1.77	15.68	12.78	18.58
		Rural	2.31	20.00	16.22	23.78
35.	Jawa Timur	Urban	0.89	23.01	21.56	24.46
		Rural	0.96	28.07	26.50	29.64
36.	Banten	Urban	2.07	17.70	14.30	21.10
		Rural	2.55	21.16	16.97	25.35
51.	Bali	Urban	1.91	19.17	16.04	22.30
		Rural	1.34	17.21	15.01	19.41
52.	Nusatenggara Barat	Urban	2.58	36.18	31.95	40.41
		Rural	2.17	39.23	35.68	42.78
53.	Nusatenggara Timur	Urban	2.85	35.19	30.52	39.86
		Rural	1.27	39.02	36.94	41.10
61.	Kalimantan Barat	Urban	2.42	24.05	20.09	28.01
		Rural	2.17	37.31	33.75	40.87
62.	Kalimantan Tengah	Urban	5.77	31.21	21.74	40.68
		Rural	3.03	29.04	24.08	34.00
63.	Kalimantan Selatan	Urban	2.29	31.33	27.57	35.09
		Rural	1.76	30.05	27.16	32.94

Province		Urban/Rural	Standard	Children Under-Five Underweight	Confidence Interval (%), α=10%	
			Error (%)	WAZ < -2 SD (%)	Lower Value (%)	Upper Value (%)
64.	Kalimantan Timur	Urban	2.14	21.64	18.13	25.15
		Rural	2.10	26.64	23.19	30.09
71.	Sulawesi Utara	Urban	3.46	22.68	17.01	28.35
		Rural	2.79	22.88	18.31	27.45
72.	Sulawesi Tengah	Urban	2.88	28.37	23.65	33.09
		Rural	1.60	31.77	29.14	34.40
73.	Sulawesi Selatan	Urban	1.50	30.12	27.65	32.59
		Rural	1.03	28.88	27.19	30.57
74.	Sulawesi Tenggara	Urban	2.82	25.85	21.22	30.48
		Rural	1.98	28.09	24.85	31.33
75.	Gorontalo	Urban	4.48	37.69	30.34	45.04
		Rural	3.69	45.69	39.64	51.74

Data Source: SUSENAS 2002.

The number before each province is the official area code of BPS.

ANNEX 3

LIST OF DISTRICT LEVEL ESTIMATION

Table 1: Underweight Children under Five Years of Age by District

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
11	**Nanggroe Aceh Darussalam**	**191,070**	**67,152**	**35.1**	**32.0**	**38.3**
1101	Simeuleu	7,058	2,607	36.9	30.4	43.5
1102	Singkil	13,976	5,179	37.1	30.3	43.8
1103	Aceh Selatan	18,914	5,068	26.8	21.0	32.6
1104	Aceh Tenggara	26,533	7,514	28.3	22.3	34.4
1105	Aceh Timur	56,161	17,475	31.1	25.5	36.8
1106	Aceh Tengah	20,813	6,013	28.9	23.8	34.0
1107	Aceh Barat	18,416	9,321	50.6	44.5	56.8
1108	Aceh Besar	4,036	1,370	34.0	27.5	40.4
1110	Bireuen	648	248	38.3	32.2	44.4
1111	Aceh Utara	9,575	5,199	54.3	48.1	60.5
1171	Kota Banda Aceh	12,659	6,388	50.5	44.2	56.7
1172	Kota Sabang	2,281	768	33.7	28.0	39.3
12	**Sumatera Utara**	**1,318,482**	**436,302**	**33.1**	**27.5**	**38.6**
1201	Nias	93,387	44,071	47.2	37.6	56.7
1202	Mandailing Natal	48,061	15,572	32.4	25.6	39.2
1203	Tapanuli Selatan	98,341	26,722	27.1	21.5	32.8
1204	Tapanuli Tengah	33,394	11,761	35.2	28.2	42.2
1205	Tapanuli Utara	48,571	14,892	30.7	24.2	37.2
1206	Toba Samosir	34,317	10,070	29.3	22.3	36.4
1207	Labuhan Batu	110,566	34,599	31.3	26.0	36.7
1208	Asahan	109,526	33,840	30.9	24.8	36.9
1209	Simalungun	87,182	24,691	28.3	22.6	34.1
1210	Dairi	38,352	11,891	31.0	22.9	39.1
1211	Karo	32,093	8,728	27.2	19.8	34.5
1212	Deli Serdang	218,481	65,840	30.2	23.3	37.0
1213	Langkat	96,562	27,898	28.9	23.5	34.3
1271	Sibolga	10,443	4,292	41.1	28.4	53.7
1272	Tanjung Balai	17,258	7,536	43.6	28.8	58.5
1273	Pematang Siantar	23,476	8,423	35.9	25.3	46.6
1274	Tebing Tinggi	12,645	4,699	37.2	26.8	47.5
1275	Medan	184,749	72,962	39.5	29.5	49.5
1276	Binjai	21,078	7,812	37.1	25.8	48.4
13	**Sumatera Barat**	**482,210**	**124,581**	**25.8**	**23.0**	**28.6**
1301	Kepulauan Mentawai	7,893	2,213	28.0	20.8	35.3
1302	Pesisir Selatan	44,560	13,162	29.5	25.3	33.7
1303	Solok	52,000	13,860	26.7	22.4	30.9
1304	Sawahlunto/Sijunjung	36,434	9,203	25.3	21.7	28.8
1305	Tanah Datar	33,333	8,462	25.4	21.7	29.1
1306	Padang Pariaman	49,769	13,270	26.7	22.1	31.2
1307	Agam	45,167	11,831	26.2	22.0	30.4
1308	Lima Puluh Koto	34,586	9,100	26.3	22.5	30.1
1309	Pasaman	67,707	19,569	28.9	23.9	33.9
1371	Padang	74,332	16,402	22.1	18.1	26.0
1372	Solok	5,639	1,135	20.1	14.3	26.0
1373	Sawah Lunto	5,381	1,185	22.0	16.3	27.7
1374	Padang Panjang	4,512	812	18.0	12.2	23.8
1375	Bukittinggi	10,167	2,040	20.1	15.9	24.2
1376	Payakumbuh	10,730	2,337	21.8	17.3	26.2
14	**Riau**	**559,470**	**121,271**	**21.7**	**13.6**	**29.8**
1401	Kuantan Sengingi	24,643	5,885	23.9	13.7	34.1
1402	Indragiri Hulu	29,109	7,026	24.1	14.6	33.7
1403	Indragiri Hilir	61,334	15,923	26.0	15.6	36.4
1404	Pelalawan	18,784	4,448	23.7	11.7	35.6
1405	Siak	33,059	7,145	21.6	9.5	33.7
1406	Kampar	57,713	14,101	24.4	14.1	34.8
1407	Rokan Hulu	35,081	8,687	24.8	14.2	35.3
1408	Bengkalis	59,397	12,789	21.5	12.3	30.8
1409	Rokan Hilir	46,657	11,200	24.0	12.7	35.3

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
1410	Kepulauan Riau	31,059	5,903	19.0	9.5	28.5
1411	Karimun	16,880	3,252	19.3	8.0	30.5
1412	Natuna	8,873	2,129	24.0	13.3	34.6
1471	Pekan Baru	67,544	10,740	15.9	8.9	22.9
1472	Batam	49,120	8,064	16.4	8.6	24.2
1473	Dumai	20,217	3,980	19.7	8.4	30.9
15	**Jambi**	**266,002**	**67,388**	**25.3**	**16.4**	**34.3**
1501	Kerinci	28,659	7,115	24.8	15.8	33.8
1502	Merangin	32,471	7,795	24.0	13.7	34.3
1503	Sarolangun	22,525	6,029	26.8	14.4	39.1
1504	Batang Hari	21,075	4,767	22.6	12.3	33.0
1505	Muaro Jambi	24,965	6,280	25.2	14.8	35.5
1506	Tanjung Jabung Timur	19,822	5,843	29.5	16.8	42.2
1507	Tanjung Jabung Barat	22,938	7,450	32.5	16.2	48.7
1508	Tebo	25,818	6,804	26.4	15.3	37.4
1509	Bungo	26,241	6,523	24.9	14.5	35.3
1571	Jambi	41,488	8,784	21.2	14.9	27.5
16	**Sumatera Selatan**	**738,036**	**199,601**	**27.0**	**23.6**	**30.5**
1601	Ogan Komering Ulu	128,434	34,828	27.1	22.8	31.5
1602	Ogan Komering Ilir	106,777	32,370	30.3	25.7	34.9
1603	Muara Enim	76,474	20,227	26.5	21.9	31.0
1604	Lahat	72,470	20,172	27.8	23.2	32.5
1605	Musi Rawas	74,732	21,328	28.5	23.8	33.3
1606	Musi Banyu Asin	134,980	39,849	29.5	24.8	34.2
1671	Palembang	144,169	30,828	21.4	16.6	26.1
17	**Bengkulu**	**175,825**	**42,154**	**24.0**	**17.7**	**30.3**
1701	Bengkulu Selatan	40,099	10,418	26.0	21.0	30.9
1702	Rejang Lebong	50,274	11,789	23.5	16.9	30.0
1703	Bengkulu Utara	55,170	13,241	24.0	19.6	28.4
1771	Bengkulu	30,282	6,670	22.0	6.4	37.7
18	**Lampung**	**692,681**	**153,203**	**22.1**	**18.3**	**26.0**
1801	Lampung Barat	40,283	9,412	23.4	18.7	28.1
1802	Tanggamus	82,960	19,512	23.5	18.5	28.5
1803	Lampung Selatan	118,866	25,865	21.8	17.5	26.1
1804	Lampung Timur	87,599	20,332	23.2	19.1	27.4
1805	Lampung Tengah	104,499	24,091	23.1	18.1	28.0
1806	Lampung Utara	56,847	12,790	22.5	17.2	27.8
1807	Way Kanan	38,399	8,811	22.9	18.3	27.6
1808	Tulangbawang	77,924	18,323	23.5	18.7	28.3
1871	Bandar Lampung	74,127	12,107	16.3	9.0	23.7
1872	Metro	11,177	1,961	17.5	5.5	29.5
19	**Kep. Bangka Belitung**	**92,452**	**23,378**	**25.3**	**17.2**	**33.4**
1901	Bangka	59,905	15,715	26.2	16.8	35.6
1902	Belitung	20,955	5,187	24.8	15.8	33.7
1971	Pangkal Pinang	11,592	2,476	21.4	13.9	28.8
31	**DKI Jakarta**	**711,142**	**148,026**	**20.8**	**19.4**	**22.3**
3171	Kota Jakarta Selatan	152,926	25,253	16.5	15.4	17.6
3172	Kota Jakarta Timur	214,441	34,021	15.9	14.8	16.9
3173	Kota Jakarta Pusat	63,613	11,849	18.6	17.3	19.9
3174	Kota Jakarta Barat	162,101	43,063	26.6	24.7	28.5
3175	Kota Jakarta Utara	118,061	32,993	27.9	25.9	29.9
32	**Jawa Barat**	**3,764,430**	**786,169**	**20.9**	**15.8**	**26.0**
3201	Bogor	417,218	98,379	23.6	17.6	29.6
3202	Sukabumi	238,687	58,141	24.4	19.9	28.8
3203	Cianjur	221,617	48,210	21.8	16.5	27.0
3204	Bandung	462,296	89,266	19.3	11.8	26.9

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
3205	Garut	253,793	57,763	22.8	18.5	27.0
3206	Tasikmalaya	215,525	45,195	21.0	17.0	25.0
3207	Ciamis	153,233	31,968	20.9	17.1	24.6
3208	Kuningan	89,514	18,870	21.1	17.2	25.0
3209	Cirebon	194,900	49,098	25.2	19.7	30.7
3210	Majalengka	105,210	23,623	22.5	18.2	26.8
3211	Sumedang	88,702	17,299	19.5	15.3	23.7
3212	Indramayu	156,566	38,447	24.6	21.4	27.7
3213	Subang	127,475	27,298	21.4	18.0	24.9
3214	Purwakarta	78,986	16,148	20.4	15.9	25.0
3215	Karawang	187,342	42,877	22.9	18.9	26.9
3216	Bekasi	180,881	36,322	20.1	15.1	25.0
3271	Bogor	73,510	12,413	16.9	8.8	25.0
3272	Sukabumi	25,163	4,936	19.6	11.9	27.4
3273	Bandung	190,498	26,550	13.9	6.2	21.7
3274	Cirebon	25,077	4,968	19.8	11.9	27.7
3275	Bekasi	165,101	29,262	17.7	10.8	24.7
3276	Depok	113,136	15,651	13.8	7.4	20.3
33	**Jawa Tengah**	**2,782,825**	**665,095**	**23.9**	**22.0**	**25.8**
3301	Cilacap	159,106	36,117	22.7	20.3	25.1
3302	Banyumas	132,500	30,104	22.7	20.0	25.4
3303	Purbalingga	78,818	18,719	23.8	20.9	26.6
3304	Banjarnegara	79,417	19,290	24.3	21.8	26.8
3305	Kebumen	111,684	24,459	21.9	19.6	24.2
3306	Purworejo	57,214	12,381	21.6	19.2	24.1
3307	Wonosobo	72,801	18,186	25.0	22.3	27.6
3308	Magelang	97,167	23,029	23.7	21.4	26.0
3309	Boyolali	74,992	17,878	23.8	21.0	26.7
3310	Klaten	75,026	17,541	23.4	20.3	26.5
3311	Sukoharjo	61,577	13,418	21.8	18.4	25.2
3312	Wonogiri	72,382	14,433	19.9	17.0	22.8
3313	Karanganyar	61,786	13,506	21.9	18.5	25.2
3314	Sragen	68,295	15,653	22.9	20.0	25.9
3315	Grobogan	120,585	33,631	27.9	24.9	30.9
3316	Blora	69,177	19,508	28.2	24.8	31.6
3317	Rembang	48,062	13,563	28.2	24.9	31.5
3318	Pati	93,766	22,926	24.5	21.9	27.0
3319	Kudus	62,146	14,785	23.8	20.1	27.5
3320	Jepara	91,809	22,897	24.9	21.3	28.5
3321	Demak	97,044	26,551	27.4	23.9	30.8
3322	Semarang	71,365	16,285	22.8	19.7	26.0
3323	Temanggung	57,095	13,583	23.8	21.1	26.5
3324	Kendal	76,729	19,221	25.1	22.1	28.0
3325	Batang	62,988	16,093	25.6	22.3	28.8
3326	Pekalongan	84,680	20,806	24.6	21.7	27.4
3327	Pemalang	130,062	32,112	24.7	21.3	28.1
3328	Tegal	138,200	33,610	24.3	21.1	27.5
3329	Brebes	171,113	46,645	27.3	24.2	30.3
3371	Magelang	9,005	1,519	16.9	12.3	21.5
3372	Surakarta	35,896	5,887	16.4	12.2	20.6
3373	Salatiga	11,574	1,971	17.0	11.8	22.2
3374	Semarang	102,570	19,499	19.0	15.8	22.2
3375	Pekalongan	24,886	5,154	20.7	16.7	24.7
3376	Tegal	21,308	4,251	20.0	15.4	24.5
34	**DI. Yogyakarta**	**281,968**	**43,512**	**15.4**	**11.9**	**19.0**
3401	Kulon Progo	35,427	6,108	17.2	12.4	22.1
3402	Bantul	73,560	11,899	16.2	12.1	20.2
3403	Gunung Kidul	60,198	11,098	18.4	11.9	25.0
3404	Sleman	80,161	10,694	13.3	10.4	16.3
3471	Yogyakarta	32,622	3,713	11.4	8.6	14.2
35	**Jawa Timur**	**2,870,576**	**739,460**	**25.8**	**25.4**	**26.2**
3501	Pacitan	39,406	11,034	28.0	27.3	28.7
3502	Ponorogo	62,404	16,582	26.6	25.7	27.4
3503	Trenggalek	52,047	14,809	28.5	27.1	29.8

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
3504	Tulungagung	78,374	19,365	24.7	23.4	26.0
3505	Blitar	88,369	23,523	26.6	25.6	27.7
3506	Kediri	119,552	30,590	25.6	24.4	26.8
3507	Malang	197,209	51,835	26.3	25.3	27.2
3508	Lumajang	80,033	22,532	28.2	26.9	29.4
3509	Jember	185,384	52,830	28.5	27.1	29.9
3510	Banyuwangi	115,727	32,527	28.1	26.5	29.7
3511	Bondowoso	55,038	16,096	29.2	28.1	30.4
3512	Situbondo	46,520	13,412	28.8	26.5	31.1
3513	Probolinggo	89,221	25,759	28.9	27.8	29.9
3514	Pasuruan	120,225	33,174	27.6	26.6	28.6
3515	Sidoarjo	140,088	31,463	22.5	20.7	24.3
3516	Mojokerto	78,722	20,000	25.4	24.2	26.6
3517	Jombang	94,348	24,419	25.9	24.7	27.1
3518	Nganjuk	78,959	21,144	26.8	25.7	27.8
3519	Madiun	47,311	12,368	26.1	25.0	27.3
3520	Magetan	41,845	10,730	25.6	24.6	26.7
3521	Ngawi	60,921	16,776	27.5	26.9	28.2
3522	Bojonegoro	94,282	26,041	27.6	27.0	28.2
3523	Tuban	89,864	25,858	28.8	27.8	29.7
3524	Lamongan	95,197	26,032	27.3	26.5	28.2
3525	Gresik	88,281	20,203	22.9	21.5	24.3
3526	Bangkalan	73,119	19,695	26.9	25.9	28.0
3527	Sampang	74,531	20,509	27.5	26.6	28.4
3528	Pamekasan	60,580	16,803	27.7	26.5	29.0
3529	Sumenep	74,696	19,807	26.5	25.8	27.3
3571	Kota Kediri	18,199	3,010	16.5	12.8	20.3
3572	Kota Blitar	9,843	1,729	17.6	11.6	23.6
3573	Kota Malang	56,533	9,829	17.4	13.8	20.9
3574	Kota Probolinggo	17,584	4,491	25.5	20.2	30.9
3575	Kota Pasuruan	15,754	3,722	23.6	19.4	27.9
3576	Kota Mojokerto	8,997	1,703	18.9	11.4	26.5
3577	Kota Madiun	12,034	1,741	14.5	10.0	18.9
3578	Kota Surabaya	209,379	37,318	17.8	15.3	20.4
36	**Banten**	**1,044,844**	**185,957**	**17.8**	**10.0**	**25.6**
3601	Pandeglang	119,724	18,404	15.4	7.9	22.9
3602	Lebak	173,080	23,524	13.6	7.2	20.0
3603	Tangerang	366,415	76,164	20.8	11.4	30.2
3604	Serang	266,119	47,397	17.8	9.5	26.1
3671	Tangerang	75,630	11,415	15.1	6.9	23.3
3672	Cilegon	43,876	9,052	20.6	9.2	32.0
51	**B A L I**	**369,573**	**63,043**	**17.1**	**10.4**	**23.8**
5101	Jembrana	24,884	3,999	16.1	8.5	23.6
5102	Tabanan	34,651	4,721	13.6	7.6	19.6
5103	Badung	39,333	6,520	16.6	9.5	23.7
5104	Gianyar	44,368	9,594	21.6	12.3	31.0
5105	Klungkung	17,573	2,747	15.6	7.4	23.8
5106	Bangli	24,379	4,963	20.4	9.4	31.3
5107	Karang Asem	47,912	8,593	17.9	7.4	28.5
5108	Buleleng	68,529	13,116	19.1	10.2	28.1
5172	Denpasar	67,944	8,791	12.9	7.8	18.1
52	**Nusa Tenggara Barat**	**527,938**	**188,209**	**35.6**	**31.8**	**39.5**
5201	Lombok Barat	89,892	33,922	37.7	30.6	44.9
5202	Lombok Tengah	88,345	32,227	36.5	31.0	42.0
5203	Lombok Timur	123,677	45,036	36.4	29.9	43.0
5204	Sumbawa	64,228	21,009	32.7	27.3	38.1
5205	Dompu	33,463	11,488	34.3	28.6	40.1
5206	Bima	84,486	28,541	33.8	28.5	39.0
5271	Mataram	43,847	15,785	36.0	29.4	42.6
53	**Nusa Tenggara Timur**	**503,813**	**195,539**	**38.8**	**35.2**	**42.4**
5301	Sumba Barat	55,476	17,663	31.8	28.0	35.7
5302	Sumba Timur	24,193	9,473	39.2	32.5	45.8

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
5303	Kupang	51,793	21,349	41.2	37.0	45.4
5304	Timor Tengah Selatan	48,551	22,744	46.8	42.2	51.5
5305	Timor Tengah Utara	23,818	11,381	47.8	41.6	53.9
5306	Belu	36,051	15,146	42.0	37.1	46.9
5307	Alor	20,737	8,531	41.1	35.7	46.6
5308	Lembata	10,857	4,686	43.2	37.5	48.8
5309	Flores Timur	24,152	8,353	34.6	29.6	39.6
5310	Sikka	31,110	10,974	35.3	29.9	40.7
5311	Ende	27,570	9,747	35.4	28.6	42.1
5312	Ngada	30,658	11,363	37.1	32.2	41.9
5313	Manggarai	93,229	35,727	38.3	34.7	41.9
5371	Kupang	25,618	8,411	32.8	20.1	45.6
61	**Kalimantan Barat**	**420,998**	**146,815**	**34.9**	**31.4**	**38.3**
6101	Sambas	48,740	17,385	35.7	32.1	39.2
6102	Bengkayang	37,076	12,453	33.6	30.2	36.9
6103	Landak	34,926	18,997	54.4	48.9	59.9
6104	Pontianak	73,372	20,036	27.3	24.6	30.0
6105	Sanggau	56,931	22,422	39.4	35.4	43.3
6106	Ketapang	50,644	21,667	42.8	38.5	47.1
6107	Sintang	54,120	24,975	46.1	41.5	50.8
6108	Kapuas Hulu	19,485	5,851	30.0	27.1	33.0
6171	Kota Pontianak	45,704	5,459	11.9	10.8	13.1
62	**Kalimantan Tengah**	**199,916**	**32,525**	**29.9**	**26.1**	**33.8**
6201	Kotawaringin Barat	27,810	2,607	17.3	15.2	19.3
6202	Kotawaringin Timur	59,488	8,350	25.8	22.7	29.0
6203	Kapuas	55,402	13,553	45.0	38.9	51.2
6204	Barito Selatan	18,876	3,572	34.8	30.4	39.2
6205	Barito Utara	22,024	3,050	25.5	22.2	28.8
6271	Kota Palangka Raya	16,316	1,249	14.1	12.5	15.7
63	**Kalimantan Selatan**	**301,034**	**93,729**	**31.1**	**28.3**	**34.0**
6301	Tanah Laut	24,718	7,810	31.6	28.8	34.4
6302	Kotabaru	46,506	14,025	30.2	27.4	32.9
6303	Banjar	40,110	14,126	35.2	32.0	38.4
6304	Barito Kuala	23,781	7,625	32.1	29.2	34.9
6305	Tapin	13,542	4,462	32.9	30.1	35.8
6306	Hulu Sungai Selatan	18,909	3,964	21.0	19.2	22.7
6307	Hulu Sungai Tengah	21,561	8,085	37.5	34.1	40.9
6308	Hulu Sungai Utara	30,091	14,485	48.1	43.5	52.8
6309	Tabalong	17,590	6,388	36.3	33.0	39.7
6371	Kota Banjarmasin	51,674	9,832	19.0	17.3	20.7
6372	Kota Banjar Baru	12,552	3,173	25.3	22.9	27.6
64	**Kalimantan Timur**	**274,307**	**63,687**	**23.2**	**18.6**	**27.8**
6401	Pasir	31,150	9,902	31.8	24.5	39.1
6402	Kutai Barat	15,000	4,420	29.5	25.4	33.5
6403	Kutai	47,602	13,987	29.4	23.9	34.8
6404	Kutai Timur	19,288	5,072	26.3	20.7	31.9
6405	Berau	14,729	3,732	25.3	19.9	30.8
6406	Malinau	4,831	1,745	36.1	32.0	40.3
6407	Bulongan	9,629	2,655	27.6	23.3	31.8
6408	Nunukan	9,604	2,926	30.5	27.3	33.6
6471	Kota Balikpapan	42,313	4,594	10.9	6.0	15.8
6472	Kota Samarinda	54,675	5,999	11.0	4.3	17.7
6473	Kota Tarakan	13,333	1,969	14.8	11.1	18.5
6474	Kota Bontang	12,153	1,487	12.2	8.6	15.9
71	**Sulawesi Utara**	**190,687**	**48,936**	**25.7**	**24.2**	**27.1**
7101	Bolaang Mengondow	46,309	12,198	26.3	24.8	27.8
7102	Minahasa	72,124	17,750	24.6	22.9	26.3
7103	Sangihe Talaud	23,441	6,340	27.0	25.6	28.5

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
7171	Manado	33,516	8,272	24.7	22.9	26.4
7172	Bitung	15,297	4,376	28.6	26.1	31.1
72	**Sulawesi Tengah**	**242,790**	**63,286**	**26.1**	**24.6**	**27.5**
7201	Banggai Kepulauan	17,837	4,376	24.5	22.3	26.8
7202	Banggai	30,694	7,657	24.9	23.0	26.9
7203	Morowali	18,158	4,273	23.5	21.3	25.7
7204	Poso	21,577	5,273	24.4	22.6	26.2
7205	Donggala	90,543	25,270	27.9	26.4	29.4
7206	Toli-Toli	20,616	5,675	27.5	26.0	29.1
7207	Buol	14,415	3,265	22.6	20.5	24.8
7271	Palu	28,950	7,497	25.9	24.1	27.7
73	**Sulawesi Selatan**	**864,270**	**224,461**	**26.0**	**24.5**	**27.5**
7301	Selayar	10,451	2,614	25.0	23.1	26.9
7302	Bulukumba	35,703	8,959	25.1	23.5	26.6
7303	Bantaeng	18,218	4,904	26.9	25.2	28.7
7304	Jeneponto	34,389	8,786	25.5	23.6	27.5
7305	Takalar	22,790	5,907	25.9	23.9	27.9
7306	Gowa	56,827	13,521	23.8	22.0	25.6
7307	Sinjai	22,841	5,892	25.8	24.0	27.6
7308	Maros	30,356	8,740	28.8	27.0	30.6
7309	Pangkajene Kepulauan	28,888	7,803	27.0	24.6	29.4
7310	Barru	15,790	4,291	27.2	25.3	29.0
7311	Bone	65,879	15,848	24.1	22.2	25.9
7312	Soppeng	20,443	5,056	24.7	22.7	26.8
7313	Wajo	31,242	8,154	26.1	23.9	28.3
7314	Sidenreng Rappang	23,714	6,499	27.4	24.6	30.2
7315	Pinrang	34,864	8,692	24.9	22.9	27.0
7316	Enrekang	20,467	4,631	22.6	20.6	24.7
7317	Luwu	47,916	11,953	24.9	23.2	26.7
7318	Tana Toraja	49,926	13,546	27.1	24.2	30.1
7319	Polewali Mamasa	57,646	16,088	27.9	25.4	30.4
7320	Majene	15,754	4,129	26.2	24.2	28.2
7321	Mamuju	41,384	10,167	24.6	21.7	27.4
7322	Luwu Utara	54,307	12,187	22.4	20.5	24.4
7371	Ujung Pandang	112,423	32,412	28.8	26.9	30.7
7372	Pare-Pare	12,052	3,684	30.6	28.1	33.0
74	**Sulawesi Tenggara**	**228,118**	**58,902**	**25.8**	**24.1**	**27.5**
7401	Buton	70,861	19,377	27.3	25.7	28.9
7402	Muna	38,136	9,529	25.0	22.9	27.0
7403	Kendari	55,263	12,913	23.4	21.4	25.3
7404	Kolaka	40,187	10,579	26.3	24.4	28.3
7471	Kendari	23,671	6,504	27.5	25.4	29.5
75	**Gorontalo**	**96,726**	**31,987**	**33.1**	**30.7**	**35.5**
7501	Boalemo	74,851	25,710	34.3	31.8	36.9
7502	Gorontalo	27,957	8,524	30.5	28.0	33.0
7571	Gorontalo	12,730	3,489	27.4	25.6	29.3
81	**Maluku**	**136,375**	**51,524**	**37.8**	**30.1**	**45.5**
8101	Maluku Tenggara Barat	18,550	5,757	31.0	25.3	36.7
8102	Maluku Tenggara	21,298	8,353	39.2	31.6	46.9
8103	Maluku Tengah	63,973	25,700	40.2	33.6	46.7
8104	Buru	14,043	5,471	39.0	32.2	45.7
8171	Ambon	18,511	6,243	33.7	16.9	50.5
82	**Maluku Utara**	**83,498**	**29,734**	**35.6**	**29.3**	**41.9**
8201	Maluku Utara	50,034	20,408	40.8	34.9	46.7
8202	Halmahera Tengah	16,410	6,116	37.3	30.7	43.8
8271	Ternate	17,054	3,210	18.8	9.5	28.2
94	**Papua**	**218,238**	**80,832**	**37.0**	**30.4**	**43.6**

Code	Province District	Number of Children Under 5 Years	Number of Underweight Children Under 5 Years	Percentage of Underweight Children Under 5 Years	Interval (%), ±=10%	
					Lower	Upper
9401	Merauke	28,393	12,915	44.8	37.7	52.0
9402	Jayawijaya	41,211	12,484	29.6	20.4	38.9
9403	Jayapura	17,114	5,500	32.6	23.2	42.0
9404	Nabire	14,869	6,028	39.6	29.8	49.5
9405	Paniai	12,380	3,571	27.1	18.0	36.2
9406	Puncak Jaya	6,403	1,813	24.3	15.5	33.2
9407	Fak-Fak	8,393	3,388	37.6	27.8	47.3
9408	Mimika	5,160	2,224	45.3	38.2	52.4
9409	Sorong	11,674	4,677	40.3	30.4	50.2
9410	Manokwari	19,660	6,618	36.0	26.4	45.6
9411	Yapen Waropen	8,693	3,370	41.3	31.4	51.3
9412	Biak Numfor	13,591	5,979	42.7	35.7	49.6
9471	Jayapura	18,174	8,170	43.4	36.4	50.4
9472	Sorong	12,523	4,094	33.5	24.1	43.0

Data Source: 2002 Susenas Core, 2000 Population Cencus, 2003 Village Potentials and 1999 Susenas (only for: NAD, Maluku, Maluku Utara and Papua provinces)

Table 2: Infant Mortality Rate (IMR) by District

Code	Province District	Infant Mortality Rate
11	**Nanggroe Aceh Darussalam**	
1101	Simeulue	41.7
1102	Aceh Singkil	65.6
1103	Aceh Selatan	55.6
1104	Aceh Tenggara	36.7
1105	Aceh Timur	41.7
1106	Aceh Tengah	47.7
1107	Aceh Barat	37.7
1108	Aceh Besar	33.7
1109	Pidie	43.7
1110	Bireuen	21.8
1111	Aceh Utara	39.7
1171	Banda Aceh	37.7
1172	Sabang	36.7
12	**Sumatera Utara**	
1201	Nias	53.7
1202	Mandailing Natal	66.6
1203	Tapanuli Selatan	51.7
1204	Tapanuli Tengah	50.7
1205	Tapanuli Utara	50.7
1206	Toba Samosir	43.7
1207	Labuhan Ratu	51.7
1208	Asahan	50.7
1209	Simalungun	41.7
1210	Dairi	49.7
1211	Karo	25.8
1212	Deli Serdang	47.7
1213	Langkat	44.7
1271	Kota Sibolga	47.7
1272	Kota Tanjung Balai	57.6
1273	Kota Pematang Siantar	29.8
1274	Kota Tebing Tinggi	33.7
1275	Kota Medan	34.7
1276	Kota Binjai	33.7
13	**Sumatera Barat**	
1301	Kepulauan Mentawai	43.7
1302	Pesisir Selatan	55.6
1303	Solok	71.6
1304	Sawahlunto/Sijunjung	71.6
1305	Tanah Datar	45.7
1306	Padang Pariaman	53.7
1307	Agam	47.7
1308	Lima Puluh Koto	55.6
1309	Pasaman	67.6
1371	Kota Padang	37.7
1372	Kota Solok	47.7
1373	Kota Sawahlunto	30.8
1374	Kota Padang Panjang	34.7
1375	Kota Bukit Tinggi	30.8
1376	Kota Payakumbuh	43.7
14	**Riau**	
1401	Kuantan Singigi	48.7
1402	Indragiri Hulu	48.7
1403	Indragiri Hilir	43.7
1404	Pelalawan	43.7
1405	Siak	30.8
1406	Kampar	44.7
1407	Rokan Hulu	56.6
1408	Bengkalis	36.7
1409	Rokan Hilir	50.7
1410	Kepulauan Riau	42.7
1411	Karimun	36.7

Code	Province District	Infant Mortality Rate
1412	Natuna	48.7
1471	Kota Pekan Baru	28.8
1472	Kota Batam	32.7
1473	Kota Dumai	32.7
15	**Jambi**	
1501	Kerinci	40.7
1502	Merangin	57.6
1503	Sarolangun	55.6
1504	Batang Hari	58.6
1505	Muaro Jambi	46.7
1506	Tanjung Jabung Timur	70.6
1507	Tanjung Jabung Barat	57.6
1508	Tebo	55.6
1509	Bungo	71.6
1571	Kota Jambi	31.7
16	**Sumatera Selatan**	
1601	Ogan Komering Ulu	47.7
1602	Ogan Komering Ilir	63.6
1603	Muara Enim	53.7
1604	Lahat	58.6
1605	Musi Rawas	68.6
1606	Musi Banyu Asin	44.7
1671	Kota Palembang	39.7
17	**Bengkulu**	
1701	Bengkulu Selatan	57.6
1702	Rejang Lebong	65.6
1703	Bengkulu Utara	54.7
18	**Lampung**	
1801	Lampung Barat	55.6
1802	Tanggamus	53.7
1803	Lampung Selatan	57.6
1804	Lampung Timur	37.7
1805	Lampung Tengah	44.7
1806	Lampung Utara	48.7
1807	Way Kanan	44.7
1808	Tulang Bawang	51.7
1871	Kota Bandar Lampung	41.7
1872	Kota Metro	23.8
19	**Kep. Bangka Belitung**	
1901	Bangka	56.6
1902	Belitung	43.7
1971	Kota Pangkal Pinang	37.7
31	**DKI Jakarta**	
3171	Jakarta Selatan	25.8
3172	Jakarta Timur	24.8
3173	Jakarta Pusat	31.7
3174	Jakarta Barat	28.8
3175	Jakarta Utara	25.8
32	**Jawa Barat**	
3201	Bogor	58.6
3202	Sukabumi	65.6
3203	Cianjur	63.6
3204	Bandung	43.7
3205	Garut	75.6
3206	Tasikmalaya	56.6
3207	Ciamis	57.6
3208	Kuningan	52.7

Code	Province District	Infant Mortality Rate
3209	Cirebon	59.6
3210	Majalengka	61.6
3211	Sumedang	46.7
3212	Indramayu	62.6
3213	Subang	52.7
3214	Purwakarta	64.6
3215	Karawang	63.6
3216	Bekasi	46.7
3271	Kota Bogor	42.7
3272	Kota Sukabumi	47.7
3273	Kota Bandung	37.7
3274	Kota Cirebon	42.7
3275	Kota Bekasi	42.7
3276	Kota Depok	23.8
33	**Jawa Tengah**	
3301	Cilacap	48.7
3302	Banyumas	43.7
3303	Purbalingga	41.7
3304	Banjarnegara	46.7
3305	Kebumen	43.7
3306	Purworejo	41.7
3307	Wonosobo	43.7
3308	Magelang	41.7
3309	Boyolali	33.7
3310	Klaten	34.7
3311	Sukoharjo	29.8
3312	Wonogiri	24.8
3313	Karanganyar	25.9
3314	Sragen	32.7
3315	Grobogan	41.7
3316	Blora	37.7
3317	Rembang	41.7
3318	Pati	29.8
3319	Kudus	39.7
3320	Jepara	30.8
3321	Demak	42.7
3322	Semarang	28.8
3323	Temanggung	31.7
3324	Kendal	51.7
3325	Batang	46.7
3326	Pekalongan	52.7
3327	Pemalang	59.6
3328	Tegal	51.7
3329	Brebes	60.6
3371	Kota Magelang	34.7
3372	Kota Surakarta	26.8
3373	Kota Salatiga	35.7
3374	Kota Semarang	29.8
3375	Kota Pekalongan	39.7
3376	Kota Tegal	41.7
34	**DI Yogyakarta**	
3401	Kulon Progo	25.8
3402	Bantul	27.8
3403	Gunung Kidul	28.8
3404	Sleman	22.8
3471	Kota Yogyakarta	20.8
35	**Jawa Timur**	
3501	Pacitan	37.7
3502	Ponorogo	39.7
3503	Trenggalek	32.7
3504	Tulungagung	28.8
3505	Blitar	36.7
3506	Kediri	39.7
3507	Malang	47.7
3508	Lumajang	54.7

Code	Province District	Infant Mortality Rate
3509	Jember	73.6
3510	Banyuwangi	55.6
3511	Bondowoso	79.6
3512	Situbondo	67.6
3513	Probolinggo	78.6
3514	Pasuruan	68.6
3515	Sidoarjo	39.7
3516	Mojokerto	42.7
3517	Jombang	43.7
3518	Nganjuk	43.7
3519	Madiun	43.7
3520	Magetan	37.7
3521	Ngawi	41.7
3522	Bojonegoro	49.7
3523	Tuban	49.7
3524	Lamongan	45.7
3525	Gresik	41.7
3526	Bangkalan	69.6
3527	Sampang	89.5
3528	Pamekasan	73.6
3529	Sumenep	68.6
3571	Kota Kediri	37.7
3572	Kota Blitar	31.7
3573	Kota Malang	47.7
3574	Kota Probolinggo	43.7
3575	Kota Pasuruan	57.6
3576	Kota Mojokerto	29.8
3577	Kota Madiun	33.7
3578	Kota Surabaya	42.7
36	**Banten**	
3601	Pandeglang	70.6
3602	Lebak	69.6
3603	Tangerang	57.6
3604	Serang	84.6
3671	Kota Tangerang	42.7
3672	Kota Cilegon	45.7
51	**Bali**	
5101	Jembrana	34.7
5102	Tabanan	23.8
5103	Badung	27.8
5104	Gianyar	32.7
5105	Klungkung	44.7
5106	Bangli	32.7
5107	Karang Asem	46.7
5108	Buleleng	47.7
5171	Kota Denpasar	23.8
52	**Nusa Tenggara Barat**	
5201	Lombok Barat	92.5
5202	Lombok Tengah	89.5
5203	Lombok Timur	106.5
5204	Sumbawa	87.6
5205	Dompu	92.5
5206	Bima	78.6
5271	Kota Mataram	61.6
53	**Nusa Tenggara Timur**	
5301	Sumba Barat	65.6
5302	Sumba Timur	77.6
5303	Kupang	59.6
5304	Timor Tengah Selatan	53.7
5305	Timor Tengah Utara	53.7
5306	Belu	59.6
5307	Alor	64.6
5308	Lembata	50.7
5309	Flores Timur	51.7

Code	Province District	Infant Mortality Rate
5310	Sikka	52.7
5311	Ende	65.6
5312	Ngada	52.7
5313	Manggarai	55.7
5371	Kupang	56.7
61	**Kalimantan Barat**	
6101	Sambas	81.6
6102	Bengkayang	40.7
6103	Landak	67.6
6104	Pontianak	53.7
6105	Sanggau	48.7
6106	Ketapang	51.7
6107	Sintang	47.7
6108	Kapuas Hulu	53.7
6171	Kota Pontianak	49.7
62	**Kalimantan Tengah**	
6201	Kotawaringin Barat	34.7
6202	Kotawaringin Timur	45.7
6203	Kapuas	43.7
6204	Barito Selatan	48.7
6205	Barito Utara	33.7
6271	Kota Palangka Raya	26.8
63	**Kalimantan Timur**	
6301	Tanah Laut	47.7
6302	Kota Baru	59.6
6303	Banjar	63.6
6304	Barito Kuala	81.6
6305	Tapin	52.7
6306	Hulu Sungai Selatan	67.6
6307	Hulu Sungai Tengah	67.6
6308	Hulu Sungai Utara	78.6
6309	Tabalong	73.6
6371	Kota Banjarmasin	52.7
6372	Kota Banjar Baru	43.7
64	**Kalimantan Timur**	
6401	Pasir	39.7
6402	Kutai Barat	36.7
6403	Kutai	49.7
6404	Kutai Timur	45.7
6405	Berau	47.7
6406	Malinau	45.7
6407	Bulungan	25.8
6408	Nunukan	34.7
6471	Kota Balikpapan	28.8
6472	Kota Samarinda	36.7
6473	Kota Tarakan	29.8
6474	Kota Bontang	27.8
71	**Sulawesi Utara**	
7101	Bolaang Mongondow	36.7
7102	Minahasa	29.8
7103	Sangihe Talaud	30.8
7171	Kota Manado	22.8
7172	Kota Bitung	25.8
72	**Sulawesi Tengah**	
7201	Banggai Kepulauan	84.6
7202	Banggai	47.7
7203	Morowali	56.6
7204	Poso	66.6

Code	Province District	Infant Mortality Rate
7205	Donggala	72.6
7206	Toli Toli	74.6
7207	Buol	69.6
7271	Kota Palu	45.7
73	**Sulawesi Selatan**	
7301	Selayar	62.6
7302	Bulukumba	53.7
7303	Bantaeng	41.7
7304	Jeneponto	66.6
7305	Takalar	59.6
7306	Gowa	43.7
7307	Sinjai	49.7
7308	Maros	49.7
7309	Pangkajene Kepulauan	60.6
7310	Barru	59.6
7311	Bone	58.6
7312	Soppeng	43.7
7313	Wajo	43.7
7314	Sidenreng Rappang	47.7
7315	Pinrang	49.7
7316	Enrekang	36.7
7317	Luwu	40.7
7318	Tana Toraja	34.7
7319	Polewali Mamasa	60.6
7320	Majene	79.6
7321	Mamuju	59.6
7322	Luwu Utara	51.7
7371	Kota Makassar	33.7
7372	Kota Pare Pare	32.7
74	**Sulawesi Tenggara**	
7401	Buton	50.7
7402	Muna	55.6
7403	Kendari	52.7
7404	Kolaka	52.7
7471	Kota Kendari	42.7
75	**Gorontalo**	
7501	Boalemo	55.6
7502	Gorontalo	56.6
7571	Kota Gorontalo	53.7
81	**Maluku**	
8101	Maluku Tenggara Barat	54.7
8102	Maluku Tenggara	52.7
8103	Maluku Tengah	66.6
8104	Buru	59.6
8171	Ambon	31.7
82	**Maluku Utara**	
8201	Maluku Utara	77.6
8202	Halmahera Tengah	76.6
8271	Ternate	40.7
94	**Papua**	
9401	Merauke	87.6
9402	Jayawijaya	60.6
9403	Jayapura	47.7
9404	Paniai	57.6
9405	Puncak Jaya	55.6
9406	Nabire	57.6
9407	Fak Fak	43.7
9408	Mimika	49.7
9409	Sorong	58.6

Code	Province District	Infant Mortality Rate
9410	Manokwari	50.7
9411	Yapen Waropen	66.6
9412	Biak Numfor	57.6
9471	Jayapura	50.7
9472	Sorong	40.7

Data Source: 2000 Population Cencus, 2003 Village Potentials and 1999 Susenas (only for: NAD, Maluku, Maluku Utara and Papua provinces)

Table 3: Population Living with Energy Intake less than 1,700 Kilo Calories by District

Code	Province District	Number of Household	Number of Population	Less than 1,700 KCal		Interval (%), ±=10%	
				Number of Population	Percentage of Population	Lower	Upper
11	**Nanggroe Aceh Darussalam**	**409,501**	**1,724,522**	**295,361**	**17.1**	**13.1**	**21.2**
1101	Simeuleu	11,532	50,772	10,456	20.6	10.0	31.2
1102	Singkil	22,658	98,984	22,948	23.2	12.5	33.8
1103	Aceh Selatan	41,091	176,002	33,329	18.9	8.5	29.4
1104	Aceh Tenggara	44,954	199,413	27,235	13.7	3.4	23.9
1105	Aceh Timur	122,192	522,293	83,878	16.1	5.7	26.4
1106	Aceh Tengah	43,550	182,147	33,832	18.6	8.1	29.0
1107	Aceh Barat	44,930	177,965	37,115	20.9	10.4	31.3
1108	Aceh Besar	8,936	37,898	5,053	13.3	3.1	23.5
1110	Bireuen	2,174	9,985	1,289	12.9	2.7	23.1
1111	Aceh Utara	23,093	92,238	13,966	15.1	4.7	25.5
1171	Kota Banda Aceh	38,543	153,451	22,922	14.9	4.6	25.3
1172	Kota Sabang	5,848	23,374	3,297	14.1	3.9	24.4
12	**Sumatera Utara**	**2,374,360**	**10,584,749**	**1,162,226**	**11.0**	**5.9**	**16.0**
1201	Nias	134,971	619,902	54,078	8.7	0.2	17.3
1202	Mandailing Natal	47,300	217,214	15,692	7.2	1.5	12.9
1203	Tapanuli Selatan	127,167	585,132	56,523	9.7	2.6	16.7
1204	Tapanuli Tengah	43,798	201,165	37,081	18.4	10.0	26.9
1205	Tapanuli Utara	76,082	355,258	23,373	6.6	1.4	11.8
1206	Toba Samosir	53,729	259,424	28,443	11.0	3.4	18.5
1207	Labuhan Batu	158,051	723,917	90,968	12.6	3.5	21.6
1208	Asahan	150,556	689,087	74,930	10.9	3.0	18.8
1209	Simalungun	180,281	836,548	94,982	11.4	3.5	19.2
1210	Dairi	59,692	265,352	14,146	5.3	0.9	9.7
1211	Karo	76,723	282,821	18,692	6.6	0.8	12.4
1212	Deli Serdang	442,620	1,953,289	217,049	11.1	6.0	16.2
1213	Langkat	209,938	901,901	85,557	9.5	3.1	15.9
1271	Sibolga	17,894	81,280	10,442	12.8	8.8	16.9
1272	Tanjung Balai	27,827	130,204	5,233	4.0	0.8	7.2
1273	Pematang Siantar	54,849	241,301	22,976	9.5	7.6	11.4
1274	Tebing Tinggi	28,266	124,663	25,943	20.8	14.3	27.4
1275	Medan	435,844	1,902,666	281,464	14.8	11.5	18.1
1276	Binjai	48,772	213,625	13,813	6.5	3.1	9.8
13	**Sumatera Barat**	**1,019,484**	**4,232,773**	**304,915**	**7.2**	**3.7**	**10.7**
1301	Kepulauan Mentawai	14,466	60,847	2,732	4.5	1.0	8.0
1302	Pesisir Selatan	92,224	390,759	30,650	7.8	3.1	12.6
1303	Solok	106,455	438,378	18,846	4.3	1.7	6.9
1304	Sawahlunto/Sijunjung	75,078	307,223	22,931	7.5	2.9	12.0
1305	Tanah Datar	83,699	325,650	21,110	6.5	2.2	10.8
1306	Padang Pariaman	96,442	430,842	22,186	5.1	1.4	8.9
1307	Agam	100,090	414,232	19,981	4.8	1.4	8.3
1308	Lima Puluh Koto	82,059	311,642	19,040	6.1	2.3	9.9
1309	Pasaman	120,838	512,676	20,957	4.1	1.2	7.0
1371	Padang	170,822	712,059	81,456	11.4	7.1	15.8
1372	Solok	11,158	48,106	4,454	9.3	4.8	13.7
1373	Sawah Lunto	12,490	50,830	7,990	15.7	8.4	23.0
1374	Padang Panjang	9,020	39,795	4,651	11.7	6.2	17.2
1375	Bukittinggi	22,061	91,940	12,414	13.5	8.3	18.8
1376	Payakumbuh	22,582	97,794	15,516	15.9	9.5	22.2
14	**Riau**	**1,162,305**	**4,747,058**	**621,414**	**13.1**	**7.5**	**18.7**
1401	Kuantan Sengingi	54,981	216,289	26,476	12.2	6.8	17.7
1402	Indragiri Hulu	59,378	246,753	28,570	11.6	7.2	16.0
1403	Indragiri Hilir	134,935	554,834	66,532	12.0	7.0	17.0
1404	Pelalawan	37,975	152,714	18,617	12.2	5.5	18.9
1405	Siak	58,323	238,714	31,219	13.1	5.1	21.1
1406	Kampar	106,594	446,582	47,149	10.6	6.5	14.6
1407	Rokan Hulu	65,573	265,537	30,287	11.4	6.2	16.6
1408	Bengkalis	116,115	519,530	62,169	12.0	6.6	17.4
1409	Rokan Hilir	80,708	351,607	56,172	16.0	8.4	23.5
1410	Kepulauan Riau	79,572	318,629	45,186	14.2	6.6	21.8
1411	Karimun	37,301	164,534	28,140	17.1	7.7	26.5

Code	Province District	Number of Household	Number of Population	Less than 1,700 KCal		Interval (%), ±=10%	
				Number of Population	Percentage of Population	Lower	Upper
1471	Pekan Baru	143,193	585,159	86,308	14.7	4.9	24.6
1472	Batam	129,537	435,647	62,331	14.3	7.2	21.4
1473	Dumai	38,519	172,573	19,697	11.4	3.5	19.3
15	**Jambi**	**594,324**	**2,400,670**	**289,935**	**12.1**	**8.3**	**15.8**
1501	Kerinci	84,272	294,415	24,067	8.2	5.2	11.2
1502	Merangin	63,592	253,910	18,846	7.4	4.4	10.5
1503	Sarolangun	42,803	177,805	14,405	8.1	4.9	11.3
1504	Batang Hari	46,708	189,199	15,151	8.0	4.2	11.8
1505	Muaro Jambi	57,781	233,630	21,254	9.1	5.6	12.6
1506	Tanjung Jabung Timur	47,920	191,287	22,721	11.9	5.6	18.2
1507	Tanjung Jabung Barat	50,921	206,565	28,717	13.9	7.2	20.6
1508	Tebo	52,626	221,984	18,168	8.2	4.4	11.9
1509	Bungo	52,428	216,656	19,403	9.0	5.3	12.6
1571	Jambi	95,273	415,219	107,203	25.8	17.0	34.6
16	**Sumatera Selatan**	**1,486,339**	**6,891,379**	**1,181,775**	**17.1**	**12.4**	**21.9**
1601	Ogan Komering Ulu	251,298	1,155,639	151,646	13.1	9.9	16.3
1602	Ogan Komering Ilir	220,189	973,460	187,812	19.3	14.6	24.0
1603	Muara Enim	161,613	719,002	121,219	16.9	12.0	21.7
1604	Lahat	146,113	670,463	91,510	13.6	9.6	17.7
1605	Musi Rawas	140,491	640,520	87,362	13.6	9.0	18.3
1606	Musi Banyu Asin	272,817	1,288,348	215,727	16.7	12.3	21.2
1671	Palembang	293,818	1,443,947	326,499	22.6	12.4	32.9
17	**Bengkulu**	**358,359**	**1,588,955**	**221,315**	**13.9**	**9.8**	**18.1**
1701	Bengkulu Selatan	86,360	381,046	46,224	12.1	8.4	15.9
1702	Rejang Lebong	112,329	447,515	61,580	13.8	8.8	18.8
1703	Bengkulu Utara	101,505	480,746	72,406	15.1	10.9	19.2
1771	Bengkulu	58,165	279,648	41,105	14.7	7.4	22.0
18	**Lampung**	**1,617,288**	**6,671,115**	**919,149**	**13.8**	**9.8**	**17.7**
1801	Lampung Barat	92,402	365,710	40,758	11.1	7.9	14.4
1802	Tanggamus	183,170	798,516	135,726	17.0	11.9	22.1
1803	Lampung Selatan	269,823	1,139,997	149,827	13.1	8.6	17.7
1804	Lampung Timur	219,170	870,584	89,389	10.3	6.6	13.9
1805	Lampung Tengah	262,259	1,044,670	123,076	11.8	7.7	15.8
1806	Lampung Utara	124,110	530,182	69,598	13.1	8.6	17.7
1807	Way Kanan	84,017	348,677	32,312	9.3	6.5	12.1
1808	Tulangbawang	179,662	714,891	82,008	11.5	7.6	15.4
1871	Bandar Lampung	173,134	740,087	176,838	23.9	15.9	31.9
1872	Metro	29,541	117,801	19,617	16.7	7.7	25.6
19	**Kep. Bangka Belitung**	**214,247**	**896,321**	**122,224**	**13.6**	**8.6**	**18.6**
1901	Bangka	133,893	566,833	68,489	12.1	7.4	16.8
1902	Belitung	50,036	204,478	31,041	15.2	8.7	21.6
1971	Pangkal Pinang	30,318	125,010	22,694	18.2	11.8	24.5
31	**DKI Jakarta**	**2,227,138**	**8,310,442**	**1,404,382**	**16.9**	**16.4**	**17.4**
3171	Kota Jakarta Selatan	462,236	1,774,556	378,035	21.3	20.9	21.7
3172	Kota Jakarta Timur	613,033	2,339,000	518,634	22.2	21.8	22.6
3173	Kota Jakarta Pusat	245,826	868,522	164,033	18.9	18.4	19.4
3174	Kota Jakarta Barat	511,425	1,897,037	251,201	13.2	12.5	13.9
32	**Jawa Barat**	**9,561,444**	**35,636,656**	**6,224,311**	**17.5**	**2.7**	**32.3**
3201	Bogor	857,111	3,501,120	680,942	19.4	2.2	36.7
3202	Sukabumi	567,500	2,072,626	320,932	15.5	7.0	24.0
3203	Cianjur	535,011	1,944,429	293,661	15.1	6.1	24.1
3204	Bandung	1,097,090	4,149,979	767,728	18.5	0.0	37.0
3205	Garut	512,935	2,046,479	351,840	17.2	7.0	27.4
3206	Tasikmalaya	568,372	2,062,036	337,609	16.4	6.8	26.0
3207	Ciamis	486,602	1,615,565	215,071	13.3	5.9	20.7
3208	Kuningan	255,551	981,453	154,171	15.7	6.2	25.2

Code	Province District	Number of Household	Number of Population	Less than 1,700 KCal		Interval (%), ±=10%	
				Number of Population	Percentage of Population	Lower	Upper
3209	Cirebon	489,145	1,922,515	358,370	18.6	2.2	35.1
3210	Majalengka	327,547	1,120,485	148,032	13.2	2.9	23.5
3211	Sumedang	290,036	965,758	131,302	13.6	4.5	22.7
3212	Indramayu	451,048	1,587,311	222,090	14.0	5.2	22.8
3213	Subang	394,652	1,326,733	176,766	13.3	5.7	21.0
3214	Purwakarta	186,537	698,021	113,388	16.2	3.6	28.9
3215	Karawang	491,332	1,784,196	291,196	16.3	4.6	28.0
3216	Bekasi	445,393	1,661,833	297,400	17.9	0.3	35.5
3271	Bogor	179,663	747,125	165,289	22.1	0.0	50.0
3272	Sukabumi	65,813	251,649	50,105	19.9	0.0	47.3
3273	Bandung	582,909	2,126,481	459,099	21.6	0.0	48.7
3274	Cirebon	67,157	270,436	60,829	22.5	0.0	50.6
3275	Bekasi	423,354	1,661,047	382,922	23.1	0.0	52.5
3276	Depok	286,686	1,139,379	245,565	21.6	0.0	48.9
33	**Jawa Tengah**	**6,378,678**	**27,042,832**	**5,089,461**	**18.8**	**15.8**	**44.7**
3301	Cilacap	332,766	1,416,363	297,578	21.0	16.3	25.7
3302	Banyumas	300,241	1,267,820	211,219	16.7	12.8	20.5
3303	Purbalingga	158,393	696,996	130,826	18.8	14.3	23.2
3304	Banjarnegara	174,652	752,593	120,340	16.0	12.4	19.6
3305	Kebumen	229,875	1,020,827	178,441	17.5	13.8	21.1
3306	Purworejo	146,627	597,269	101,536	17.0	13.1	20.9
3307	Wonosobo	156,283	660,809	113,197	17.1	13.4	20.8
3308	Magelang	230,558	965,470	188,363	19.5	15.6	23.4
3309	Boyolali	192,191	790,410	153,893	19.5	15.5	23.5
3310	Klaten	231,528	939,636	179,846	19.1	14.8	23.5
3311	Sukoharjo	153,238	654,054	129,045	19.7	14.6	24.9
3312	Wonogiri	200,113	841,182	177,237	21.1	16.9	25.2
3313	Karanganyar	158,432	673,855	146,092	21.7	16.8	26.6
3314	Sragen	184,182	749,537	145,935	19.5	15.0	24.0
3315	Grobogan	293,642	1,143,255	266,150	23.3	18.1	28.4
3316	Blora	186,340	727,344	136,741	18.8	14.6	23.0
3317	Rembang	120,366	495,707	82,238	16.6	12.1	21.1
3318	Pati	254,050	992,344	191,721	19.3	14.9	23.7
3319	Kudus	141,698	608,642	119,598	19.7	14.2	25.1
3320	Jepara	209,013	858,704	161,522	18.8	13.9	23.7
3321	Demak	205,822	867,399	174,174	20.1	15.4	24.7
3322	Semarang	173,602	723,046	143,597	19.9	15.2	24.5
3323	Temanggung	140,586	592,881	104,762	17.7	13.8	21.5
3324	Kendal	169,341	705,804	121,751	17.3	13.3	21.2
3325	Batang	131,629	581,042	102,205	17.6	13.1	22.1
3326	Pekalongan	149,638	699,133	102,143	14.6	10.8	18.4
3327	Pemalang	240,070	1,121,413	215,199	19.2	14.9	23.5
3328	Tegal	263,098	1,212,340	181,609	15.0	11.2	18.7
3329	Brebes	351,264	1,517,934	321,195	21.2	16.4	25.9
3371	Magelang	22,886	95,531	13,814	14.5	7.0	21.9
3372	Surakarta	90,051	392,730	64,251	16.4	10.2	22.5
3373	Salatiga	29,093	123,628	21,004	17.0	8.6	25.4
3374	Semarang	265,112	1,135,095	223,727	19.7	13.6	25.9
3375	Pekalongan	47,513	219,743	35,620	16.2	9.7	22.7
3376	Tegal	44,785	202,296	31,801	15.7	10.1	21.3
34	**D I Yogyakarta**	**921,708**	**3,102,736**	**620,677**	**20.0**	**9.5**	**30.5**
3401	Kulon Progo	100,755	369,241	66,843	18.1	5.7	30.5
3402	Bantul	217,207	778,686	130,837	16.8	5.1	28.5
3403	Gunung Kidul	178,631	669,837	107,501	16.0	3.1	29.0
3404	Sleman	292,636	894,964	192,639	21.5	10.5	32.5
3471	Yogyakarta	132,479	390,008	122,857	31.5	18.1	44.9
35	**Jawa Timur**	**9,499,753**	**34,633,101**	**6,683,885**	**19.3**	**15.4**	**23.2**
3501	Pacitan	142,031	525,011	98,590	18.8	12.9	24.6
3502	Ponorogo	228,997	836,498	154,439	18.5	13.6	23.4
3503	Trenggalek	176,052	648,141	126,309	19.5	13.5	25.5
3504	Tulungagung	256,604	927,970	174,216	18.8	14.6	23.0
3505	Blitar	288,897	1,061,810	195,771	18.4	13.7	23.1
3506	Kediri	371,780	1,402,693	271,918	19.4	15.2	23.6
3507	Malang	631,955	2,405,871	443,985	18.5	14.4	22.5
3508	Lumajang	268,732	961,706	178,223	18.5	13.0	24.1

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3509	Jember	645,177	2,182,303	388,068	17.8	13.3	22.3
3510	Banyuwangi	436,165	1,485,680	278,940	18.8	14.5	23.1
3511	Bondowoso	229,297	687,067	114,206	16.6	11.5	21.7
3512	Situbondo	199,819	595,150	96,785	16.3	11.3	21.2
3513	Probolinggo	287,194	999,349	179,396	18.0	12.9	23.0
3514	Pasuruan	366,534	1,355,323	232,814	17.2	13.2	21.2
3515	Sidoarjo	420,235	1,559,290	278,491	17.9	14.6	21.2
3516	Mojokerto	242,362	905,890	165,091	18.2	14.3	22.1
3517	Jombang	295,899	1,121,184	214,135	19.1	15.3	22.9
3518	Nganjuk	260,677	971,442	193,977	20.0	15.4	24.5
3519	Madiun	183,518	638,452	118,877	18.6	14.0	23.3
3520	Magetan	166,844	613,724	122,995	20.0	14.9	25.1
3521	Ngawi	237,529	810,604	137,772	17.0	12.2	21.8
3522	Bojonegoro	306,833	1,163,864	213,078	18.3	13.2	23.4
3523	Tuban	267,945	1,049,575	199,095	19.0	13.5	24.5
3524	Lamongan	285,602	1,179,567	245,804	20.8	15.4	26.3
3525	Gresik	250,037	1,003,328	200,217	20.0	15.9	24.0
3526	Bangkalan	201,525	796,829	164,473	20.6	13.9	27.4
3527	Sampang	187,819	743,047	139,969	18.8	12.1	25.6
3528	Pamekasan	175,352	685,254	126,400	18.4	12.8	24.1
3529	Sumenep	310,516	982,565	145,236	14.8	10.0	19.6
3571	Kediri	62,879	243,522	53,653	22.0	18.2	25.9
3572	Blitar	30,842	118,783	29,923	25.2	18.1	32.3
3573	Malang	211,751	753,086	212,680	28.2	22.6	33.8
3574	Probolinggo	49,077	188,888	44,349	23.5	17.5	29.5
3575	Pasuruan	40,838	167,143	40,530	24.2	18.8	29.7
3576	Mojokerto	27,542	108,714	26,382	24.3	17.3	31.2
3577	Madiun	44,906	163,180	40,682	24.9	19.4	30.5
3578	Surabaya	709,991	2,590,598	651,966	25.2	21.1	29.2
36	**Banten**	**1,541,130**	**6,749,880**	**690,441**	**10.2**	**6.6**	**13.9**
3601	Pandeglang	148,166	663,150	44,233	6.7	3.2	10.1
3602	Lebak	194,842	851,071	63,614	7.5	3.7	11.3
3603	Tangerang	566,748	2,452,243	244,567	10.0	5.9	14.0
3604	Serang	300,770	1,384,386	178,316	12.9	7.7	18.1
3671	Tangerang	271,803	1,137,877	128,564	11.3	7.2	15.4
3672	Cilegon	58,801	261,153	31,148	11.9	6.1	17.7
51	**Bali**	**724,948**	**2,971,138**	**143,985**	**4.8**	**3.7**	**6.0**
5101	Jembrana	59,657	222,850	16,074	7.2	5.5	8.9
5102	Tabanan	91,073	365,556	18,888	5.2	3.6	6.7
5103	Badung	74,869	324,343	13,103	4.0	2.6	5.5
5104	Gianyar	79,739	373,126	16,714	4.5	2.9	6.0
5105	Klungkung	36,461	148,119	8,408	5.7	3.7	7.7
5106	Bangli	47,845	191,003	6,132	3.2	1.1	5.3
5107	Karang Asem	88,212	354,924	10,608	3.0	1.5	4.5
5108	Buleleng	138,013	533,183	22,709	4.3	2.9	5.6
5171	Denpasar	109,079	458,034	31,345	6.8	5.6	8.1
52	**Nusa Tenggara Barat**	**987,475**	**3,822,840**	**295,008**	**7.7**	**5.8**	**9.6**
5201	Lombok Barat	172,075	664,076	72,490	10.9	6.1	15.7
5202	Lombok Tengah	203,201	744,509	35,001	4.7	3.1	6.3
5203	Lombok Timur	261,695	971,934	64,911	6.7	4.9	8.5
5204	Sumbawa	110,274	443,820	26,545	6.0	3.7	8.2
5205	Dompu	41,920	180,615	10,705	5.9	3.5	8.4
5206	Bima	118,064	504,932	36,073	7.1	4.6	9.7
5271	Mataram	80,246	312,954	49,290	15.8	11.3	20.2
53	**Nusa Tenggara Timur**	**792,627**	**3,790,354**	**564,536**	**14.9**	**7.0**	**22.8**
5301	Sumba Barat	61,121	352,653	59,666	16.9	7.1	26.8
5302	Sumba Timur	36,773	183,238	19,842	10.8	4.4	17.2
5303	Kupang	89,721	398,948	54,209	13.6	6.2	21.0
5304	Timor Tengah Selatan	87,721	386,753	51,521	13.3	5.1	21.5
5305	Timor Tengah Utara	43,969	193,198	28,741	14.9	6.2	23.5
5306	Belu	59,653	275,666	45,703	16.6	8.1	25.1
5307	Alor	35,459	163,670	29,999	18.3	8.9	27.7

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5308	Lembata	21,149	89,385	14,853	16.6	7.2	26.0
5309	Flores Timur	41,040	195,722	32,550	16.6	7.0	26.2
5310	Sikka	53,209	262,407	32,376	12.3	4.9	19.8
5311	Ende	48,150	230,840	34,016	14.7	5.9	23.6
5312	Ngada	42,980	222,021	35,419	16.0	6.7	25.2
5313	Manggarai	119,053	599,641	85,014	14.2	6.0	22.3
5371	Kupang	52,629	236,212	40,627	17.2	3.0	31.4
61	**Kalimantan Barat**	**846,722**	**3,715,931**	**614,249**	**16.5**	**9.2**	**23.9**
6101	Sambas	98,848	453,827	99,083	21.8	13.2	30.5
6102	Bengkayang	71,140	327,335	60,095	18.4	9.2	27.5
6103	Landak	55,658	280,297	55,110	19.7	9.3	30.0
6104	Pontianak	141,734	624,902	108,674	17.4	10.6	24.2
6105	Sanggau	117,788	504,123	81,041	16.1	6.9	25.2
6106	Ketapang	103,869	423,587	57,160	13.5	5.2	21.8
6107	Sintang	109,789	458,008	88,776	19.4	9.1	29.7
6108	Kapuas Hulu	44,040	181,921	30,821	16.9	7.0	26.9
6171	Pontianak	103,856	461,931	32,506	7.0	1.5	12.6
62	**Kalimantan Tengah**	**468,610**	**1,795,500**	**119,104**	**6.6**	**4.1**	**9.1**
6201	Kotawaringin Barat	65,392	245,355	18,480	7.5	3.6	11.4
6202	Kotawaringin Timur	138,025	519,750	33,741	6.5	3.6	9.3
6203	Kapuas	130,251	510,479	29,709	5.8	3.2	8.4
6204	Barito Selatan	46,187	179,092	10,383	5.8	2.9	8.7
6205	Barito Utara	48,107	182,697	10,417	5.7	3.0	8.4
6271	Palangka Raya	40,648	158,127	16,710	10.6	3.8	17.3
63	**Kalimantan Selatan**	**616,948**	**2,540,995**	**299,469**	**11.8**	**9.1**	**14.4**
6301	Tanah Laut	50,628	204,171	24,916	12.2	8.2	16.2
6302	Kota Baru	90,422	369,905	38,325	10.4	6.9	13.8
6303	Banjar	85,764	354,564	37,093	10.5	7.3	13.6
6304	Barito Kuala	50,835	207,280	18,396	8.9	5.3	12.5
6305	Tapin	29,719	118,322	12,730	10.8	5.7	15.8
6306	Hulu Sungai Selatan	40,632	163,937	19,889	12.1	6.3	18.0
6307	Hulu Sungai Tengah	45,216	183,113	22,930	12.5	8.3	16.7
6308	Hulu Sungai Utara	56,607	244,094	31,200	12.8	8.4	17.2
6309	Tabalong	34,202	145,177	17,709	12.2	7.7	16.7
6371	Banjarmasin	106,925	447,161	60,510	13.5	8.0	19.1
6372	Banjar Baru	25,998	103,271	15,770	15.3	5.8	24.7
64	**Kalimantan Timur**	**466,623**	**1,876,480**	**341,616**	**18.2**	**13.1**	**23.3**
6401	Pasir	52,493	211,540	45,558	21.5	13.6	29.5
6402	Kutai Barat	27,217	104,817	21,354	20.4	11.2	29.5
6403	Kutai	85,980	338,899	71,167	21.0	13.9	28.1
6404	Kutai Timur	29,303	108,401	28,636	26.4	11.7	41.1
6405	Berau	21,254	88,185	15,742	17.9	8.9	26.8
6406	Malinau	6,582	29,126	4,798	16.5	7.8	25.2
6407	Bulongan	15,768	65,221	10,617	16.3	8.4	24.2
6408	Nunukan	14,095	63,795	10,312	16.2	5.9	26.4
6471	Balikpapan	77,039	317,984	49,982	15.7	7.8	23.6
6472	Samarinda	96,401	384,886	61,313	15.9	9.4	22.5
6473	Tarakan	20,531	89,172	15,893	17.8	9.9	25.8
6474	Bontang	19,960	74,454	6,244	8.4	0.7	16.1
71	**Sulawesi Utara**	**540,702**	**1,970,864**	**224,952**	**11.4**	**2.7**	**20.1**
7101	Bolaang Mengondow	109,858	430,443	42,845	10.0	0.0	20.2
7102	Minahasa	221,189	767,469	95,346	12.4	2.5	22.3
7103	Sangihe Talaud	66,422	260,734	34,987	13.4	1.5	25.4
7171	Manado	106,211	372,195	46,267	12.4	4.0	20.8
7172	Bitung	37,022	140,023	5,508	3.9	0.0	8.2
72	**Sulawesi Tengah**	**464,898**	**2,003,308**	**209,757**	**10.5**	**3.1**	**17.8**
7201	Banggai Kepulauan	33,143	139,181	15,636	11.2	1.5	21.0
7202	Banggai	67,201	270,442	29,092	10.8	1.5	20.0

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7203	Morowali	36,357	153,653	16,736	10.9	0.7	21.0
7204	Poso	44,409	186,138	15,364	8.3	0.0	15.8
7205	Donggala	162,619	724,220	76,247	10.5	0.0	19.3
7206	Toli-Toli	40,418	169,776	16,892	9.9	0.0	20.8
7207	Buol	22,594	97,915	11,801	12.1	2.6	21.5
7271	Palu	58,157	261,983	27,989	10.7	3.6	17.8
73	**Sulawesi Selatan**	**1,759,473**	**7,789,429**	**1,184,521**	**15.2**	**5.6**	**24.8**
7301	Selayar	26,427	103,603	20,143	19.4	2.3	36.6
7302	Bulukumba	82,649	351,805	52,446	14.9	1.6	28.2
7303	Bantaeng	36,127	158,390	23,178	14.6	1.3	28.0
7304	Jeneponto	73,485	317,569	37,462	11.8	0.0	24.3
7305	Takalar	51,033	229,449	38,007	16.6	0.8	32.3
7306	Gowa	118,163	512,738	80,979	15.8	3.4	28.2
7307	Sinjai	42,067	204,155	24,162	11.8	0.8	22.9
7308	Maros	59,857	271,693	59,420	21.9	7.7	36.1
7309	Pangkajene Kepulauan	57,952	262,778	43,768	16.7	3.2	30.2
7310	Barru	35,457	150,980	31,927	21.1	5.7	36.6
7311	Bone	142,981	646,532	118,531	18.3	5.8	30.8
7312	Soppeng	53,461	219,463	43,882	20.0	5.3	34.7
7313	Wajo	82,614	356,483	75,060	21.1	5.9	36.2
7314	Sidenreng Rappang	55,000	238,081	40,615	17.1	3.8	30.3
7315	Pinrang	69,249	310,472	52,972	17.1	3.6	30.6
7316	Enrekang	34,824	165,895	27,542	16.6	1.1	32.1
7317	Luwu	84,216	397,932	53,739	13.5	4.1	22.9
7318	Tana Toraja	84,150	392,161	66,708	17.0	1.8	32.2
7319	Polewali Mamasa	99,362	446,418	72,600	16.3	4.1	28.5
7320	Majene	26,023	120,621	13,164	10.9	0.0	22.0
7321	Mamuju	67,604	296,617	27,254	9.2	0.0	19.4
7322	Luwu Utara	96,169	431,426	55,428	12.8	1.4	24.3
7371	Ujung Pandang	257,077	1,096,148	109,461	10.0	4.6	15.4
7372	Pare-Pare	23,526	108,020	16,073	14.9	5.0	24.8
74	**Sulawesi Tenggara**	**400,256**	**1,768,825**	**226,527**	**12.8**	**4.4**	**21.2**
7401	Buton	117,001	530,484	87,747	16.5	4.3	28.8
7402	Muna	61,489	273,785	28,299	10.3	1.8	18.9
7403	Kendari	102,174	443,707	39,310	8.9	0.6	17.1
7404	Kolaka	73,080	321,166	43,851	13.7	2.7	24.6
7471	Kendari	46,512	199,683	27,320	13.7	6.1	21.3
75	**Gorontalo**	**214,151**	**828,415**	**98,054**	**11.8**	**3.7**	**20.0**
7501	Boalemo	48,434	184,456	16,744	9.1	0.1	18.0
7502	Gorontalo	131,112	509,382	63,112	12.4	2.9	21.9
7571	Gorontalo	34,605	134,577	18,198	13.5	7.1	19.9
81	**M a l u k u**	**219,832**	**27,042,832**	**161,206**	**15.3**	**13.3**	**17.2**
8101	Maluku Tenggara Barat	25,418	1,416,363	30,216	22.7	19.4	25.9
8102	Maluku Tenggara	34,763	47,947	27,158	16.6	14.4	18.8
8103	Maluku Tengah	99,883	79,738	76,569	15.9	13.5	18.2
8104	Buru	20,545	64,324	19,568	19.3	16.3	22.4
8171	Kota Ambon	39,223	49,548	7,695	4.4	2.5	6.3
82	**Maluku Utara**	**135,308**	**27,042,832**	**113,326**	**16.9**	**15.1**	**18.8**
8201	Maluku Utara	75,754	1,416,363	81,702	21.8	19.6	24.1
8202	Halmahera Tengah	28,329	43,902	23,341	16.3	13.6	18.9
8271	Ternate	31,225	64,324	8,282	5.5	4.1	6.8
94	**Papua**			**334,571**	**19.1**	**13.6**	**24.7**
9401	Merauke			35,322	17.9	11.8	23.9
9402	Jayawijaya			63,859	20.0	11.9	28.1
9403	Jayapura			29,073	21.2	12.9	29.5
9404	Nabire			23,823	22.3	13.5	31.0
9405	Paniai			18,761	22.6	14.6	30.5
9406	Puncak Jaya			14,882	20.6	12.8	28.3

Code	Province District	Number of Household	Number of Population	Less than 1,700 KCal		Interval (%), ±=10%	
				Number of Population	Percentage of Population	Lower	Upper
9407	Fak-Fak			15,303	21.2	12.6	29.8
9408	Mimika			9,295	23.7	17.6	29.7
9409	Sorong			21,409	22.9	14.1	31.7
9410	Manokwari			23,353	14.7	6.2	23.2
9411	Yapen Waropen			8,024	13.0	4.2	21.9
9412	Biak Numfor			14,772	14.2	8.4	20.1
9471	Jayapura			35,844	23.0	17.1	29.0
9472	Sorong			20,851	21.6	13.2	29.9

Data Source: 2002 Susenas Consumption Module, 2002 Susenas Core, 2000 Population Cencus, 2003 Village Potentials




KEMENTERIAN KOORDINATOR BIDANG KESEJAHTERAAN RAKYAT
REPUBLIK INDONESIA

BPS

Australian Government
AusAID

WFP
United Nations
World Food Programme