COOPERATION
REPUBLIC OF INDONESIA
FEDERAL REPUBLIC
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Mitigation of Geohazards in Indonesia

Status report on the project
“Civil-society and inter-municipal cooperation for better urban services / Mitigation of Geohazards”

A contribution to the
World Conference on
Disaster Reduction
Kobe, Hyogo, Japan
18 - 22 January 2005

Bandung, Indonesia, December 2004

Foreword

Floods, storms, earthquakes, volcanic eruptions and many other natural disasters are threatening communities all over our planet. Every year they claim thousands of lives, make hundreds of thousands of peoples homeless and cause billions of dollars in economic losses. People in the developing countries are especially exposed to these risks and one of the most vulnerable regions on earth is Asia.

Indonesia is located at the conjunction of three tectonic plates (Eurasian, Pacific, and Australian), making this country one of the most highly exposed to volcanic eruptions and earthquakes. Indonesia has more volcanoes than any other nation on earth. Best known is the Krakatau volcano that exploded in 1883 and whose impact was recognized all over the world. But not only earthquakes and volcanic eruptions are posing a considerable threat to the country and its people, as they are often triggering other natural disasters like landslides, lahars, floods and tsunamis.

Population increases and the competing demands for natural resources forces more and more people to settle on and make use of areas, which originally were not suitable for permanent occupation. They settle in areas like coastal marshlands, the higher flanks of volcanoes, regions with a high earthquake risk or close to ravines or steep slopes prone to landslides and rock falls. This holds true especially for those people who are poor and normally don't have choices for an alternative lifestyle. Furthermore, every human activity creates an impact on nature, thus often exacerbating the natural threats on the fragile ecological equilibrium.

However, a community can only survive if it is able to cope with such challenges and if it becomes resilient to the risks from natural disasters. Our technical, economical and social potential shows that we are far from helpless to face these threats. Early warning systems, measures that not only rehabilitate but increase resistance, disaster oriented regional planning and activities to increase the self help potential of the affected population are at hand and must be implemented according to the specific risk situations. Local disaster risk management will increase the capabilities of communities in which every individual is given a chance to perform in a sustainable way within the framework of his society.

The link between natural disaster occurrence and regional development is apparent. Disaster risk management opens chances to reduce the economic burden on society, thus setting free financial resources that are better invested for social and economic development rather than for the rehabilitation of losses.

The Indonesian government has declared its determination to fight the risks from natural disasters by introducing pro-active measures enhancing the resilience of society by increasing the national and regional early warning systems and by involving the potentially disaster affected population in all decision making processes.

In order to strengthen the capacities of national and local governments and the risk affected population the Indonesian and German Governments are working together in the GEORISK project to provide safer living conditions and sustainable development.

The attached brochure provides an overview of the concept and achievements reached by the project.

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Executive Summary

Earthquakes, floods, volcanic eruptions, landslides and tsunamis are natural hazards that occur in Indonesia almost every day, causing a large number of casualties every year. They are a serious and constant threat to the people, bringing about heavy economic losses every year, and affecting social and economic activities all over the country. In 2003 alone about 500 natural disasters occurred all over the country, 800 people were killed, 4 500 injured, and approximately 500 000 displaced.

Most of these disasters have one thing in common: they usually occur suddenly and unexpectedly. But do they really come unexpectedly? And can the society take proactive measures to avoid or at least reduce the risk?

In order to mitigate the risk from natural disasters many activities have been carried out in the country so far. Many State Institutions were involved in order to assess and evaluate many of the risks. However, the risks are still increasing, damages are greater and an ever increasing number of especially poor people are exposed to natural hazards.

Following the recognition that disaster reduction is a social and economic imperative, the Indonesian Government approached Germany for technical cooperation. Since 2003 Indonesia has been seconded by the German-Indonesian Technical Cooperation project on "Mitigation of Geohazards (GEORISK)". The project is jointly implemented in cooperation with the Directorate General of Geology and Mineral Resources(DGGMR) together with its Directorates for Geological and Mining Area Environment (DGMAE) and the Directorate for Volcanology and Geological Hazard Mitigation (DVGHM) in Bandung, West Java. The project is an integral part of the German-Indonesian Technical Cooperation project "Civil Society and Inter-Municipal Cooperation for better Urban Services- Urban Quality", run by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the Indonesian Ministry of Home Affairs in which both Governments jointly promote the cooperation between civil society groups and local Governments towards more effective urban management.

Both project components "Urban Quality" and "Mitigation of Geohazards" are working together in order to increase efficiency of the advisory services to selected municipalities and districts in Eastern Java, NTT, NTB, through:

- **advisory services** to local municipalities/ districts and civil society groups for a better and proactive disaster management,
- **strengthening** the advisory competence of the partner Directorates in analyzing and evaluating origin and impacts caused by natural disasters, and by assessing the societal coping capacity for known hazards,
- **guidelines** for the management of natural disasters, intended to become a nationwide legal regulatory framework for local decision makers.

Advisory services have been rendered to the island of Flores where the districts (Kabupaten) Sikka (project city of Maumere) and Ende (city of Ende) have been visited. In both Kabupatens the natural hazard potential (volcanic eruption, landslides, earthquakes and liquefaction, and tsunamis) were assessed after a disastrous debris flow hit the area north of the city of Ende and killed more than 30 people in April 2003. Recommendations have been proposed and disseminated to the local stakeholders which will enable local Governments and civil society groups to enhance resilience against the threat from a disaster.

An assessment of the natural hazard exposure in the Kabupaten Sikka (Flores) has been carried out and recommendations will be given that will enable the planners and political decision makers to adjust the town planning to take into account the local risk potential. Particularly the city of Maumere has a high potential to be inundated by a tsunami and to be affected by earthquake induced liquefaction. Thus, responsible city planning requires a change of the planning concepts: the coastal area where large parts of the town are located should be cleared from strategic buildings, like schools and hospitals. In addition the town needs a second and safe access road to the airport because the existing one is lying within the three meter high tide zone. If the road were destroyed by a tsunami, the city would be cut off from outside emergency help. Based on project findings the Bupati of Sikka has already allocated funds for an assessment of local waste management. For this he asked for the project's assistance to investigate the local waste disposal site in order to get information that can be used as an Environmental Impact Assessment.

In order to evaluate the risk that may threaten the people in the shore areas from earthquake triggered tsunamis a doctorate thesis has been supervised by the University of Göttingen, Germany, in cooperation the with the Georisk project. Based on the horrific experience the people had made from the tsunami that hit the northern coast of Flores in 1992, the thesis analyzed the possible impacts in the town of Maumere. People were asked of their personal risks perception and the town development plan was discussed with the local government in the light of a possible tsunami event. It turned out that the main access road to the airport will be entirely exposed to water levels exceeding 2 meters, while the airport itself will not be inundated. Many parts of the city will be subject to severe flooding in the case of a major earthquake triggering a tsunami. Large parts along the coast should be cleared from life-strategic buildings and a comprehensive awareness raising campaign should be launched as early as possible.

The volcanoes Egon, Iya and Kelimutu on Flores have been mapped and assessed concerning their hazard potential. The Hazard Map for Egon Volcano was just finalized when the volcano erupted and 5 000 people had to be evacuated. The Georisk project was immediately informed on the event. The map was handed over to the local government and was explained to the stakeholders and formed the technical basis for the relief operations. In the aftermath the Bupati approached Urban Quality / Georisk for training for him and his staff on geohazard identification and risk mitigation concepts. A training concept has been worked out and has been carried out.

Also the volcanic hazard risk potentials of the other two great Flores volcanoes, Mount Iya and Mount Kelimutu, have been assessed. It became obvious that Mount Iya , if erupting, will erupt towards the seaside and could produce about 70 million m³ of volcanic material. As the town of Ende is lying in the opposite direction, an immediate threat to the town from lava, lahars and pyroclastic surges is not very likely. But volcanic ashes can affect the town and even more probable, there is a considerable risk that the eruption might trigger a tsunami. This potential tsunami may flood the eastern shoreline of the city to a height of up to three meters, hitting strategic infrastructure buildings like the airport (already flooded once), the central fuel tanks, and one of the two power stations located there. The report on the geohazard assessment was disseminated to local Government and will serve as the basis for recommendations on how to improve the local living conditions to make the area safer against the threat from natural disasters.

Over a long time, the town of Semarang has been known for its considerable land subsidence problems, mostly affecting the central harbor area with its neighboring industrial sites and the railway station. Several geodetic surveys have been carried out by DGMAE resulting in quite precise information on the subsidence rates. Based on the subsidence rates up to four cm per year two subsidence scenarios were calculated: one for the year 2008 and one for 2013. Today 1 500 houses with 8 000 people are lying at or below sea level, in 2008 this figure will increase to 5 000 houses with 25 000 people and in 2013 to more than 10 000 houses with 40 0000 people. In the elevation zone up to one meter above sea level in 2013 up to 20 000 houses will be situated, housing approximately 65 0000 people.

A survey of the groundwater quality of the town of Semarang revealed partially alarmingly high contamination levels, especially in the industrial areas. The land subsidence problems are mostly caused by high amounts of groundwater extraction, much of which is illegal. Hydro-chemical data show that continuing uncontrolled pumping will increase the subsidence rates and on the other hand will completely contaminate the lower aquifers, from which most of the inhabitants are taking their water. To stop further land subsidence, water extraction has to be managed in the entire catchment and alternative water supplies, probably from the hilly areas southwest of Semarang, have to be taken into consideration. An assessment of the economic losses by a cost-benefit analysis was carried out comparing the benefits from an alternative water supply with the annual municipal investments for the rehabilitation of lifelines, streets, houses and infrastructure.

Additionally the population living in the southwestern parts of Semarang are exposed to landslide hazards. This area has been marked for settlement development in the town development plan. More than a dozen newly constructed houses were already partially to severely damaged by landslides.

The project's activities in the town of Yogyakarta are concentrating on raising the awareness of the disaster-affected population. The activities are associated with efforts of a Joint Secretariat for the harmonization and coordination of the local development of the neighboring cities of Sleman, Bantul and Yogyakarta (SEKBER). The Georisk activities are assisting Sekber's efforts to improve the living conditions in the area by natural disaster risk reduction. The area is dominated by the famous Mount Merapi volcano and all its secondary and tertiary hazards. There are already a large number of hazard related investigations being carried out, mostly by UGM. Before that background, the Georisk project concentrated on community based disaster management activities. Together with SEKBER, contacts have been established with all major stakeholders in the region, including local NGOs. With the representatives of the local governments and civil society groups a community based risk assessment was carried out based on an especially developed risk indicator set. These indicators have been adopted for implementation in Indonesia from a study carried out by the Inter-American Development Bank in collaboration with GTZ. The risk indicator set will provide the country with the opportunity to assess the risk from natural disasters in a standardized and comparable form on a national level. The risk indicator is now - for the first time worldwide - in a field application.

We already got promising responses from the stakeholders for the risk indicator assessment which had also been applied in the Kabupaten Kulong Progo west of Yogyakarta and in the town of Maumere (Flores). The risk indicator assessment will lead the way to a nationwide standardized evaluation of the population's risk exposure. Examined over time the indicators will deliver information about increasing or decreasing disaster risk and can thus be a monitoring tool for the effectiveness of local mitigation measures and people’s coping capacity.

For strengthening the advisory competence of the partner directorates the Georisk project implemented a concept for a database for collection of available information on all occurring and past hazards on a countrywide scale.

The database will also assist to establish reliable information for a better forecast of disaster events and their related effects.

As natural disasters are in most cases sudden events, early warning requires not only an intensive monitoring, but also a complete as possible record of disaster events. The project is thus working very closely with the National Secretariat for Natural Disaster Management (BAKORNAS PBP), the Department of Health and National Meteorological, and the Geophysical Agency (BMG) to incorporate and integrate their databases on disaster events and the linked effects and impacts. So far, about five thousand events have been incorporated - which is definitely not enough to draw any forecast scenario - but the Georisk project has now the most complete multi-hazard database in the country. The database currently covers the last ten years and shows already a good picture of the regional variations of all types of natural hazards in the country.

In addition to these national scale activities, a concept for a geographic information system (GIS) has been implemented. It supports the analysis of all types of natural hazards and their associated risks by not only incorporating geologic and land use information but also socio-demographic and economic data of the partnering cities and districts.

The project is elaborating on a method of economic risk assessment. The first steps have already been made and a first assessment for the town of Semarang will be given very soon. It is internationally well understood that the only way to compare different types of natural disasters is by their economic losses. Only by monetarizing the economic losses, decision makers will understand the value for disaster mitigation measures. For this to occur an assessment of the risk zonations is the indispensable first step. The identified areas have then to be attributed with data on housing, population density, income from industrial and/or agricultural production as well as with data on the value of the public and private infrastructure. So far only the direct economic losses will be tackled by the project, well aware, that there are also indirect losses from production decreases, less tax and income, etc., which have to be incorporated to make any assessment complete.

The project carried out a study of the economic losses caused by soil erosion on the upper flanks of the Merapi volcano and calculated that the yearly economic losses from soil erosion are in the magnitude of one tenth of the yearly crop production. That means that ten percent of the annual income from agricultural activity has to be spend for fertilizer to compensate for the soil losses.

Two GIS and database courses were given to DGMAE and DVGHM staff in order to further improve their capacity. In addition to this, one seminar for project planning was held, and one staff member was given training on community based disaster risk management at the Asian Disaster Preparedness Center, Bangkok.

In order to strengthen the country's ability for a comprehensive hazard management strategy, guidelines for the assessment of geohazards, for economic loss assessment, for disaster risk assessment as well as for community based preparedness measures will be determined. So far the project, together with BAKORNAS PBP, finalized a glossary of internationally used terms in disaster management to serve as a guideline for harmonizing the use of these terms in the country. A list of all major international institutions relevant for natural disaster management has also been prepared. BAKORNAS PBP will supplement this list with a list of the major stakeholders in Indonesia. Furthermore, the project brought together 20 national laws, government regulations and Presidential decrees on the natural resources, land use planning and natural resources management in a bilingual form (Bahasa Indonesia - English). The collection will be printed as a booklet and distributed on CD ROM.

The Georisk project is in close contact with national decision making levels in order to give technical input to the national discussion on setting up a National Disaster Management Plan.

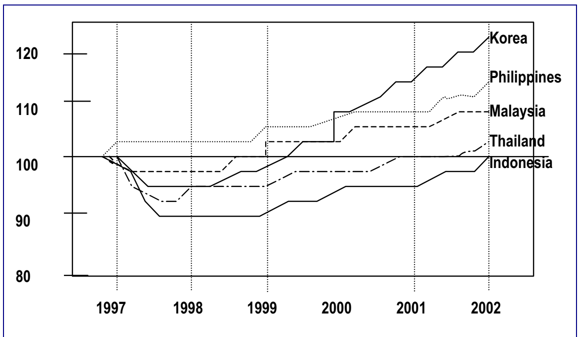
Country Profile

With a population of more than 220 million people, Indonesia is the forth-biggest country and thus the biggest Muslim society on earth. Its territory comprises almost two million km², distributed over more than 15 000 islands. Its coastline is more than 55 000 km long. The country is located at a geo-politically very sensitive spot, at the border of the Indian and Pacific Ocean; more than 600 vessels pass the Malacca Strait every day, making it the most frequented passage on earth.

More than 60 % of its territory is covered by tropical rain forests, although with an alarmingly high diminishing rate. Most of the forests are found in Kalimantan and Sumatra. Towards the East, the country's climate is becoming drier, so that many islands in the East are often facing serious droughts. Indonesia has mineral resources that rank the country among the world leaders in mineral production. Especially oil, gas, coal, gold, silver, nickel, zinc, and cupper are mined in great quantities. Together with its timber production and its industrial production of textiles, clothes and shoe ware, these resources make up the biggest share of the export earnings, totaling more than sixty billion Dollars every year. Additionally foreign labor remittances in an amount of yearly two billion Dollars are contributing to the country's income.

Although the economic damage of the Asian crisis in the mid-nineties has mostly been overcome, at least half of the population are still living on less than two Dollars a day; more than fifty million are living below the poverty line, with the rate increasing. In the last five years, Indonesia has regained economic strength with an average yearly gross national product of about four percent. Nevertheless, the income is distributed unequally in the country. While cities like Jakarta, Surabaya and Bandung and Denpasar in Bali are experiencing remarkable prosperity increases, the rural and suburban areas around the big conurbations often barely have the means to feed their child-rich families. The income of women in the country is three times below that of the male population. Although the official figure on the population growth rate is given below 2 %, it is according to the national planning ministry necessary, to considerably reduce the population growth. Otherwise, the country will have a total population of more than 300 million in the near future, 45 % more than in the year 2000.

Politically the country made its way from thirty years of autocratic rule to a democratic system. For the first time in the country's history, in 1999 free and equal elections were carried out, which brought to power a coalition of a left and a Muslim oriented party. After two dramatic years in power, the daughter of the founder of Indonesia became president. In 2004 the first parliament ever, was elected directly and in the same year, direct presidential elections were held, also for the first time. That year also saw the removal of the military from parliament and a general strengthening of the civil supremacy over the military. Increasing political stability and maintained efforts towards a solid macro-economic development gave the country further positive momentum, which upgraded Indonesia's credit ratings in the world.



Development of GDP of Asian countries following the Asian economic crisis (Index = 1997), data source: World bank

Until 1997, Indonesia experienced a yearly increase of the gross domestic product of more than seven percent. The country was able to increase living standards, i.e. the literacy rate increased from 40 to 85 % and the per capita income quadrupled, purchase power gained momentum and infant mortality was largely reduced from 160 to 45 per thousand live births. Nevertheless, growth rates remained modest, with about 3 to 4 % during President Megawati's rule, which is 1.5 % below that of the year 2000.

Following the Asian crisis many of the development achievements of the nineties were lost. The inflation rate reached 80 % and the health, social insurance and education sectors were forced to reduce their expenditures. Tremendous efforts were undertaken by the Megawati administration in order to prevent further deepening of the upcoming social disparities. The inflation rate was lowered to 8 % and by subsidizing the markets it was possible to lower the price of rice. The poor are spending a relatively large share of their income on food. That makes them especially vulnerable to changes in food prices. According to a World Bank study, the normal Indonesian household spend up to 60 % of its income for rice. A 10 % decrease in price therefore lowers the overall national poverty index by one percent. The National Poverty Reduction Strategy also increased the minimum wage and thus the income of the poor. But an increase of minimum wage brought also unintended negative effects. Especially in firms that pay salaries close to the minimum wages, many jobs were lost because the production costs became high, especially in the industrialized zones in Java. It is suggested that an increase of the minimum wage by ten percent will on one hand definitively increase the purchase power but also will reduce employment by about half a percent. But still many Indonesians are exposed to the threat of unemployment, illness, price increases, that can immediately push them under the poverty line. Nevertheless, the fraction of workers that only earn less than one Dollar a day has been reduced by four times between 1988 and 2002.

With regard to the health and education sector, Indonesia is performing well below the levels of the neighbouring ASEAN countries. For example, maternal mortality is about nine times higher and the under five child mortality five times higher than in Malaysia. Access to clean water and sanitation is much lower than in Thailand and the Philippines and is taken to be the cause for the death of every second to third child deaths under the age of five. Malnutrition remains very high as indicated by the fact that thirty percent of children under five have stunted growth and about fifty percent in the second year of live are anaemic. On the other hand, obesity problems among children of well-off families is increasing dramatically. Concerning education, the key characteristics are a very poor primary school attendance, especially in the rural areas, low rates for completion of school and a poor education quality and effectiveness. Compared to other Asian countries the levels of mathematics and natural sciences skills and the command of the English language of senior school students is much lower. There is considerable variation in school attendance and performance between high and low incomes groups as well as between rural and urban areas.

Poverty distribution in the country remains highly unequal. The industrialized centres of Java are facing substantial economic growth rates while in the rural areas poverty very often is increasing. Countrywide the poverty level was officially defined to be reduced from 27 % in the year 1999 to 16 % in 2001. But then it increased again as an assumed result of the bombing in Bali with more than one million Indonesians being pushed below the poverty line. In Bali where, before the bombing, the average poverty and unemployment rates were one of the lowest in the country, after the bombing they increased to the country's average. The unemployment rate is officially indicated to be about 8 % of the labour force. But although more than two million people enter the labour market every year, it is to be recognized that the official number of job seekers is decreasing; an indication that people have lost confidence in the public sector management.

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Situation of the Natural Disaster Management

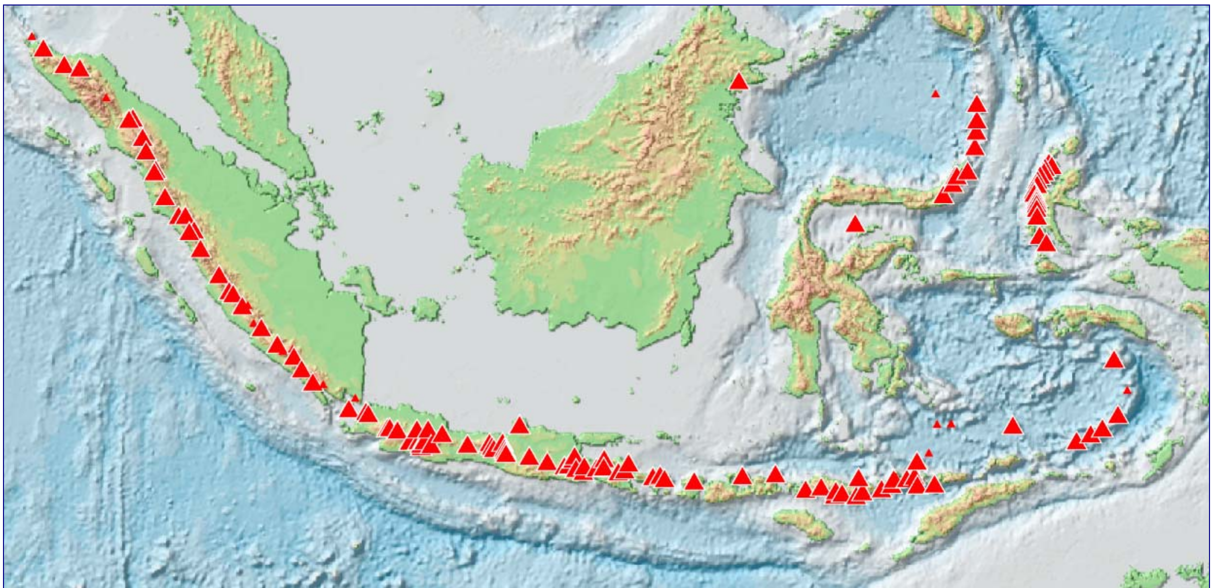
General setting

Because Indonesia is located at the conjunction of three tectonic pates (Eurasian, Pacific, and Australian) the country is exposed to a considerable threat from natural disasters every day. These plate movements make Indonesia one of the countries most exposed to volcanic eruptions and earthquakes. Along the plate junctions more than 190 volcanoes are lined up like pearls on a necklace, more than 70 of them are categorized as very active. Indonesia on its territory has more volcanoes than any other nation on earth. Best known is the Krakatau volcano that exploded in August 1883 and whose impact was recognized all over the world. Its ash clouds traveled the globe several times and the event triggered tsunamis pushed even battle ships hundreds of meters inland. The biggest volcanic eruption in human history was that of the Tambora in 1815. The ash was dispersed around the entire earth and in 1816 caused a drop of the mean global average temperature of one degree. The year 1816 since then has been known as the year without summer in the Northern Hemisphere.

About 75 % of all natural disasters worldwide occur in Asia. From Indonesia it is reported that more than 15 000 people have been killed since 1990 from such events. Every year at least 200 to 300 disasters take place with about 300 to 400 victims, leaving tens of thousands of people homeless and causing millions of Dollars of economic losses. More over, year by year these disasters destroy a large amount of arable land, making it useless for agriculture.

However, not only earthquakes and volcanic eruptions are a considerable threat to the country and its people. They also often trigger other natural disasters like landslides, lahars, floods and tsunamis. The Indonesian National Coordination Board for Natural Disaster Management (BAKORNAS PBP) estimates conservatively that in the last years more than 800 major landslides have contributed massively to soil erosion, siltation of rivers and reservoirs, inundation of lowlands and floodplains. Every year during the rainy season the deeper lying parts of the capital Jakarta are flooded. In 2001 such a flood claimed 150 lives, a quarter of a million people were left homeless and for days the public and administrative life of the capital with its 15 Million inhabitants came nearly to a stand still.

But not only natural disasters are threatening Indonesian society. All human activities are having an impact on the natural environment



Active (large symbols) an potentially active (small symbols) volcanoes in Indonesia resulting in man-made hazards and disasters. Such disasters may occur from industrial plants, from agriculture production but also from settlements (groundwater over-extraction, leakages in waste disposal sites, etc.). Man-made disasters therefore have to be an integral part of the national law of the natural disaster management strategy.

With promulgation of the law on decentralization (No.22 on Regional Autonomy) in the year 1999 disaster management became the task of the districts and local governments. The central government's authority was thus limited to set the legal framework for the national disaster management and to guide and monitor disaster reducing and prevention measures that were or have to be carried out by the provincial, district or urban authorities. According to law, natural disasters that cross the boarder of districts are falling under the jurisdiction of the provincial government and if a disaster strikes an even larger part of the country, central government will be responsible. In cases, when a local government declares its inability to cope with a disaster (regarding relief and rehabilitation measures) the central government may provide additional financial and technical assistance.

So far, a conducive and coherent legal framework for natural disaster management in the country is missing. This fact leaves the local authorities in an undefined legal situation. So it is mostly up to the local political leaders to define what importance the issue is given. In most annual provincial or district development budgets and in the annual planning documents natural disaster management is not even covered.

At present the situation of the natural disaster management can be described by an increase in public sensitivity asking for a more sustainable disaster management. Last year the Ministry of Forestry was given a three million Dollar fine to compensate victims of a debris flow/landslide that killed 32 people near the town of Garut (West Java). The Ministry of Forestry was made responsible for not having stopped illegal logging that was, according to the technical expert, the cause of the mass movement. Such a verdict has been issued for the first time in the country. It demonstrates an increase in the population's role in public matters; one of the great targets of the law on decentralization aiming at increasing public participation at all levels of political decision making. It is assumed that this verdict will lead to a more public oriented vision of national natural disaster management as well as on natural resources protection.

The shift in paradigm of the value of natural disaster management in the country should be reflected in the law on natural disaster management, which is to be formulated within the legal framework of the law on decentralization. It will open the chance to review the public sector management in this field as well as for higher public participation in the decision making process. It will also open the chance to increase the efficiency of the local decision making structures and the chance to review local coping capacities for different disasters at different regions that can be handed over to others in order to increase their specific resilience. For this it will be necessary to collect successfully implemented "best practice" examples and to check whether they can serve as lessons learned and how they can be adopted in other regions of the country.

The high degree of solidarity already shown by the Indonesian society, affected by natural disasters, should be strengthened to intensify the people's participation in the disaster mitigation policy development. Such a community based risk management strategy should comprise all local stakeholders. A very early involvement of people at risk in the local disaster mitigation planning and prevention will also lead to a higher population involvement in relief and rehabilitation operations. It will bring people's specific vulnerability to public notice and will strengthen their commitment and self help potential.

The envisaged national legal and technical framework must clearly define the duties and responsibilities of the decision-making authorities at all administrative levels. Such a framework will make people's vulnerability countrywide comparable and will give the decision-makers the opportunity to invest money and efforts for relief and prevention measures more effectively.

The laws on Decentralization and Regional Autonomy already give a mandate for a prevention-oriented disaster management to the local governments. However, according to their own judgment, they are neither technically, administratively, nor financially capable to comprehensively comply with the tasks and responsibilities they were mandated. There is a general lack of specific disaster mitigation knowledge, skills and information. Furthermore, they don't have suitable structures and instruments at their disposal and they normally have very limited financial resources. To fully comply with the tasks they are responsible for, a conducive legal and operational framework must be worked out, implemented, and managerial skills must be improved.

So far, no attempt has been made to establish a general vision on disaster prevention in national disaster management. Still the public and private sectors are merely reacting to a disaster. The vision of disaster prevention must also be based and anchored in the law.

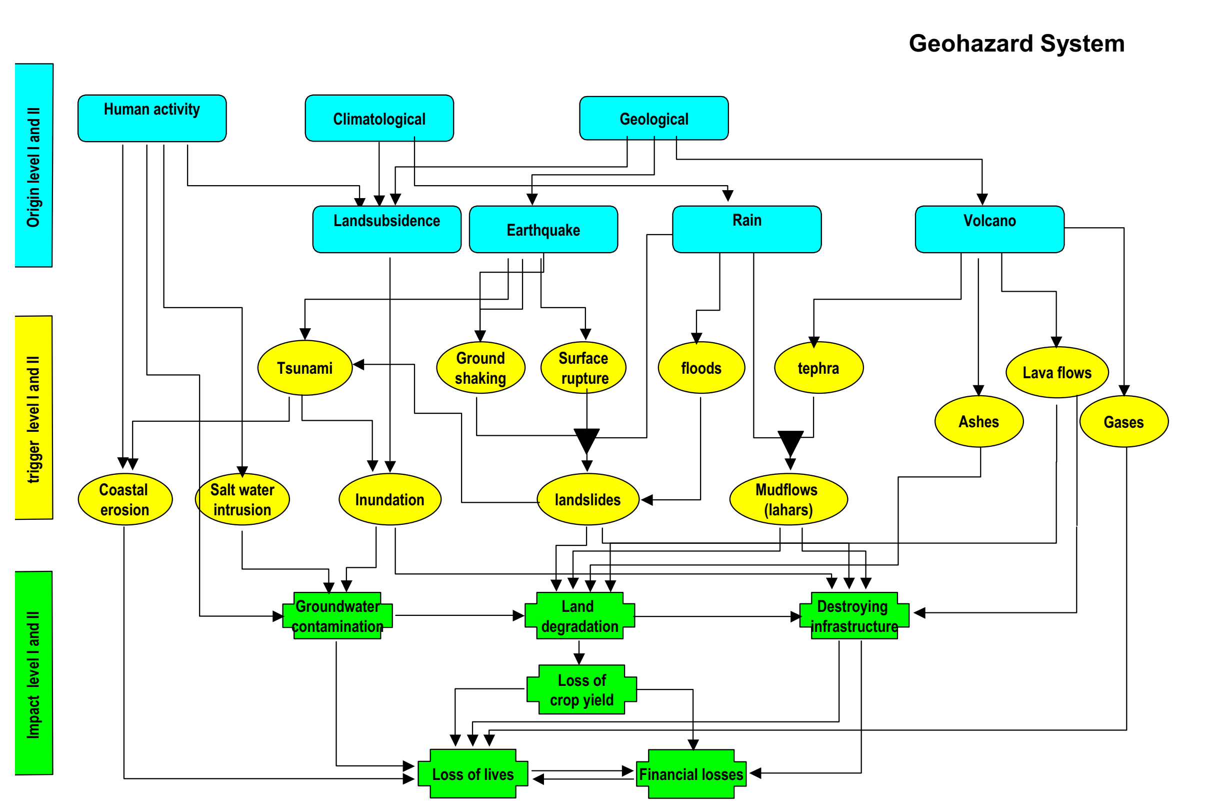
On all official levels and within the civil society such a vision can only be established, if there is competent knowledge and information available on the ecological, economical and social risks the population is exposed to from natural disasters. Such hazard, vulnerability and risk assessment and evaluation can only be carried out seriously by relevant scientific and technical institutions qualified and equipped to the necessary extent.

Already quite a number of approaches on disaster risk assessment have been carried out in the country. However, so far the country is lacking an all-hazards comprising concept for natural disaster assessment. Up to now the different institutions, government authorities and universities only deal with their particular hazard and it is necessary to develop and implement a holistic view on a multi hazard assessment that is shared by all involved parties.

Situation of the disaster affected population

About 200 to 300 natural disasters occur in the country every year, of which floods - like all over the world – have the biggest share. However, it isn't their sheer number of events that matters. Floods cover vast areas and therefore affect a large number of people at the same time. In addition, floods normally affect an area for many days, sometimes even a week or two, before the water retreats. But even when the water withdraws, damages to lifelines, infrastructure and buildings as well as water and soil pollution are persisting for months. The whole social and economic life of the flooded area is disturbed, interfering with the personal and societal development.

During the rainy season, many thousands of Indonesians living and working in the lowlands along the coast, like in the cities of Jakarta, Semarang and Surabaya are exposed to this kind of threat annually. There the floods particularly affect those parts of the cities mostly used for the



Conceptual view of the geohazard system harbors, industrial areas, and for low-income housing. The people settling these areas, normally don't have the financial means to seek alternative living quarters. And thus with every new catastrophe, their degree of marginalization is increasing.

Outside the big conurbations as well as at the steeper outskirts of them, landslides and debris flows often occur, bringing the people living there into high risk. Even when the landslide itself covers only quite a "small" area, it has serious impacts on houses, building structures, communications lines and the agriculture. In Indonesia, especially the islands of Sumatra and Java are exposed to hundreds of landslides and debris flows every year. The overall coincidence of heavy rainfall during the rainy season with the occurrence of landslides experienced so far, might give useful indicators for local easily applicable and implementable early warning systems (like rainfall gauges indicating a threatening threshold value) for landslides and debris flows.

In contrast to the more or less regularly occurring and thus generally more predictable hydro-meteorologically induced hazards, like floods and landslides, earthquakes and volcanic eruptions occur more seldom, but often more powerfully. Thus, in human disaster perception, these phenomena play a much stronger role. They terrify because they occur almost without any warning, are sudden and strong and give the people little time to react.

Although the large number of volcanoes in the country poses a considerable threat to the people, mostly in Central and West Indonesia, their impact is only local to regional. However, the biggest threats to the population and its social and economic environment are not coming from the volcanic eruptions directly. Areas at risk from lava flows can be defined before a disaster strikes as the lava flows comparably slow. In contrary to this, volcanic ash falls are posing a much bigger threat, when mixed with rainwater. Then debris flows or lahars can rapidly develop. These fast moving mass movements can rush downhill with speeds of up to a hundred km per hour, cover entire valleys, destroy entire buildings and infrastructure. They can kill people and make thousands of them homeless in a very short amount of time.

Earthquakes occur in Indonesia almost every day. Although they claim tens of victims every year, they have limited regional effects. As the big urban centers like Jakarta and Surabaya have only some degree of exposure to earthquakes, the overall amount of people at risk in the country is comparatively small. Nevertheless, the experience in the town of Bengkulu, Sumatra, recently hit twice by earthquakes within a short period of time, show how vulnerable to earthquake damage many smaller cities in Indonesia are. Shortly after Bengkulu had been reconstructed, a second earthquake hit the area and produced similar damage. This clearly shows, that the coping capacity (lessons learned) from the previous quake was not sufficiently improved to prevent a second major damage.

Like volcanoes also earthquakes trigger other hazards, one of them is called tsunami, most of which are triggered by offshore earthquakes. Quite a number of such "harbor waves" hit the country's coastline in the last years. In the most recent history, the tsunami triggered by the earthquake offshore of the island of Flores on December 12 in 1992 was disastrous. It damaged large parts of the island's coast, 2 200 people lost their lives, more then 500 were seriously injured, and 90 000 left homeless. The maximum tsunami run-up height of 26 m was measured at Riangkroko where more than 150 people were killed. In addition to this, approximately 30 000 houses were destroyed along with almost 2 000 public buildings and other infrastructure.

In addition to tsunamis, earthquakes can trigger landslides, rock falls and debris flows. There is also a clear relationship between earthquake-triggered ground movements and volcanic eruptions, making seismological volcano monitoring a valuable tool for disaster early warning.

All these disasters are affecting the country's social and economic life considerably. Like all over the world, the impacts are not equally distributed. Those who have low incomes are often forced to settle areas not suitable for living, and thus are normally affected most. However, in Indonesia it isn't the overall death toll, which really rises. It is direct and indirect economic losses during and after a disaster are increasing unproportionally.

Although considerable progress can be seen in the field of hazard mitigation and awareness, the macroeconomic development also has increased the economic assets exposed to risks.

For rescue and relief operations, special budgets are allocated by the central government. Thus, in case of an emergency, the local governments have to make use of their normal development budgets for damage rehabilitation. These budgets normally do not cover all of the losses and the money is no longer available for the purposes for which it had originally been allocated. In case of a disaster, those who are affected by the event are thus affected twice by the disaster.

However, not only the direct losses (loss of building substance, broken communications, etc.) are a burden to the society. Also indirect losses, like reduced purchasing power from missing income, shortfalls in tax revenues etc. are worsening the macroeconomic situation of the country, sometimes for many months after the disaster has happened.

In Indonesia, very poor performance is noticed on covering direct losses. After a recent landslide event, owners of destroyed houses were compensated with about 30 - 50 US$ each, not enough even to cover the costs of living, let alone the costs for reconstruction of the damaged houses. As there is no private insurance strategy available for natural disasters all costs are left to the affected population. While in western countries, like the USA, more than 80 % of the losses from disasters are covered by private insurances, such an instrument is completely missing in Indonesia.

Furthermore, those who have to be relocated in case of an emergency, often have to live in temporary shelters for a long time, sometimes even far away from their traditional living areas. After being relocated, the traditional social networks break apart and ethnic conflicts with the societies, where the refugees are being placed, are a possible result.

The traditional Indonesian neighborhood initiative is a well-established social network in the villages, providing assistance to anyone who requires help. This network has a democratic structure in which fifty families are electing their representative. These representatives are also functioning as key persons in case of emergencies, organizing local self help initiatives. The high degree of locally exercised solidarity which can be seen in case of natural disasters, should be taken as a focal point to start a local discussion on the disaster mitigation process, to define and implement disaster prevention measures, and to disseminate reliable early warning.

In order to increase the local population disaster coping capacity, the project assists selected local governments to institutionalize a dialog involving all civil society groups, scientists and technical experts from relevant institutions as well as the local decision making levels. Action plans have been discussed that will be implemented in a participatory way in order to strengthen the self help potential of the population. A community based risk disaster assessment has been introduced based on a Disaster Risk Indicator Set which makes it possible to assess a population's vulnerability in a nationwide applicable and standardized form. The project also renders technical and managerial support to the selected local governments in order to strengthen their mitigation capacity and to institutionalize an early and full involvement of the affected population.

Nabire administration seeks Rp 1.5 trillion for quake victims

Nethy Dharma Somba
Jayapura

Hundreds of residents in Nabire regency, Papua province, are still living in tents in their villages two months after a disastrous earthquake devastated the remote town in February, killing at least 37 people.

Students in affected areas were also forced to study under makeshift tents as their schools had been destroyed or damaged by the quake, which measured 6.9 on the Richter scale.

Nabire Regent AP Youw said on Tuesday his administration needed some Rp 1.5 trillion (US$174 million) in aid to rebuild the devastated town after the Feb. 6, 2004 disaster.

"The fund will be used to renovate offices, houses, clean water installations, hospitals, schools, bridges, streets, an airport, seaport and other public facilities," he said.

Youw was speaking to journalists after a meeting with Papua Governor Jaap Salossa in the provincial capital of Jayapura to report the impact of the quake.

The regent said the Nabire administration had so far received only Rp 3.5 billion in aid and the money was being used to provide clean water, tents for schools and other emergency necessities to the victims.

The Rp 100 billion in aid, promised by former coordinating minister for people's welfare Jusuf Kalla during his visit to Nabire on Feb. 7, had not yet been received by the local administration, Youw said.

"Local people have several times asked when the money would be handed over to Nabire, while *Pak* Jusuf Kalla has quit his ministerial post.

"I have also asked *Pak* Governor Salossa and he told me he had not yet got the money from central government,"Youw said.

He said that between Feb. 26 and April 18, the Army had helped rebuild at least one elementary school, a church, a mosque, two military dormitories and two houses, providing the disaster victims with free medical treatment.

"Only the Army has so far given rehabilitation assistance worth Rp 1 billion through its Sekata Dalam Nestapa Foundation," the regent said.

He said the Nabire administration had allocated Rp 38 billion from its 2004 budget for the rehabilitation projects covering 430 houses, construction materials for 1,000 homes, eight schools and four community health centers (Puskesmas).

The Ministry of Resettlement and Regional Infrastructure has allotted about Rp 16 billion, Rp 10 billion of which would be used to rebuild five mosques and seven churches. The remaining Rp 6 billion is earmarked be spent renovating the clean water facility.

The Ministry of Manpower and Transmigration had also promised to channel aid to rebuild at least 534 houses.

Youw said the powerful earthquake killed at least 37 people, seriously injured 115, with 477 others moderately hurt.

The quake also destroyed or damaged 7,000 houses, 60 school buildings, 53 places of worship, an airport, seaport, hospital, sections of streets, and swept away nine bridges.

The Papua Meteorology and Geophysics Agency (BMG) said the epicenter was about seven kilometers east of Nabire and 80 kilometers deep.

On Oct. 10, 2002, a tectonic earthquake rocked the Ransiki area in Manokwari, Papua, claiming the lives of at least three people and damaging hundreds of houses.

In 1996 a powerful quake hit Biak and Manokwari, causing a major tsunami that ripped through hundreds of houses in coastal areas. At least 96 people were reported dead.

Indonesia, the world's largest archipelagic nation, is vulnerable to earthquakes and volcanic eruptions because of its location on the Pacific "ring of fire" – volcanic arcs and oceanic trenches partly encircling the Pacific Basin.

News report on the Nabire February 2004 earthquake in Papua (source: Jakarta Post)

Institutional framework for Natural Disaster Management

With the implementation of decentralization according to laws 22 (1999) and 25 (2001) and the presidential decrees 03 and 11 of 2001, the government of Indonesia has set-up a National Coordination Board for Natural Disaster Management, BAKORNAS PBP, as a non-structural body to work out, coordinate, guide, monitor, and standardize the national approach for disaster management. It is placed under the directive of the Vice-President of Indonesia. This board integrates key ministries like Finance, Health, Home Affairs, Social Welfare, Public Works, the provincial Governments, and representatives of the military services and the Police. A Secretariat for the coordination of the BAKORNAS PBP activities was established under the Ministry of Social Welfare. On demand other national ministries, scientific and technical institutions or other stakeholders can be asked to support its efforts in disaster management

Additionally BAKORNAS PBP was given the responsibility for the affaires related to internally displaced persons (IDP) and refugees. Further it is mandated to guide and monitor man made hazards in the country.

As BAKORNAS PBP was given the responsibility on the national level, the mandate to manage natural disasters and refugee matters at local levels were given - according to the general rule of decentralization - to the provincial and local governments.

At provincial level, a Coordinating Unit, SATKORLAK PBP, has been established, a body comprising local representatives of the BAKORNAS PBP members, chaired by the provincial governor. Similar to this, an implementing unit for the disaster management and refugee treatment was established at the district level called SATLAK PBP, again composed of the members of all representatives of the BAKORNAS PBP members.

All of the three bodies from the national to the local level have only been given coordination and managing functions. The actual activities are carried out by local bodies called SATGAS, who work on behalf of and on the directives of their specific ministries (i.e. like Social Welfare and Health). This heavily fragmented line of responsibilities makes a coherent handling of emergencies difficult and has often delayed taking up appropriate emergency counter-measures.

Furthermore the laws and presidential decrees stipulating the functions of the ministries (also those of the BAKORNAS PBP members) are often formulated with contradictions, overlapping responsibilities were defined or mandates of others were obviously even fully ignored.

Although BAKORNAS PBP and its predecessors have been existing for quite some time, it has only limited technical experience, a serious lack of personnel and its organizational structure is not conducive for the tasks handed over to it. According to its inauguration memorandum it should work out the legal framework for national and local disaster management and emergency support activities. It should further define and promulgate the national strategy and set thematic-oriented guidelines for local disaster management.

For the time being BAKORNAS PBP Secretariat is:

- defining a general policy recommendation on preparedness and risk reduction,
- working out a definition of the support and technical guidance by the secretariat,
- working out guidelines for local prevention, preparedness and risk reduction,
- defining the requirements of national and local preparedness, mitigation and contingency plans,
- setting up a national disaster management information system,
- working out guidelines for a standardized assessment of natural hazards, social and economic vulnerability, and the risk from disasters.
- strengthening the integration of risk reduction measures in spatial planning
- advocating the integration of risk reduction and preparedness measures into spatial planning and local decision making,
- strengthen the nationwide early warning system,
- helping to raise public awareness.

After having such a framework available, the BAKORNAS PBP Secretariat should give guidance and assistance for its appropriate implementation. It should regularly monitor and review the achievements, and if necessary re-formulate the framework in order to achieve a common understanding that effective disaster managements constitutes good public services.

Project objectives and concept

GEORISK Project

in the Project: "Urban Quality - Civil Society and Inter-Municipal Cooperation for better Urban Services"

Natural disasters strike rural areas as well as cities. Thus, spatial planning in the cities and in districts has to consider risk reduction, risk prevention and mitigation measures to facilitate proper local government for better living conditions.

The project target was defined together with the Directorate General of Geological and Mineral Resources as to be:

> *"Guidelines for the reduction of geohazards are formulated and public authorities make use of them."*

Consequently, the project aims to promote the mitigation of geologic disasters by elaborating on specific guidelines on preventive and remedial measures to be distributed to municipalities, regional authorities and local governments in selected areas.

According to the German-Indonesian government agreement the Georisk project should aim at advising selected towns and districts in Central Java and in the East of the country (NTT, NTB), which are also be addressed by the GTZ project on "Urban Quality". Therefore, both projects were administratively and organizationally combined into one project in order to increase efficiency and effectiveness.

The Georisk project thus became part of the Urban Quality project and its target serves as one of the outcomes to be achieved. It addresses the same group of beneficiaries, like town planners, decision makers, representatives of civil groups, and other private or public stakeholders.

Of the nine cities and districts to be advised by the Urban-Quality-Project, five were selected for the Georisk project based on their disaster hazard exposure. On Java the harbor town of Semarang, which is heavily affected by land subsidence and landslides; and the town of Sleman (Yogyakarta-Bantul-Sleman), where risk prevention and vulnerability assessment were on the agenda. There, the nearby Merapi volcano is one of the best known and most active in the country. On Lombok, the town of Mataram was chosen where volcanic risk and landslides affect the city and the surrounding arable land. On Flores, the towns of Ende and Maumere both of them highly affected by landslides and exposed to risks from several volcanoes, from earthquakes and tsunamis were selected.

Besides this, the project assists the national Coordination Board for Natural Disaster Management (BAKORNAS PBP) in its efforts to formulate national laws of disaster management.

In the five project cooperation towns and districts the multiple local hazard and disaster risk assessments have been or will be carried out.. Risk prevention measures have or will be worked out for each of them and disseminated to the decision makers, stakeholders and civil society groups to improve the living conditions and to reduce the population's vulnerability to geohazards.

For the various geohazards the partner provided experts on landslide investigation, water quality assessment, land subsidence studies, regional planning, environmental geology, specialists for volcanoes and earthquakes and for geographic information systems and data base management.

The advisory services provided by the project will enhance the country's capacity to assess and evaluate the national geohazard situation, and they will strengthen the scientific and technical qualification of the disaster experts. They will also improve the ability of the policy makers to design an appropriate administrative framework and by creating organizational structures the will favor a better disaster management.

Georisk will assist the Indonesian Government in its goals to reduce the loss of lives and economic damage in the country that are increasing every year. The strategy of the project is comprehensively in line with the development goals of the Federal German Government especially with its poverty alleviation program (Agenda 2015) to reduce poverty by improving the living conditions especially of the poor and by conservation of the natural environment. It will help to strengthen the population's participation in public decision-making and for an early involvement of societal stakeholders in the urban and regional planning process. It will serve the local government administrational and organizational structures with an improvement of the living conditions of disaster affected people.

Through the project activities, also the social and economic dimensions of disasters will be comprehensively addressed. The political decision making levels will be able to better allocate disaster mitigation budgets before a disaster strikes and not having to reallocate financial means that have been originally allocated for local development.

Project output

- Provide access & render advisory services for selected local governments on:
    - Assessment of geohazards threatening the region and by recommending remediation measures to reduce the risk from natural and human disasters,
    - Identification of waste disposal site and on an appropriate waste management,
    - Improving the water supply by identification of new aquifers and / or by water conservation,
    - Supporting the working out of a national strategy on disaster management.

Benefit for target groups

- Residents of disaster prone areas enjoy safer living conditions by provision of:
    - Advisory services for self-help measures (retrofit houses, precaution and safety measures,
    - Access to rescue measures,
    - Pre-disaster planning (shelter / houses / plots in case of relocation measures,
    - Information on disaster prevention & safety measures.
    - The country will be better prepared for disaster, the living and natural environment will be better protected against threats from natural disasters.

Use of outputs

- Local governments of selected regions apply the skills transferred for improving planning functions and implement recommendations for a proactive disaster reduction,
- The national disaster management coordination body (BAKORNAS PBP) is taking up the information rendered to formulate a national Law on Disaster Management.

Indirect impacts

- Trust and reliability in the local government functions are improved.
- Safer living conditions improve the identification with the living area.
- Legitimating of local governments improved.
- A better disaster management will improve governments function.
- Safer living conditions increase income and self-sustainability.
- A conducive disaster management will improve the general local and national economic competitiveness.

The Chain of Effects for the Georisk Project

GTZ Project "Urban Quality - Civil Society and Inter-Municipal Cooperation for better Urban Services "

The Urban Quality project is a German-Indonesian development project co-funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the Indonesian Ministry of Home Affairs (Directorate General of Regional Development; BangDa) and the Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ.

The project aims at strengthening local decision making for sustainable urban development. The project works towards the following results:

- to implement an accountable and transparent decision making on urban development issues by facilitating an effective dialogue between local governments and civil society stakeholders. To achieve this, activities are carried out that include identifying the potential for such dialogues between local governments and representatives of civil societies and by formulating suitable mechanisms for such dialogue, by advising the local governments on participatory planning approaches as well as by providing training on communications skills for facilitating this dialogue. Further it assists in creating city forums and other forms of society - local government interaction.
- to improve municipal management to create further socially, economically and environmentally sustainable initiatives by providing technical and managerial consultancy services to local governments in such fields as local development planning, water supply sanitation and solid waste management, by extending support to local governments in managing organizational changes (change management) towards greater efficiency and effectiveness mostly through bench-marking and self assessment procedures.
- to develop good practices, management and technical innovations and give guidance for proper documentation and implementation on a demand oriented manner, by identification and assessment of innovations on good practices, by supporting the establishment of clearing house for documentation and dissemination of innovative practice found appropriate, by integration of sectoral oriented cooperation initiatives into boarder city and regional development strategies.
- to promote participatory mechanisms for inter-municipal cooperation and to implement them on local levels, by promoting networking processes between municipalities, by providing support to "cross-border" cooperation between neighboring local governments and by supporting the establishment and the functioning of local government associations.
- by transferring local experiences to support formulating national policies and for the development of an appropriate regulatory framework, by assessing national policies and strategies, regulations and guidelines from the perspective of city-level decision makers, by providing support to relevant central and regional government agencies initiatives to create conditions more conducive to sustainable urban development including the creation of appropriate financing methods and instruments.

In order to support local decision making processes eight districts and cities were selected to which advisory services were provided.

City of Kupang (Timor)

In the town of Kupang Urban Quality supports the local government to improve public services in the water supply sector for better management of the karstific groundwater resources. A Water Supply Agency was established in order to harmonize the interests of the local government and those of the private water supply agency, and to overcome the technical and management problems hampering an equal supply of clean drinking water. One of the major problems in Kupang is that the city water supply pipeline network is not completely documented and therefore cannot be monitored properly.

District Sikka (Flores)

In the Sikka District, insufficient solid waste management of the town of Maumere is the central target of the Urban Quality project. The local government furthermore sees a serious threat from leaking waste waters into ground-water which will then cause health problems due to water-borne diseases. The city decision makers were supported to introduce a system that supports a more efficient solid waste management system. Together with the city the project worked out awareness campaigns for the public and other stakeholders, but also for households, it gives indications for recycling and/or environmental friendly waste composting system, which will simultaneously enhance private sector activities. The approaches rendered are documented and will serve as the basis for awareness campaigns in other regions within the District but also on the national level.

District of Ende (Flores)

In the Ende District the city government of Ende was supported for improving the local solid waste management. Collection, delivery and disposal of household and industrial waste as well as the treatment of organic waste was analyzed and solutions for a better waste management system worked out and handed over to the government for further procurement. An awareness campaign has been carried out, focusing at the relations-hip between solid waste, city flooding and public health. It was agreed that also in future Urban Quality shall support the local government to improve the city management on demand.

City of Mataram (Lombok)

Together with decision makers, planners and politicians of the city of Mataram and representatives of different civil groups, a Tool Kit for Community Action Planning was developed and implemented successfully. Through posters, a video and a report, detailed ideas for activities were shown to society and to communal decision makers on how to improve solid waste collection and disposal to increase public health. The city planning processes were analyzed and suggestions made for structural improvement. The Tool Kit describing the planning processes in the Pondok Perasi administration shall be used for another five communities in Ampenan.

District of Lombok Tengah (Lombok)

Urban Quality's role in Lombok Tengah is defined as one of a facilitator to bring relevant stakeholders together to work out guidelines for planning and implementing measures aimed at enhancing the economic development of the area, especially in the tourist sector. Planning guidelines have been worked out that shall be used all over the regency in order to engage more stakeholders. A "Lombok Style" of inter-action and communication among the various local stakeholders from all parts of the society and from the public sectors was developed. It describes how the broad variety of cultures, economy, politics and public institutions be matched in order to achieve a common vision on the chances and require-ments for a sustainable local economic and social development. Through enhanced partici-pation of the broad spectrum of stakeholders the guidelines will lay the base for working out and agreeing on better urban management.

City of Bima (Sumbawa)

On Sumbawa, Urban Quality is supporting the newly established municipality of Bima in planning and working out suitable organization and administrative structures. Compulsory national policies were identified and analyzed for their applicability in Bima. Detailed needs assessment studies were carried out in core public services structures such as solid waste management, the health care sector, city development planning and the public transport sector. Performance standards were formulated for the public transport sector, that will help to assess city's management efforts and assess the degree of achievements. A cooperation was started with the neighboring districts on those public sectors that are of interest for both of them and that shall be promoted jointly (water, sanitation).

City of Semarang (Java)

Together with the City Secretariat a set of public performance indicators were worked out. These indicators will now be implemented in the municipality under the guidance of Urban Quality. The indicator assessment will be supplemented by a set of institutional performance audit reports. In the future the city of Semarang will assess and review the effectiveness of its efforts for good governance on a regular basis. A technical team was created with the municipality that functions as a counterpart of Urban Quality and will accompany the organizational management support rendered to improve the functioning of Semarang municipality.

SekBer Yogyakarta - Bantul - Sleman (Java)

The neighboring cities of Yogyakarta, Bantul and Sleman formed a secretariat to jointly promote their three cities development. Urban Quality supports these efforts through organizational and management assistant. Further support is given to analyze the legal requirements, which have to be fulfilled in order to make the secretariat function as an independent association, representing the interests of its members and to become a full legal entity. Capacity building is provided to strengthen municipal services, preferably with regard to enhancing drinking water supply, establishing a socially and economically acceptable water tariff structure, strengthening the organizational set up of the public transport system and to increase the overall performance in the water supply and sanitation sectors.

LUQA POOL Advisory Network

The Local Urban Advisory Pool (LUQA) is a group of advisors created to function as a network of advisors helping municipalities to implement urban development programs. The pool will advise and support all stakeholders in Indonesian municipalities and local governments in the process of designing and utilization local decision making structures, to strengthen cooperation between civil society organizations and local governments. The pool provides a framework for the mobilization and application of skills and knowledge to increase local impact for the success of municipal management and urban services. LUQA is made up from local civil servants who are well-informed about the management of urban areas. The LUQA pool is open to new members from all sectors (civil servants, stakeholders, society groups) of cities or regencies all over the country. It has worked out a set of criteria which has to be fulfilled by applicants who wish to become a member.

Outputs	GTZ Urban provides organizational and management support to Kota/Kabupaten
Use of Outputs	Local authorities of Kotas/Kabupatens apply innovative approaches developed through organizational and managerial support to ensure that their local government functions are served and the Principles of Good Governance are adhered to.
Benefit for Target Groups	The benefits for further improved local government functioning in adherence to the Principles of Good Governance for the target group that are residents in Kotas/ Kabupatens, particularly the poor are twofold: 1. residents will gain better access to services and social and technical infrastructure; 2. residents will acquire more rights and obligations of citizens and their relationship with local authorities in their Kota/ Kabupaten will follow the Principles of Good Governance more closely.
Indirect Impact	Ultimately Kotas/Kabupatens will be more effectively governed and administered in accordance with the Principles of Good Governance and Kotas/Kabupatens will become more attractive and competitive.

The Chain of Effects for the Urban Quality Project

Project achievements

Within the two years the project has been running, several achievements have already been made in different areas and on various topics.

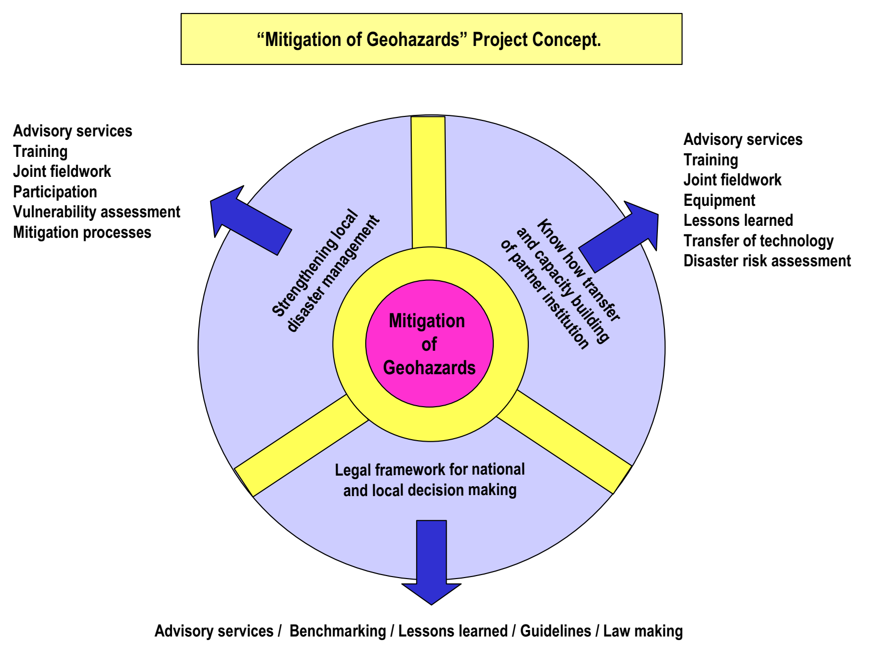
The project achieved to:

- provide information about the national hazard and risk situation,
- adjust internationally accepted state-of-the-art disaster mitigation methods on hazard, vulnerability and risk assessments as well as on evaluating economic losses for implementation in the local spatial planning,
- develop communication "channels" to convey information to the responsible local authorities and to the affected public,
- monitor the result of these processes.

Although the project focuses on selected cities and districts in NTT, NTB and Central Java, the mandate of the Directorate General for Geology and Mineral Resources is on a nationwide assessment of the different geo-disasters. Thus, the project supported the partner also in setting up technical support systems and facilities such as a GIS system and an all-hazards database including retrieval tools.

Furthermore, the project introduced methodology for an effective communication of geo-related risk information with the concerned authorities and civil society groups in affected hazard-prone regions, in order to create a socially accepted attitude towards improving living conditions.

The following paragraphs thus not only summarize the technical achievements but also the steps taken towards a successful communication process through a community based approach.



Georisk project concept and products

Assisting national authorities formulating a law on Natural Disaster Management

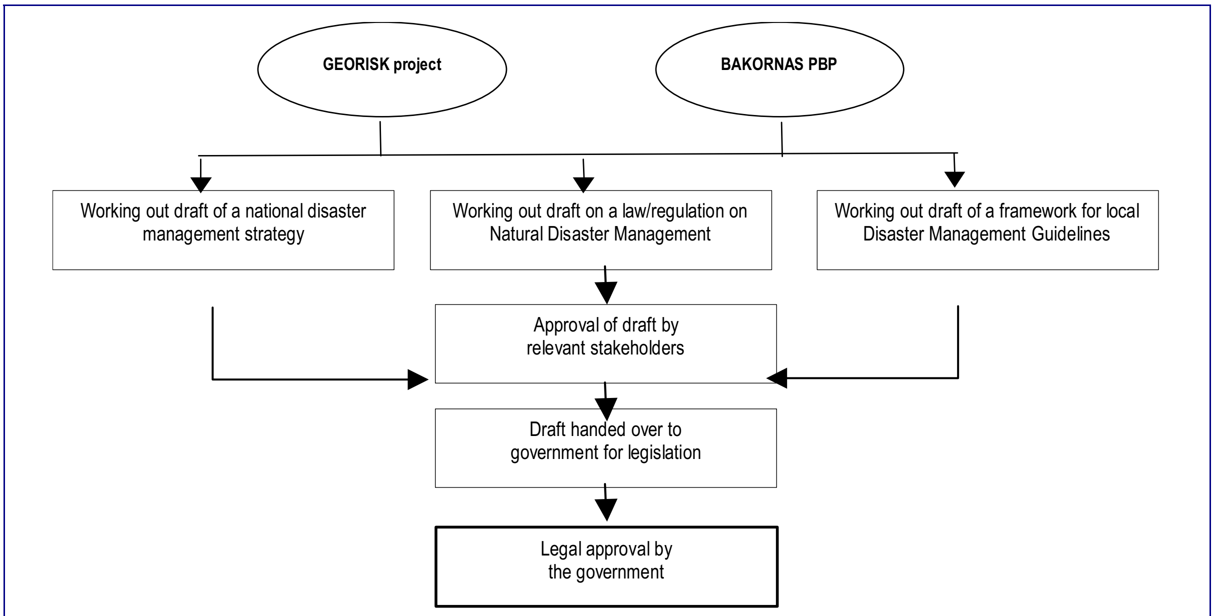
Among other things, the decentralization process in Indonesia also stipulates the natural disaster management in the country. But fragmented policies and strategies at national, district and local levels and a lack of inter-regional coordination in the past often have hampered appropriate disaster mitigation operations.

A further handicap is missing subsequent legal frameworks following the Law of Decentralization. Concerning the natural disaster management the Ministry of Mines and Energy is responsible at the national level to establish general standards on disaster assessment and for geo-related hazard prevention, whereas the Ministry of Home Affairs was given the responsibility to work out guidelines for disaster management. At the district level the Ministry of Mines and Energy is obliged to monitor geohazards, whereas at the provincial and local levels disaster mitigation and management regulations and guidelines are completely missing.

BAKORNAS PBP, as the central government authority to coordinate, guide and monitor natural disaster operations at all levels, focuses at present on improvements of the actual concepts and strategies for applied disaster management in the country. It realized that most of the district and municipal authorities are not pre-pared, qualified and equipped to cope with the regularly occurring natural disasters. Therefore BAKORNAS PBP approached the Georisk project through the Ministry of Mines and Energy - as one of its board members - to assists their efforts setting up a conducive legal framework and provide assistance for designing and implementing a National Strategy on Natural Disaster Management. Furthermore, BAKORNAS PBP asked the project for assistance in the formulation of a technical framework under which guidelines are to be worked out for local disaster mitigation.

As one the steps in working out a legal framework the Georisk project collected 20 Laws, Presidential Decrees and Ministerial Regulations on natural resources management and natural disaster management from the years 1990 until 2003. The texts have been translated into English and published in book form. The book was distributed to stakeholders and decision makers all over the country. The collection will be extended in the future.

The following example shows how the Indonesian text and the corresponding English text are combined in the book.



Flow diagram on the decision making for drafting a National Law on Natural Disaster Management

KEPUTUSAN PRESIDEN REPUBLIK INDONESIA

NOMOR 3 TAHUN 2001

TENTANG BADAN KOORDINASI NASIONAL PENANGGULANGAN BENCANA DAN PENANGANAN PENGUNGSI

PRESIDEN REPUBLIK INDONESIA

Menimbang

a. bahwa bencana yang ditimbulkan oleh alam atau karena ulah manusia dan masalah pengungsi yang terjadi sebagai dampak kerusuhan atau konflik sosial politik, perlu segera diupayakan penanggulangan dan penanganannya secara cepat, tepat, terpadu, dan terkoordinasi melalui kegiatan pencegahan, penyelamatan, rehabilitasi, dan rekonstruksi;

b. bahwa dalam upaya penanggulangan bencana dan penanganan pengungsi secara berdayaguna dan berhasilguna perlu dilakukan penataan kembali tugas, fungsi, susunan organisasi dan Sekretariat Badan Koordinasi Nasional Penanggulangan Bencana;

c. bahwa sehubungan dengan hal-hal di atas, dan dalam upaya penanggulangan bencana dan penanganan pengungsi yang lebih efektif, dipandang perlu menyempurnakan Keputusan Presiden Nomor 106 Tahun 1999 tentang Badan Koordinasi Nasional Penanggulangan Bencana.

Mengingat:

1. Pasal 4 ayat (1) Undang-Undang Dasar 1945;
2. Undang-undang Nomor 6 Tahun 1974 tentang Ketentuan-ketentuan Pokok Kesejahteraan Sosial (Lembaran Negara Tahun 1974 Nomor 53, Tambahan Lembaran Negara Nomor 3039);
3. Undang-undang Nomor 20 Tahun 1982 tentang Ketentuan-ketentuan Pokok Pertahanan Keamanan Negara (Lembaran Negara Tahun 1982 Nomor 51, Tambahan Lembaran Negara Nomor 3234) sebagaimana telah diubah dengan Undang-undang Nomor 1 Tahun 1988 (Lembaran Negara Tahun 1988 Nomor 3, Tambahan Lembaran Negara Nomor 3368);

DECREE OF PRESIDENT OF THE REPUBLIC OF INDONESIA

No. 03 YEAR 2001

REGARDING THE NATIONAL COORDINATING MANAGEMENT BOARD FOR DISASTER MITIGATION AND TREATMENT OF REFUGEES

THE PRESIDENT OF THE REPUBLIC OF INDONESIA

Consideruing

a. that the disaster caused by nature or human and the problem of refugees that occurred as impact of riot or social, political conflicts need to be tackled and handled immediately, accurately, integrated and coordinated by the efforts of prevention, rescue, rehabilitation and reconstruction;

b. that in the effort to mitigate the disaster and treatment of the refugees in effective and beneficial use, the tasks, function, organization and the Secretariat of the National Coordinating Management Board for disaster mitigation need to be reorganized;

c. that in connection to the above matters and in the framework of disaster mitigation and the treatment of refugees more effective, it is considered need to improve the Presidential Decree No. 106 year 1999 concerning the National Coordinating Management Board for disaster mitigation

Referring to:

1. Article 4, article (1) of the Constitution 1945;
2. Act No. 6, 1974 concerning the main definition on social welfare (State Paper 1974, No. 53, Additional State Paper No. 3039);
3. Act No. 20, 1982 concerning the main definition of National Defense and Security (State Paper 1982 No. 51, Additional State Paper No. 3234) as already changed with the Act No. 1 year 1988 (State Paper 1988 No. 3, Additional State Paper No. 3368);

Extract of the Presidential Decree No 3, 2001

Hazard mitigation as one step for a National Disaster Management Strategy

To make the life of Indonesian people safer, to reduce their risk to life, their losses of property and their social vulnerability from natural disasters, a diverse approach has to be endorsed. It must include the legal framework, the mandate for the involved parties, and standardized procedures for hazard and risk assessment. A technical framework has to be set up under which local governments can work out guidelines to be applied within their jurisdiction, and which defines measures for institutional strengthening and capacity building.

All these activities have to be directed towards a national disaster management responsibility.

Goal The risk of loss of life, injuries, economic costs and the destruction of natural and cultural resources from natural hazards are substantially reduced.

This goal clearly defines that reducing the risks from natural disasters is a task that encompasses all societal groups, from the national legislative level down to the local communities. To create a shift in paradigm, that can best be described as "From Resistance to Resilience".

To achieve this, the following principles are proposed:

- All mitigation is local.
- Hazard identification and risk assessment are cornerstones of hazard mitigation.
- Preventive actions (pre-disaster) as well as corrective (post-disaster) actions make up hazard mitigation.
- Impacts of natural disasters have to be reduced through pro-active mitigation measures before emergency response is required.
- Substantially increased public awareness of risk from natural hazards is indispensable.
- Those who knowingly choose to live in areas at higher risk, have to accept a higher degree of responsibility for their living conditions.
- Through building strategic partnerships between national - provincial and local authorities as well as through public-private-partnership, countermeasures to reduce disaster risk will be more effective.
- Plan and carry out risk reduction measures to achieve maximum possible safety.
- Risk reduction measures for one natural hazard must be compatible with risk reduction measures for other natural hazards and with measures to protect the natural and cultural heritage.

For this:

- A law on Natural Disaster Management is required in order to give an umbrella for all national, provincial and local mitigation activities and decision-making.
- A nationwide and all natural disasters comprising database has to be set up. Only with such an instrument will it be possible to make assumptions for a better disaster forecast.
- At the provincial and local levels SATKORLAKs and SATLAKs are not yet given the necessary skills, technologies and information for a reliable early warning, a better disaster relief and for improving people's awareness. A disaster related training program is necessary and has to be implemented nationwide.

It is internationally accepted that natural disaster management is comprised of four stages:

- **Preparedness**
  Because it is not possible to mitigate completely and comprehensively against each type of natural hazard, preparedness and awareness creating measures are an indispensable part of any pro-active disaster mitigation strategy. Preparedness includes plans, strategies and other preparatory activities that are directed towards saving lives, reducing economic and ecological losses, but also provisions to reduce, for instance, psychological traumas of the affected people. Furthermore, preparedness measures contribute largely to facilitate response and recovery operations.
- **Response**
  Response begins when an emergency event is imminent and/or immediately after the event has happened. Response comprises all kind of activities taken to save lives and to reduce the damage from the event. This includes the provision of medical and technical assistance to the victims, the restoration of critical infrastructure mainly water supply, energy and shelter. It cares for identifying the appropriate response measures, the responsibilities and for the provision of technical equipment. Response has also to ensure the allocation of financial support necessary, a proper law enforcement and the restoration of public order. It is thus putting the preparedness plans into action.

- **Recovery**
  means to bring the community system and activities back to normal. It is directed at restoring economic and social life, houses and other communal facilities and infrastructure making up the functioning and well-being of the affected population. Recovery begins immediately after the emergency. Some recovery activities last longer and are concurrent with the response efforts. Recovery from a disaster is unique to each community, unique to each disaster situation.
- **Mitigation**
  Mitigation is the initial phase of disaster management and should be considered before a disaster or an emergency occurs. Mitigation however should also be seen as a continuous process that is integrated in the disaster management cycle. The goal of mitigation is to develop plans and strategies to protect people and their property in risk prone areas.

Of the four stages mentioned, mitigation is the first one to take place, well before the disaster strikes. This is placing mitigation at the centre of the National Disaster Management Strategy.

> *"Mitigation is the most cost effective disaster reduction approach. For every Dollar you spend on mitigation, seven Dollars can be saved for recovery."*

Mitigation starts with analyzing the existing and the possible natural hazards in a given area. This includes identifying what kind of hazard might occur and with what probability or likelihood it may occur. It assesses what kind of damage, how many casualties, and which economic losses have to be expected and works out the best remediation and/or countermeasures.

Natural disaster mitigation is taking advance action to reduce or - even better - eliminate the risks to human life and the property of the society. For every area at risk, it is necessary to develop a special mitigation strategy, defining activities for risk reduction. A sound mitigation strategy comprises detailed prevention measures based on the assessment of the existing risks.

Following the demands from the above formulated disaster mitigation strategy, it becomes evident, that mitigation of natural hazards in Indonesia can only be undertaken by combined and coordinated actions by all political decision making levels, as it cannot be shouldered by central or provincial government, nor by the local levels alone. As natural hazard events cannot be completely prevented, their impacts on the local population can be reduced if advance action is taken to mitigate risks and minimize vulnerability. Only by implementing precautionary measures it will be possible to reduce continued human suffering and enhance the recovery of the affected societies after a disaster strikes.

In order to substantially reduce the losses from disasters a threefold mitigation strategy has to be specified, comprising mitigation efforts on national, provincial and local levels. Additionally also the local communities have to be involved according to the responsibilities that were assigned to them by the Indonesian decentralization model.

In order to implement the approach of a concerted national management strategy, a cooperative intergovernmental system is needed with shared responsibilities and clearly defined mandates. Law 22 (1999) on decentralization not only assigns development responsibilities to local governments, it also stipulates that the central government and thus BAKORNAS PBP, holds the responsibility for setting the general legal framework for a nationwide applicable disaster management.

Law 25 (2001) and many other legal regulations define, that within such a framework the provincial and local governments should carry out their respective disaster mitigation. The local efforts nevertheless should be harmonized and guided by BAKORNAS PBP, and through the local disaster/emergency management units at provincial or local level headed by the respective district heads or mayors.

In order to standardize mitigation efforts at the local level, a model guideline with a compulsory table of contents will be formulated by BAKORNAS PBP to guide local governments in working out appropriate disaster management regulations for their respective and specific situations.

Although local governments are charged with setting up and implementing disaster mitigation plans, they do not necessarily have to carry out the technical steps themselves, since most of them lack the technical expertise. The procedures can be commissioned to external agencies like the Directorate of Geology and Mineral Resources, the Universities of Yogyakarta, Bandung or Jakarta and others.

This requires also the allocation of special funds in the yearly local development budgets, a condition that has to be stipulated in the respective Law on Natural Disaster Management. Such assessment tasks would also open new fields of activities for the local consultancy market; provided their products are licensed and certified.

Therefore, a legal framework, standardized guidelines, and standard operation procedures have to be set up by the national natural disaster coordination board.

Under the goal of providing leadership and coordination a national disaster management strategy has to be worked out, stipulating the development of a nationwide research and mitigation agenda in order to integrate and coordinate existing research and mitigation programs into a unified preventive disaster management program.

This includes, among many others, the creation of an all-geohazard / natural disaster data base in which all national institutions shall be asked to feed in their respective data and which should act as the national reference for the assessment of natural disasters. Within the Directorate General for Geology and Mineral Resources a data base system has been set up that so far comprises all hazard data of the last ten years (more than 5 000 disaster events) and which may serve as a nucleus. The more events are listed, the earlier a reliable disaster forecast will be possible, thus forming the base for a sustainable early warning system in the country.

Natural hazard mitigation is advance action to reduce risk from disasters. A disaster mitigation plan or strategy will have to cover both the structural and the non-structural elements of mitigation.

Structural elements comprise building codes, regulations for house retrofitting, construction principles and all kind of technical regulations that are intended to increase the disaster resistance of buildings and infrastructure.

Non-structural elements are guidelines and implementing regulations directing land-use planning, resources management, but also regulations and guidelines to improve public awareness of the desirable mitigation and on disaster preparedness in general.

The summary given below describes the fields of intervention that are necessary to come up with a National Disaster Management Strategy:

Strengthening the central government's performance

- Define the legal status of the national disaster coordination authority,
- Define what kind of hazards should be included in the National Disaster Management Strategy,
- Work out a draft on the National Natural Disaster Management Strategy,
- Discuss the draft with political and public stakeholders,
- Convert the draft into national law,
- Define the procedures for the declaration of a state of emergency,
- Work out guidelines for a nationwide adoptable hazard, risk and economic loss assessment,
- Set up a compulsory table of contents for local disaster guidelines,
- Make the Disaster Risk Index a national tool for disaster preparedness assessment,
- Review the local guidelines already worked out by different authorities,
- Identify which kind of technical and administrative support BAKORNAS PBP can provide to local disaster affected communities and decision-makers,
- Make financial provisions for strategic buy out of highly disastrous areas,
- Set up disaster mitigation task forces at the local and national level,
- Commission local governments to assess their specific Disaster Risk Index,
- Work out emergency response plans for national, provincial and locals levels,
- Invite private entities and civil society groups to participate in disaster management,
- Work out a checklist for local emergency managers,
- Define minimum requirements for disaster mitigation (Minimum Mitigation Kit),
- Establish close relationships with international stakeholders,
- Seek international cooperation,
- Establish cooperation with print and electronic media,
- Work out and make operational a disaster mitigation information net work,
- Prepare a national disaster newsletter,
- Conduct training seminars for disaster mitigation with affected communities,
- Carry out a national conference on disaster management.

Strengthening the national and local disaster mitigation capacity

- Designate a training bureau for BAKORNAS PBP and its members,
- Define the status of provincial and local disaster coordination authorities SATKORLAKs / SATLAKs,
- Assess the mandates and capacity of the various stakeholders,
- Set up training modules for disaster management for the local governments (SATKORLAKs, SATLAKs),
- Carry out disaster oriented training for local governments.

Hazard, risk, and vulnerability assessment

- Ask relevant institutions to carry out lessons learned from previous disasters,
- Benchmarking with experiences from others international institutions,
- Ask and assist national institutions to create a National Natural Hazard Databank,
- Strengthening the national hazard monitoring systems,
- Make financial provisions for a national disaster monitoring systems to be operational (state-of-the-art technology),
- Make financial provisions to assure that national disaster monitoring personnel are permanently present,
- Work out guidelines for natural hazards identification and assessment as a base for a nationwide compatible hazard assessment,
- Work out guidelines for risk assessment as a base for a nationwide compatible risk assessment,
- Work out guidelines for vulnerability and disaster risk index assessment as a base for a nationwide compatible assessment,
- Work out a methodology for economic loss assessment as a base for a nationwide compatible assessment,
- Strengthen the national disaster forecast through financial provisions and other support.
- Requests from all local governments to carry out (or let carry out) natural hazard assessment on all areas at risk,
- Carry out cost-benefit analysis for mitigation countermeasures.,
- Ask relevant scientific institutions to carry out post-mortem analysis for all major disaster events,
- Ask relevant scientific institutions to work out an inventory of all natural hazards in the country,
- Ask relevant scientific institutions to make prediction for the likelihood of natural disaster likelihood.

Awareness Building

- Assist national stakeholders in awareness raising campaigns,
- Strengthen the local population self help capacity,
- Carry out training,
- Incorporate local stakeholders in local decision making (regional planning),
- Strengthen response capacity through technical and financial support.

Strengthening Relief and Response Capacities

- Review the existing disaster / emergency management cycle,
- Review the early warning systems,
- Work out Emergency Management Plans,
- Carry out training on emergency relief operations with local governments,
- Make guidelines for local contingency planning for at least 5 major types of natural disasters,
- Work out an all-hazard comprising model for introducing a private risk insurance system,
- Assist in designing appropriate building codes and initiate programs for house retrofitting.

GIS and databases

Dealing with natural hazard related issues requires the utilization of information of various types and from a variety of sources. Most of these data are of a spatial nature and thus are best accessed with the help of geographic information technology. Geographic Information Systems (GIS) in combination with database systems help to effectively manage hazard and risk assessment methods. They also provide for the possibility to visualize results in the form of maps or three-dimensional visualizations.

Therefore, much effort has been put into the development of an appropriate database concept. Personnel have been trained and data from various authorities are constantly being collected and prepared for efficient access. These data include geographic data as well as demographic and economic data at various scales.

GIS data

An extensive data collection covering the project's pilot areas as well as countrywide data layers has been compiled into a comprehensive GIS database. It covers thematic data layers from the fields of geology, geomorphology, topography, drainage, transportation utility lines, public buildings, land use and administrative boundaries. All data are documented with metadata descriptions. Important sources are the digital topographic base data from the national mapping authority BAKOSURTANAL.

Training of staff with an on-the-job approach is an essential part and an ongoing activity of the project. It is seen as crucial to develop a thorough understanding of the possibilities GIS can provide for natural hazard and risk assessment at all scales dealt with in the project. Emphasize is given to the fact, that a vast amount of data is already available and in many cases easily accessible at various institutions and authorities and is waiting to be analyzed for risk assessment purposes. Consequently, the training is particularly directed towards the appraisal of already existing data, rather than towards gathering new data. The chapter on local scale risk assessment will elaborate in more detail on this.

Natural hazard events database

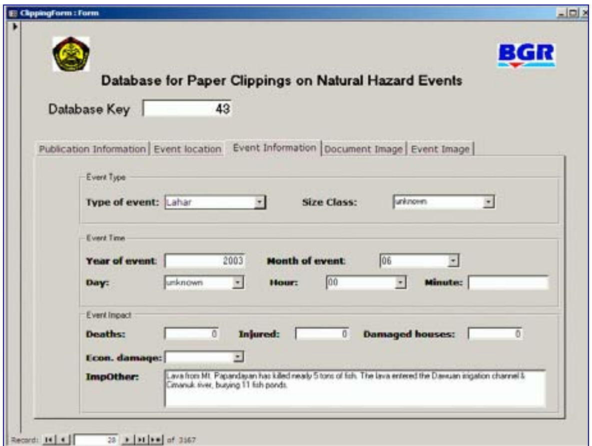
In addition to the spatial data, information about natural hazard events is collected in the form of a database holding records about articles

GIS training

published in newspapers as well as records from BAKORNAS PBP, BMG, Ministry of Health and about 1000 records from engineering geological field reports available with the DGMAE.

With such a database, the project follows well-established examples available throughout the world, some of them being global, others national or regional. By including also non-technical (i.e. non-geological) sources such as newspapers and the reports from BAKORNAS PBP the focus shifts from geological appraisal to impact-oriented recording. The aim is to be able to concentrate on the effects caused by a natural hazard event rather than on its causes.

However, since the database holds information about the location, the type, and the time of events, the analysis of spatial and temporal relationships of disaster events are also carried out in the project.



Example of database form for natural hazard event recordings

- **publication information**
  A group of database fields for recording the source of information as reproducible as possible, so that it will in any case be possible to trace back to the original newspaper, it also intends to characterize the article by it's size, a possible hint on the importance of an event. Finally the article itself is stored as an image file within the database,
- **event location information**
  This important group of values holds information about the location of the natural hazard event. They comprise administrative field codes and geographic coordinates, if known,
- **event type information**
  This group of values characterizes the hazard event by its type its size and its time of occurrence,
- **event impact information**
  To provide a storage mechanism for the impact of an event on both human life and on the economy is the reasoning for this group of values.

Summary of the characteristics of the natural hazard event database

Of course, the nature of the sources of some recordings implies a certain level of uncertainty. In particular those from newspapers have a certain spatial and temporal impreciseness. These uncertainties are addressed in the database by using the possibility of putting in location details with a certain level of spatial accuracy. As an example it is still possible to record the administrative affiliation of the location where an event has occurred, even if no exact geographic coordinates may be mentioned, which is rarely the case in newspapers. No record will be lost because of spatial inaccuracies. With respect to the time of occurrence, also a multi level accuracy recording possibility is available. Subsequent analysis can consider the data with respect to its accuracy.

In addition to the temporal and spatial accuracy details, the "intensity" of recording particular events can be documented in the database. For example, the database can record the number and the length of newspaper articles relating to an individual event as well as their size. These are believed to be "soft" indicators of the societal importance of an event, in addition to the "hard" facts, such as the number of dead and injured persons.

12 killed in West Java landslide

Yuli Tri Suwarni
The Jakarta Post
Bandung

Hours before Indonesians commemorated Earth Day across the country on Thursday, a landslide hit Bandung in West Java following two days of rain, leaving at least 12 people dead and three others missing.

The disaster, which occurred at around 9 p.m. on Wednesday night, also injured 15 residents living on the slopes of Mount Gedugan in Cililin subdistrict, some 60 kilometers west of Bandung. Six of them sustained serious injuries.

At least 43 houses were buried or damaged in the landslide that affected the hamlet of Walahir in Kidang Pananjung village, Cililin.

Cililin subdistrict secretary Ikin Sodikin said the disaster was triggered by two days of heavy rain that began on Tuesday.

The 35-hectare area on the slope where the landslide occurred, planted with pine trees by state-owned forestry firm PT Perhutani, was unable to absorb the heavy downpour.

But local Perhutani official Heri Puriyanto blamed the disaster on local residents who plant cassava and corn on the slopes of the mountain.

He said Perhutani started planting pine trees in the former deforested area in 2000. "It's understandable that the soil is still unstable because we have just begun reforesting."

The company immediately gave a total of Rp 10 million (US$1,162) in aid for the families of the dead and injured villagers.

Bandung regent Obar Sobarna, who arrived at the scene on a motorcycle, provided rice and instant noodles for the victims, while asking local residents to abandon their village.

The local administration plans to resettle them in an area some seven kilometers from the Kidang Pananjung village office, which can be accessed only on foot or by motorcycle.

This hampered police in sending in heavy equipment to help evacuate the three missing victims — Ence, 45, Asep, 30, and Ajang, 70.

The search for those missing was later halted by bad weather with rescuers planning to resume their mission on Friday.

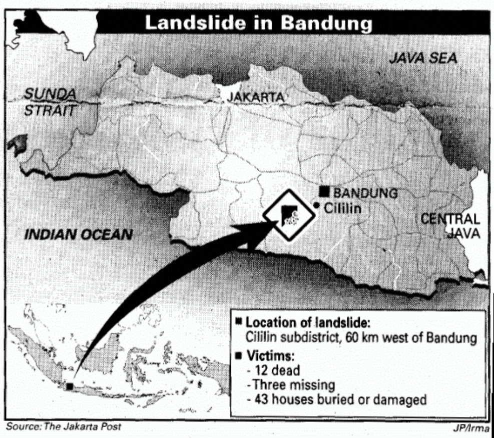
The 12 fatalities were identified as Mahria, 50, Endah, 47, Dadang, 15, Rus, 17, Ene, 70, Otib, 35, Titi, 65, Agus, 31, Mamat, 22, Dede, 20, Hendri, 70 and an eight-year old child, Neng.

The injured are receiving medical care at the Cibabat Hospital in Cimahi and the Hasan Sadikin General Hospital, Bandung.

Euis, 40, a local villager who lost seven relatives including her husband Ence and son Dede, said the landslides hit twice — the first at around 9 p.m., with the second one taking place 30 minutes later, destroying 21 houses and damaging 22 others.

"During the first landslide, we all went out of the house including me and my husband."

Many of the victims who were killed were those who tried to take their valuable goods like televisions and other electronics out of their homes after the first landslide.



Typical newspaper article about a natural hazard event (source: Jakarta Post)

All three data sources, the newspaper articles, the records from other authorities and the field reports have been systematically gathered during the regular work process. Collecting these data in a database mainly serves three purposes:

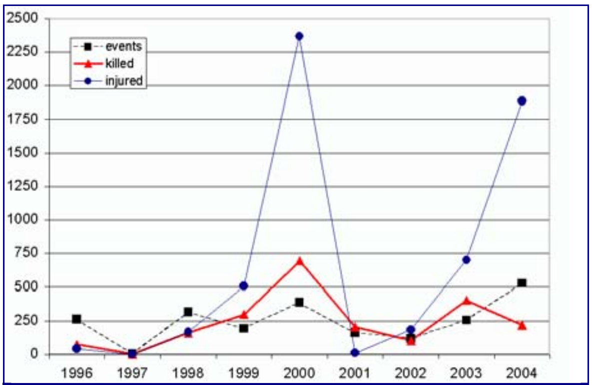
- **systematic recording**
  to collect possible information about natural hazard events from all possible sources in order to provide easy access for analysis,
- **analysis**
  of magnitude-frequency relationships for various types of natural hazards and comparing them to other time series data in order to improve the knowledge about probabilities or recurrence intervals of disastrous events, to gather information about the economic impact,
- **creating awareness**
  through the preparation and dissemination of maps and statistics to the public and decision makers.

To meet these goals, the database allows for the recording of many characteristics of natural hazard events. Realizing that in most cases precise information about the location and/or the impact is unavailable, the information is categorized to allow for the recording of multiple levels of precision. For example in most cases the exact location, in the form of geographic coordinates, of a landslide that occurred in Papua may not be reported in a newspaper, but rather the administrative affiliation of the village that was hit will be mentioned. Although this geographic imprecision makes such a recording not usable for a geological assessment, the recording nonetheless is of value because it can provide other important information such as its time of occurrence or its economic and social impact. With a growing number of recordings, a clearer picture about the costs of natural hazards will emerge. These figures can then be compared to post-crises disaster assessments and incorporated to risk mapping procedures.

As at fall 2004 the database holds more than 5 000 individual recordings describing more than 3 500 natural hazard events for the years from 1994 until now and there are still many more to come. There is a clear spatial bias in the database due to the fact, that the intensity of reporting is much higher in the densely populated areas of Java or south Sumatra. Many events go unnoticed in areas scarcely inhabited. However, this doesn't reduce the merit of the work put into the database, because the densely populated areas presumably are also the ones with the highest risk in terms of the number of people and assets exposed to hazardous processes.

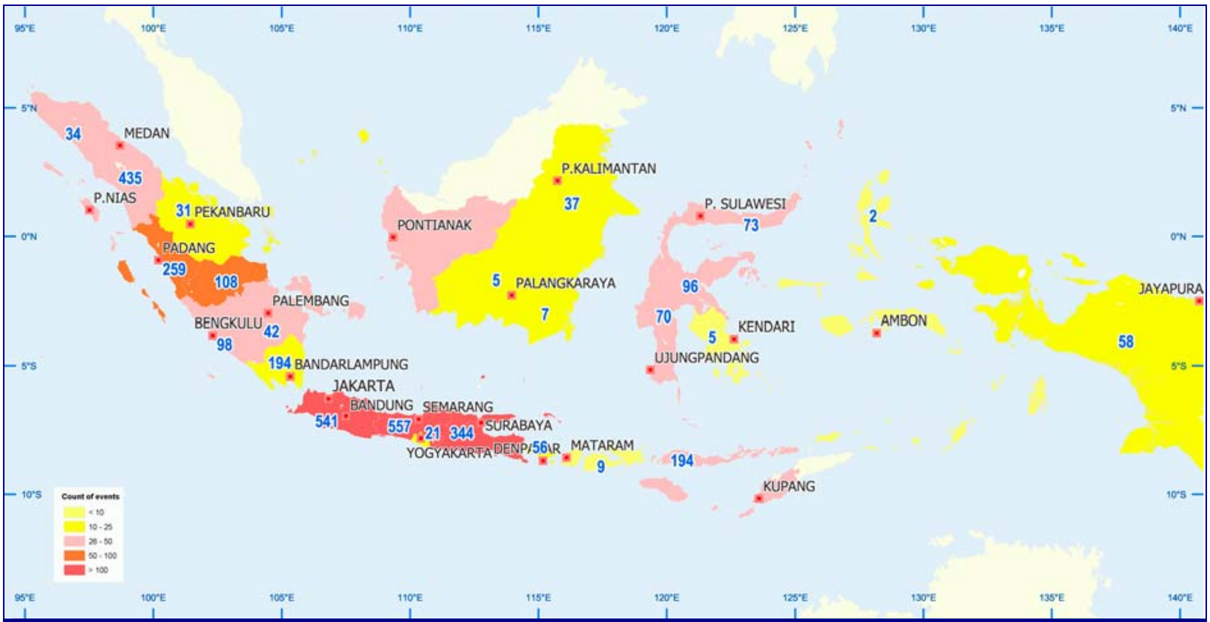
By combining the database records with the GIS data layers, maps can be produced showing the distribution of events on various scales or administrative levels.

This effort of the project aims at creating awareness among the public as well as among decision makers.



Graph summarizing events and casualties as recorded in the database

It is possible to provide overviews for different types of hazard events and/or events of a certain magnitude. Analyzing the annual or monthly distribution of hazards and related losses is also possible.



Amount of natural hazard events (color legend) and number of people killed (text labels), shown on province level

Future activities

Future project activities related to this first countrywide all-geohazard database will include supplementary enhancements to the database to accommodate additional reporting from external sources. Standardized database reports to be distributed to authorities are already being developed. It is envisaged to give external agencies the technical possibility to upload data directly to the database via the Internet.

Monthly distribution of hazards related to climate (landslides, floods)

Risk and exposure assessment concepts for communities

The basic ideas about risk assessment concepts adopted in the German – Indonesian cooperation project follow approaches already discussed and applied in various projects around the world. Although every single country presents its own unique problems and possibilities, the general concept of assessing risks can be viewed as an internationally accepted one and is endorsed by international organizations, such as the UNDP.

An important part of the mitigation process is to properly assess the vulnerability of the local community in terms of how much of the population is exposed to a potential hazard. Furthermore, every assessment must identify critical infrastructure objects as well as give estimates about potential economic damages.

We think that establishing a risk assessment procedure is an important and indispensable tool for national, regional and local decision makers. The concept that the project team is elaborating on, involves various methods believed to be appropriate for the situation in Indonesia. Delivering pre-disaster figures about the spatially variable number of people, houses, transportation and other economic assets at risk enables responsible authorities to target mitigation efforts in the right place more effectively. Additionally the identification of “hotspots” or critical infrastructure objects plays an important role. Hospitals, bridges, airports and other lifelines and infrastructure objects need to be identified and analyzed as to how important they might be before, during and after an emergency situation occurs. In general, the basic steps for the risk assessment can be described as follows:

- delineation and definition of hazard zones
- assessment of figures for the number of people at risk in hazard zones, if possible distinguishing by social groups
- appraisal of the number of households exposed, if possible distinguishing by type of household
- identification of critical infrastructure objects exposed to hazard
- estimation of economic values at risk
- appraisal of potential economic losses associated with hazards.

Available national data sources

Even though in a country like Indonesia the institutional capacity for providing detailed data required for risk assessments may not be comparable to the situation of highly developed and industrial nations, the amount of publicly available data has grown tremendously over the last years. This puts Indonesia in a position, from where well-informed estimations are possible. The approaches applied in the project aim at a reliable but extendible method, should the data situation become even better.

Among the important institutions are national authorities having the direct mandate to deal with natural hazards as well as authorities with a more general agenda, such as the statistics agency or the topographic and mapping authority.

As can be seen in many internationally available risk assessment studies, the assessment process involves a multidisciplinary effort in order to combine the data into a useful planning basement for better coping with threats.

Assessing risk in most cases involves some sort of spatial delineation or zonation of an area (e.g. a city or a county) in zones of different magnitudes and frequency for a specific hazardous process (e.g. floods or tsunamis). To provide such information in the form of hazard or susceptibility maps and in the form of statistical analysis is the job of the technical agencies, which have the necessary scientific background. In particular, the Directorate for Volcanology and Geologic Hazard Mitigation (DVGHM), and the Directorate for Geological and Mining Area Environment (DGMAE) are to be mentioned.

Extensive landslide susceptibility mapping projects have been carried out as well as a large collection of volcano hazard maps produced over many years. Many of the approx. 130 active volcanoes in Indonesia are monitored permanently.

Utilizing these data based upon a GIS concept plays a central role for risk assessments, as will be outlined below.

Hazard data

The delineation of hazard zones is a regular procedure in those government agencies responsible for geological and hydrological issues, such as the

- DVGHM
  Department of Volcanology and Geologic Hazard Mitigation
- DGMAE
  Department of Geology and Mining Area Environment
- BMG,
  the Meteorological and Geophysical Agency

Gathering these data sources and preparing it for utilization in a GIS based risk assessment approach is a major activity of the project.

Demographic data

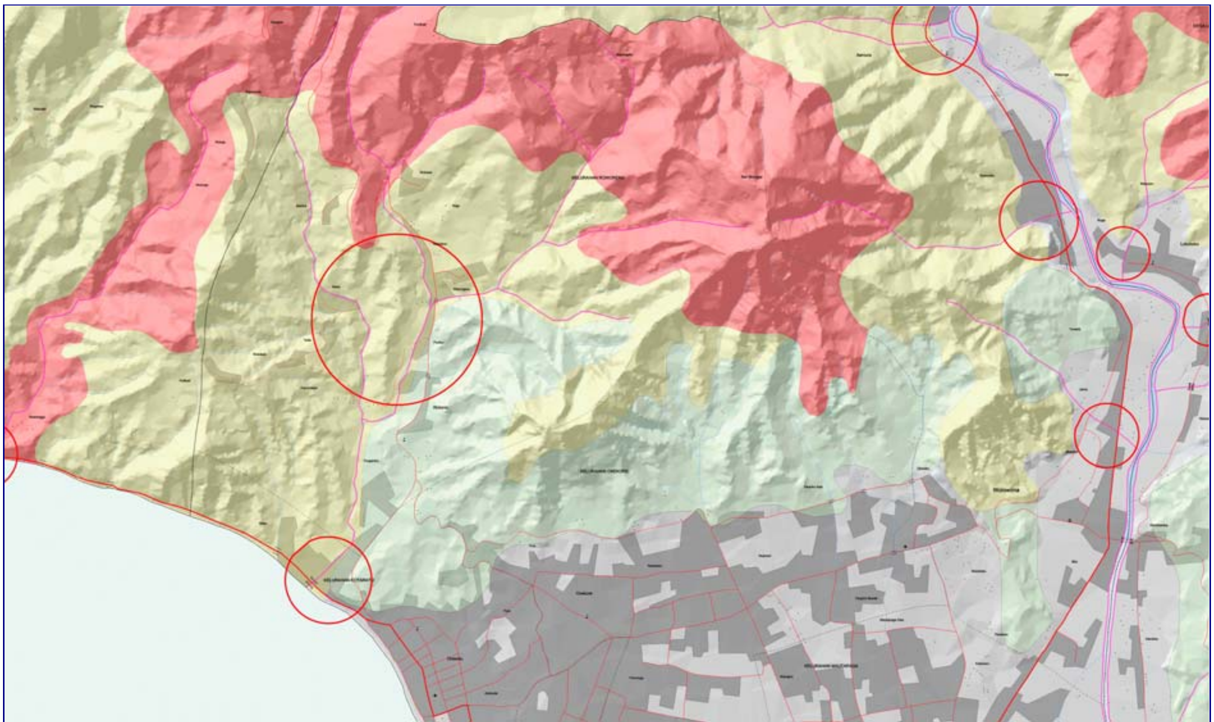
The number and variety of available demographic and housing data is enormous at all administrative levels. They provide a very good basis for analyzing various aspects related to risk assessment. Most of it is accessible through the national or regional BPS offices. The amount of detail recorded in the BPS data varies but in general the basic figures will be accessible. A nationwide coding system for identifying administrative entities allows for combining these data with the administrative GIS data layers, which themselves are not provided with statistical data.

Land use data

Land use data plays an important twofold role in risk assessment. The first role land use (better: spatially varying or temporally changing land use) plays is that many natural hazard processes, are controlled by land use parameters or land use patterns.

The second role land use plays is that it defines the spatially variable vulnerability or exposure because different land use can be assigned different economic values.

Additionally, land use types are an indicator for the intensity by which certain areas are inhabited by people. In ideal cases good land use data can, in combination with statistical data, even provide information about building structures or their economic values.

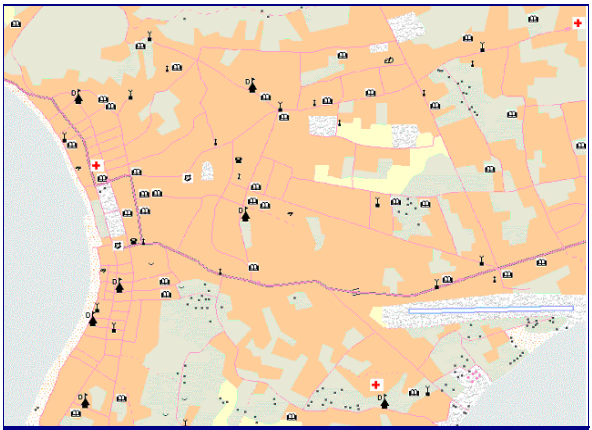


Section of the landslide susceptibility map of Ende, Flores island (see also chapter on city advisory services), red circles indicate areas potentially hit by debris flows

In the project land use data are derived from topographic data provided by BAKOSURTANAL. The data are in digital form and resemble the topographic maps 1:25 000. Although some of the data may not be the most recent available, its general usefulness based on the availability, accessibility, and standardized GIS data format outweighs more than this disadvantage. However, the procedures described here are not limited to that particular data format. If more accurate data is available in an area to be assessed, it can easily replace the BAKOSURTANAL data.

Utilizing the data requires the combination of the high number of land use classes to manageable categories for which also economic data can realistically be gathered. For the project, it was decided to group the 20 plus land use codes of BAKOSURTANAL into five categories:

- Settlement areas
- Industrial areas
- Agricultural areas
- Forest areas
- Water areas



Infrastructure (symbols) and land use data (colors) example / city of Ende, Flores

1415 Majid	1375 Desa
1425 Gereja	1525 Menara
1435 Pura (Hindu)	1615 Sekolah
1325 Gubernur	1625 Ruma Sakit
1445 Vihara (Budha)	1635 Polisi
1335 Walikota	1645 Pasar
1345 Bupati	1655 Pos
1355 Camat	1665 telekom
1365 Lurah	

Selection of codes and symbols for infrastructure point data, names in Indonesian

Infrastructure data sources

Like land use data, infrastructure information plays a vital role in risk assessment concepts. Critical infrastructure facilities on one hand are vulnerable features in terms of the economic efforts required to rebuild or repair them in case of their destruction during hazard events. On the other hand many infrastructure facilities are important features during the immediate coping period of an emergency, among them e.g. hospitals, school buildings, airports, roads, and bridges.

A very good basic set of infrastructure data is again provided by BAKOSURTANAL's 1:25 000 topographic GIS data layers.

- BPS, the statistics authorities at national, provincial, and district level
- BAPPEDA, the planning authorities at district level
- BAKORNAS, the national coordinating agency for natural disasters
- KIMPRASWIL, the public works authorities
- BAKOSURTANAL, National Mapping Agency
- LAPAN, the national remote sensing authority

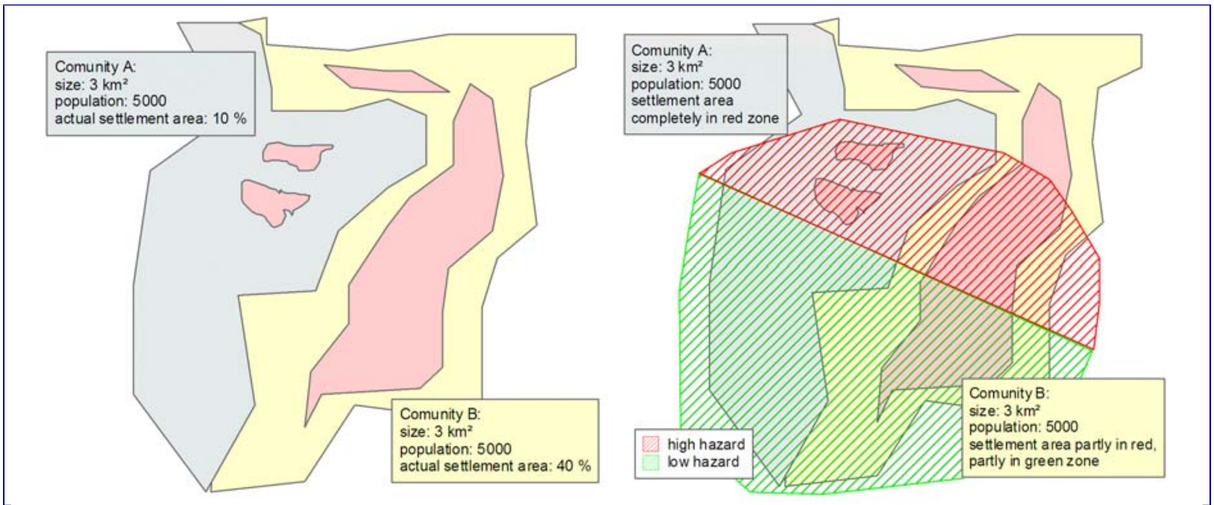
Additional national, regional and local institutions providing important data for risk assessments

Estimating the population and houses exposed to hazard

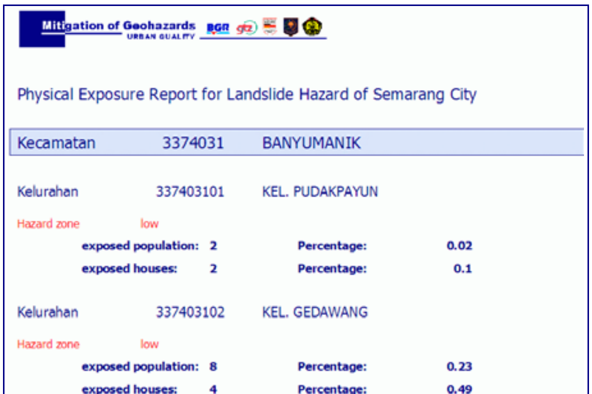
The physical exposure of the population to natural hazards is one of the most important risk determining factors (see also UNDP, 2004). The methods used to define the number of people exposed to hazards require scale dependent considerations and also scale dependent data sources.

The focus in the project is put on local / urban scale. The goal is to have a representation of population distribution, which is spatially as accurate as possible. Accuracy at these local scales requires considering the fact, that settlement activity within the boundaries of a community or municipality is not evenly distributed but usually concentrated in particular areas. This implies that the population within a community is not necessarily exposed to a hazard only because the hazard is affecting the community's area. At local scales, the spatial extent of a hazard zone and the distribution of the population matter.

Making estimates for the number of houses involves the same procedure. Standard GIS and database procedures for this kind of assessment have been developed and documented within the project framework.



Two communities of same size and population can have different exposure to hazards due to different settlement patterns, pink areas represent residential areas



Mitigation of Geohazards URBAN QUALITY

Physical Exposure Report for Landslide Hazard of Semarang City

Kecamatan	3374031	BANYUMANIK

Kelurahan 337403101 KEL. PUDAKPAYUN

Hazard zone low

exposed population:	2	Percentage:	0.02
exposed houses:	2	Percentage:	0.1

Kelurahan 337403102 KEL. GEDAWANG

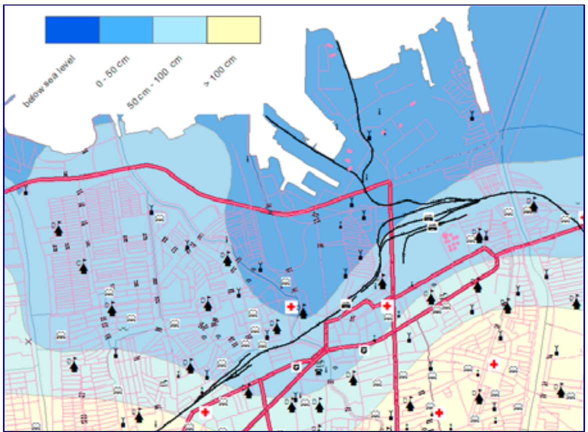
Hazard zone low

exposed population:	8	Percentage:	0.23
exposed houses:	4	Percentage:	0.49

Section of a standardized exposure report

Finding critical infrastructure exposed to hazards

As pointed out above consideration of infrastructure issues is an inevitable part of any risk assessment study. The procedures developed in the project are comparable to the one developed for the exposure of people and housing described above in the sense that a GIS is used to intersect the hazard zones with infrastructure objects, such as buildings or lines. A subsequent statistical analysis can then summarize how many objects of a certain type are exposed or how many kilometers of a particular road type. The GIS is used to produce maps.



Map showing infrastructure objects (symbols and lines) intersected with subsidence projections for 2013 for center of Semarang City, Central Java

The map data of the national mapping agency do not contain information about individual objects, e.g. the number of beds of a hospital or if a particular school needs special attention because the students are physically disabled.

Such additional information needs to be gathered by consulting other data sources, e.g. municipal authorities and will be part of future activities within city advisory services.

Estimating economic exposure

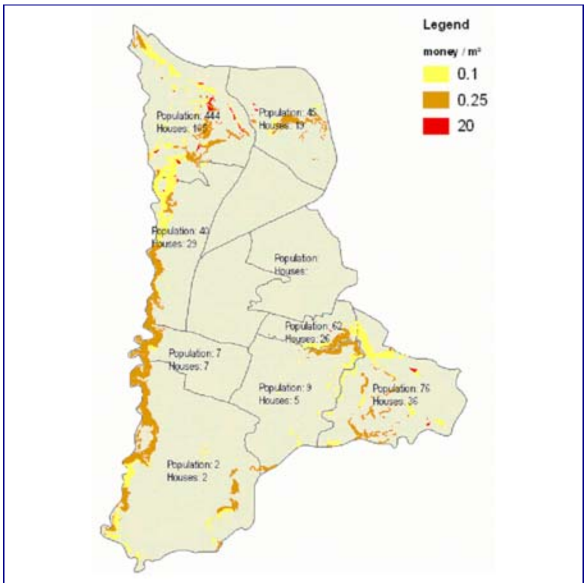
Three approaches to economic exposure assessments are followed in the project. In the first, methods supported by GIS and database have been developed to assign economic values to certain land use types provided by the GIS data of BAKOSURTANAL.

These data have a very detailed land use coding system, too detailed for economic assessments. However, after classifying the data in groups, a possibility is given to assign economic values based on per m² basis. Defining regionalized figures for these categories is an ongoing process. The tables below is an example.

land use code	class	description	value / m^2
1224	1	Settlement	20.00
5214 5224 5234 5254 6324	2	Agriculture	0.10
5244 5264 5274 5284	3	Forest and shrubs	0.25
5294	4	Barren or rocky	0.00
3354 3364 6214 6264 6314	5	Water or water related	0.00

Land use categories, classified and valued

By intersecting these data with hazard zones, figures on economic exposure can be derived by multiplying the square-meter figure with the size.



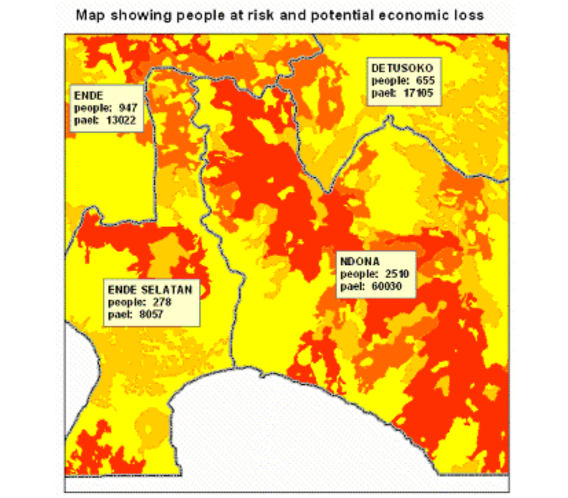
Example of an economic exposure map in landslide hazard zones, Kecamatan Banyumanik, City of Semarang, Central Java

In a further step linear objects, such as roads or utility lines can be assigned with monetary values. Intersecting these data with hazard zones by GIS techniques provides the length of features contained in a particular zone. An example of this type of application will be given in the section on city of Semarang.

Description	Value / m
Road Brigdes	100
Road class 1	10
Road class 2	25
Food path	1
Tunnel	100
Railway bridge	120
Railway	50
Foot Bridge	5
Airport	200

Applying monetary values to linear objects (values are taken arbitrarily)

In a still somewhat experimental stage is the assigning of return periods for certain landslide types. In order to define the real monetary risk a probability needs to be assigned to the hazard. In the case of landslides, we have to consider that in the case of an event not all the entire zone is affected but rather a small proportion. Applying



Map showing the number of people and the mean annual potential economic exposure in landslide hazard zones, District of Ende, Flores

susceptibility zone	return period	proportion of area affected
1 (high)	100	0.001 (0.1 %)
2 (moderate)	60	0.005 (0.5 %)
3 (low)	30	0.01 (1 %)

Assumptions for return periods and affected area for shallow landslide

some assumptions (see below example of the area of the district of Ende, Flores) about the proportion and the return periods, listed in the table below, the mean annual expected economic loss for administrative entities such as sub-districts can be derived and shown in a map.

Further activities

Spatially accurate delineation of potential risk is an important part of the mitigation process and can only be achieved with the help of geographic information tools. The activities in this field will be intensified and the existing methodology is refined. In particular it is envisaged to develop the database as a tool for advisors, which is able to deliver results quickly. For this matter, data about economic values of critical infrastructure will be systematically collected and incorporated in the database.

Community based disaster risk management

Background

Traditionally disasters were viewed as isolated natural events and few linkages were made to the conditions of the affected people. Technical solutions prevailed and relief and rehabilitation measures normally taken were to re-install pre-disaster conditions. Since the United Nations Decade for Disaster Reduction (IDNDR) in the 1990s, and now followed by UN-International Strategy for Disaster Reduction (ISDR) a shift in paradigm towards a more development oriented approach has emerged. It incorporates hazard mitigation and vulnerability reduction concerns. The approach combines the technical and scientific experiences with special attention given to social, economic and ecological factors for a holistic disaster risk management.

Under the auspices of UNDP a Global Vulnerability Index was developed to compare countries according to their level of risk. With such an index it is envisaged to identify a country's social and economic vulnerabilities along with hazards caused by natural conditions and human activities that contribute to the risk. The approach to assess the local population's risk is called Community Based Disaster Risk Management (CBDRM).

Some of the serious deficiencies of many disaster mitigation programs worldwide include the following:

- Failure to involve people
  Because of their reliance on specialized technologies and professional skills, many programs run without the involvement of local people and their organizations in planning and decision-making.
- Failure to address vulnerability
  Many programs respond to a particular hazard type in a specific and limited period of time and do not address vulnerability, which is a complex relationship between people and their social, physical and economic environment.
- Susceptibility to manipulation
  Because of the concentration of power and knowledge within a centralized management, many programs are particularly susceptible to political manipulation by powerful groups.

The UN launched an initiative to involve the diaster affected population in the mitigation process leading to the assumption that the prevailing top-down approaches in disaster risk management mostly resulted in inequitable, unsustainable and irrelevant results. Many such programs fail to address the specific local needs of vulnerable communities; they ignored the potential of local resources and capacities, and in some cases even increased people's social and economic vulnerability.

Contrary to that, Community Based Disaster Risk Management (CBDRM) focuses on the evaluation of the community's risk and the people's vulnerability.

The aim of CBDRM is to reduce vulnerabilities and increase capacities of households and communities to withstand damaging effects of disasters. CBDRM contributes to people's participation and empowerment in achieving sustainable development and sharing in it's benefits. The benefits of CBDRM are pointed out by IDNDR as follows:

- Communities are knowledgeable about their own environment and are able to predict unfavorable events. It makes use of their broad experience of coping with unprepared emergencies.
- Community's coping methods, which evolved over time, normally best suit the local economic, cultural, and political environment.
- Communities will be more independent from relief operations and strengthen their own capacities to support their livelihoods.
- Community participation will positively address the local socio-economic concerns. It will empower them with new knowledge and skills; develop the leadership capability of the community members, which will further strengthen their capacity to contribute to development initiatives.

CBDRM at work in the community

- The impacts of disasters on women are different from that on men. Community based approaches, which recognize this concern have the potential to contribute towards gender equity.

Developing a Community Based Disaster Risk Index (CBDRM) for Indonesia

To sensitize local decision makers a CBDRM working group was established for the first time with the partner organization in order to promote, discuss, and develop concepts to support the approach.

Based on a CBDRM monitoring system that was designed in Latin America by the Inter-American Development Bank (IADB) and GTZ in 2003, a set of indicators was worked out that suit the conditions of Indonesia. One group member got an advanced training on "Community Based Disaster Risk Management" at the ADPC, Bangkok. In order to link the Georisk initiative with other groups involved in this field in Indonesia, the working group visited different organizations to discuss opportunities and obstacles of the approach and to avoid overlapping activities. In regular meetings the group discusses the latest scientific papers where disaster risk management is linked as a cross cutting issue to development, urban and regional planning, poverty and gender. There have been already many activities in the last years covering all aspects of hazard assessment and risks evaluation. However, the assessment of people’s vulnerability (life and assets) and their coping capacity at community level is still in its infancy.

To develop a Disaster Risk Index applicable at a local level has been the subject of international discussion for a few years but so far no field assessment could prove its applicability. The Georisk project was the first international cooperation project worldwide to make use of this concept.

The established conceptual framework systemizes the key elements of risk management into the main factors of

- Hazard,
- Exposure,
- Vulnerability,
- Capacity.

The indicator set worked out by Georisk comprises a total of 47 indicators, arranged according to the above mentioned four main factors and are further broken down into factor components. The framework helps to identify and understand the driving forces of social and economic vulnerability. Close cooperation was sought with NGOs, universities, and research institutions in Bandung and Yogyakarta (ITB, UGM, SABO, BPPTK), the local government (BAPPEDA), and local disaster preparedness institutions (SATLAK, PUSKESMAS) in order to increase efficiency of the indicator based assessment procedure.

Consequently, a questionnaire was developed to collect all necessary information for the indicators from knowledgeable people. Before applying it at the local level the questionnaire was discussed with experts from universities, NGOs and research centers to find out what scaling and hazard specific weighting of the indicators were found to be most suitable to describe the impacts of different geohazards (landslides, volcanic eruption, earthquake

The expected benefits from the questionnaire are:

- Identification and evaluation of key elements of local disaster risk and vulnerability based on a standardized and nationwide accepted form,
- Possibility for long term assessments and monitoring vulnerability and coping capacity, as a measure of evaluation of effects of policies and investments in disaster management,
- Identification of the major deficiencies in local disaster mitigation and of the optimal areas of intervention,
- Systemization of the dissemination efforts on risk information at the community level...

Factor	Component
Hazard	Probability ▪ Experienced hazards ▪ Possible hazards
	Severity ▪ Intensity of experience hazards ▪ Intensity of possible hazards
Exposure	Structures ▪ Number of housing units ▪ Lifelines
	Population ▪ Total residents population ▪ Economy ▪ Gross domestic product
Vulnerability	Physical/demographic ▪ Density ▪ Demographic pressure ▪ Unsafe settlements ▪ Access to basic services
	Social ▪ Poverty level ▪ Literacy rate ▪ Attitude ▪ Decentralization ▪ Community participation
	Economic ▪ Local resources ▪ Diversification ▪ Smalls scale business ▪ Accessibility
	Environmental ▪ Areas under forest ▪ Degraded land ▪ Overused land
Capacity	Physical planning and engineering ▪ Land use planning ▪ Building codes ▪ Retrofitted / maintenance ▪ Preventive structures ▪ Environmental management
	Societal ▪ Public awareness programs ▪ School curricula ▪ Emergency response drills ▪ Public participation ▪ Local risk management
	Management and institutional ▪ Societal capacity groups

Factor	Component
Capacity	Economic ▪ Local emergency funds ▪ Access to nat. emerg. funds ▪ Access to intl. emerg. funds ▪ Insurance market ▪ Mitigation loans ▪ Reconstruction loans ▪ Public works

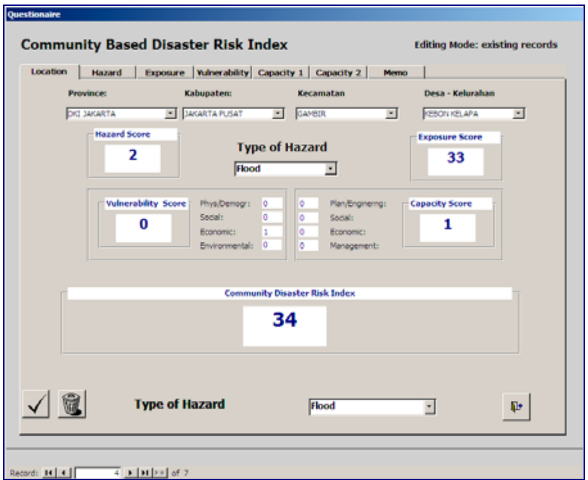
Disaster Risk Indicator set

The CDBRM approach is backed up by a database system that allows for the systematic recording of the questionnaires gathered during community activities. The advantage of the database is the possibility to easily making scenarios by changing the given answers and thus identifying those areas where mitigation measures could reduce the risk most effectively.

The information generated by the indicator system supports the decision-makers on local and national levels to analyze and understand the disaster risk a community is exposed to. Regular application of the indicator system will allow monitoring changes over time as a measure of evaluation of initiated policies and interventions.

The Georisk project applied the indicators and questionnaire in cooperation with the Urban Quality Joint Secretariat in the area of the Sleman and Kulon Progo regencies, Central Java, and the Sikka district, Flores.

During several meetings and the field surveys, the necessity of the CBDRM approach became



A database is used fore a systematic recording of questionnaires

evident. All local governments contacted and all representatives of societal groups expressed their great interest and willingness to participate in this kind of vulnerability assessment. Field assessments were supporting our assumption that the set of indicators worked out by the Georisk project will help to design appropriate countermeasures for local disaster mitigation.

Outlook and further steps

The monitoring system is still in its development phase and constantly needs to be verified and adjusted to ensure that the system is as suitable as possible for the country.

As further steps, the system needs to be tested and verified on a number of cases to:

- Adjust the system by modifying the factors according to different hazards,
- Adjust the range of the value system to represent actual Indonesian's conditions,
- To ensure the same perception of the questions between the experts and the user/community,
- To develop a national benchmark to define what is a high - medium - low risk, valid for the whole country.

The results so far achieved, proved that the Community Based Disaster Risk Management system is a reliable instrument and will present a facts-oriented basis to local and national decision makers. It will serve as a standard to sensitize the population at risk for all kind of disaster risk mitigation efforts. Especially the disaster mitigation change monitoring system will give an instrument at the hands of the local disaster managers to monitor the effectiveness of disaster mitigation activities carried out.

Analysis of results

City advisory services

Three communities have been selected together with Urban Quality to carry out geohazard and risk assessment, combined with working out technical recommendations and advisory services for their dissemination at community levels.

Presented here are examples of natural disaster risk reducing measures for the

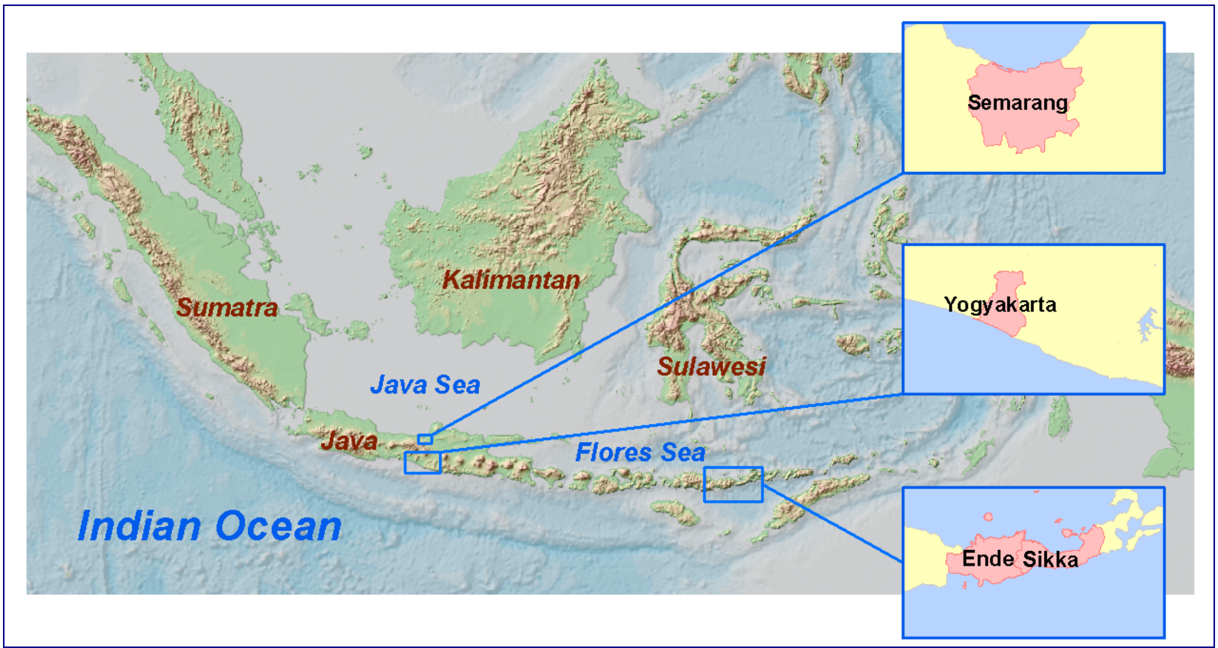
- District of Ende with its capital Ende (Flores),
- District of Sikka with its capital Maumere (Flores),
- City of Semarang, Central Java.

Each of the three areas has a set of geological hazards specific to the area.

The district of Ende is facing a multitude of geohazards related to the nearby active volcano Mount Iya, while the city of Maumere and its surrounding district Sikka (also on Flores Island) is heavily prone to earthquake triggered tsunamis.

The city of Semarang (West Java) has been experiencing land subsidence for many decades and additionally is facing landslides in its southern parts.

The following map shows the areas where the project focused its activities during the last two years, including the community based approaches around the Yogyakarta area mentioned above. In the future, more districts or cities might be addressed according to demands already expressed by the local governments.



Partner cities and districts

District of Ende (City of Ende)

The district of Ende with its capital of the same name was repeatedly affected by natural disasters, some of which are listed below:

- In **1939** unusual amounts of rainfall triggered **landslides** and **floods** and destroyed many houses.
- In **1961** an **earthquake** shocked Flores damaging houses all over the Island.
- In **1969** Iya **Volcano erupted** and the City of Ende was close to a major disaster. On Iya Peninsula and on Ende Island, lahars (a mixture of volcanic material and water) claimed three lives and injured ten. Two people were seriously injured by hot air and gases on Ende Island. 177 houses, 6 mosques and 3 schools collapsed and several other buildings were severely damaged.
- In **1988** heavy rainfall triggered floods, **landslides and debris flows.** A debris flow destroyed almost the whole village of Rowo Reke and claimed 48 lives. Also Aeisa village 2km northwest of Ende was partly destroyed by a debris flow. The road between Ende and Detusoko was blocked in 11 places.
- In **1992** an **earthquake** hit the region. In Kabupaten Ende 25 people lost their lives in collapsing buildings, damages of the quake can still be seen in the city.
- In **2003** heavy rainfall triggered **flashfloods, landslides and debris flows** all over the province. Kabupaten Ende was worst affected: all major roads were blocked in numerous places and the airport and harbor unusable. A major part of the village of Detumbawa was destroyed by a debris flow killing 27 people. Due to the vast destructions, the city of Ende was cut of from the outer world for more then one week, which caused severe shortages in supplies to treat injured and refugees. It took half a year to repair all damages and bring live in the region back to normal.

Because of various natural disasters the city and its vicinity experienced in the last time, the Ende district administration expressed their urgent demand for support in assessing the existing risk and in assisting to work out and disseminate community based disaster mitigation measures from the Georisk project. In the future the local government wants to establish a comprehensive hazard disaster management system to which they are seeking technical assistance from the Georisk project.

To meet the demand, the Georisk Project carried out comprehensive risk assessment through several field trips, evaluating the geological hazard situation but also assessing the vulnerability of the affected population. This included an analysis of the local decision-making processes, the technical and organizational infrastructure of the local disaster management and current approaches in hazard mitigation and disaster management.

After collecting and interpreting all relevant data, three major groups of hazards were identified, for each of which a specific mitigation strategy was developed:

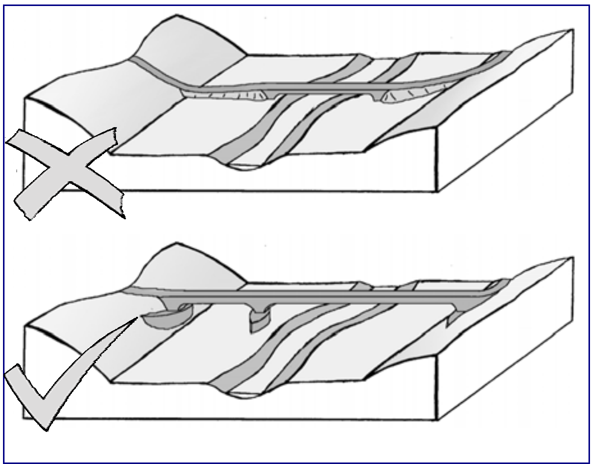
- hazards caused by heavy rainfall,
- hazards caused by volcanic activity,
- hazards caused by earthquakes.

Hazards from Heavy Rainfall

Triggered by extremely heavy rainfall events, landslides, flashfloods and debris flows repeatedly devastate large parts of the district.

Especially debris flows, a mixture of water, gravel, rocks and boulders - as big as houses - pose a high risk to several villages in the region and caused many casualties in the past. Another problem is the fact, that during extreme rainfall events, access roads bridges and other lifelines are often severely damaged or even totally washed away. Even the airport once was flooded during an extreme rain event, so that it could not function as the region's gateway for relief operations.

The Georisk field missions identified those settlements in the district, which are especially prone to these kinds of disasters. It worked out set of disaster mitigation countermeasures and offered a comprehensive dialog to help to reduce the district's vulnerability. These measures include reforestation in upstream areas and on slopes especially prone to landslides, the training of evacuation measures in the most endangered villages and structural measures to maintain crucial infrastructure.

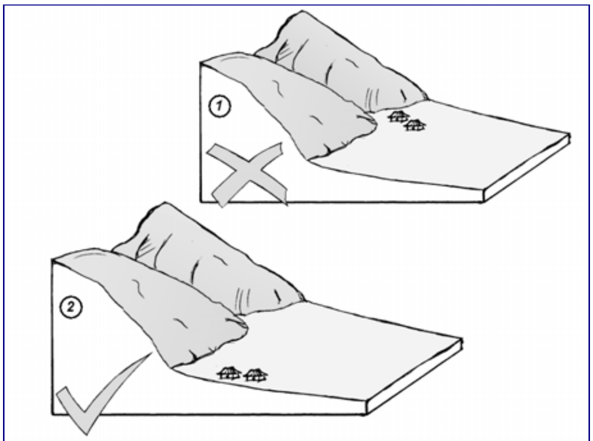


Example on flood-disaster mitigation from the Guidelines for Geohazard Mitigation in Ende District.

During the project's visits to the region, it turned out that the Subdistrict of Ndona (E of Ende) already applied measures towards a well functioning hazard mitigation strategy: One of theses measures was the construction of a massive embankment near the village of Wolosoko, established in cooperation between the district administration and the local population, which recently prevented a debris flow from entering the village and saved many lives. This good example was taken up by the project as one of the local good practices and was propagated to other parts of Ende District. It is believed that it may serve as an example for the whole country.

Volcanic Hazards

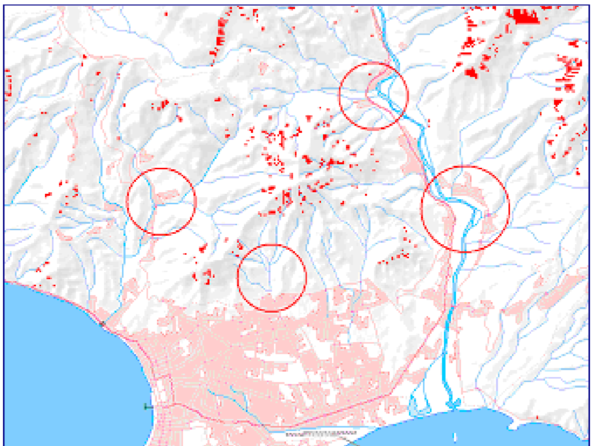
There are two active volcanoes within Ende District, which both - due to their different character and eruption history - need a different disaster mitigation approach:



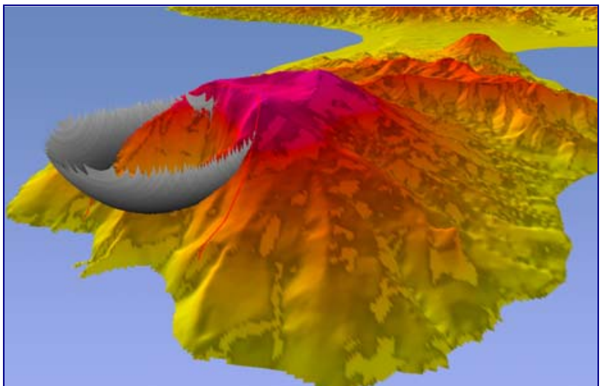
pictorial recommendation for debris flow hazard mitigation

Mount Iya Volcano is located on the peninsula just a few kilometers south of Ende City. Since the mountain's last eruption in 1969, the local population is well aware of their personal exposure to this highly explosive volcano.

Unfortunately Mount Iya already shows precursory signs of a huge slope failure, which is likely to be triggered by one of the next eruptions. Although this giant landslide, comprising of 70 million cubic-meters of rock, would take place on the unpopulated side, just seaward of the volcano, it would trigger tsunami waves and endanger all coastal settlements in the region especially that of the city of Ende (see also plate *Conceptual view of the combination procedure og the synthesized hazard map*).



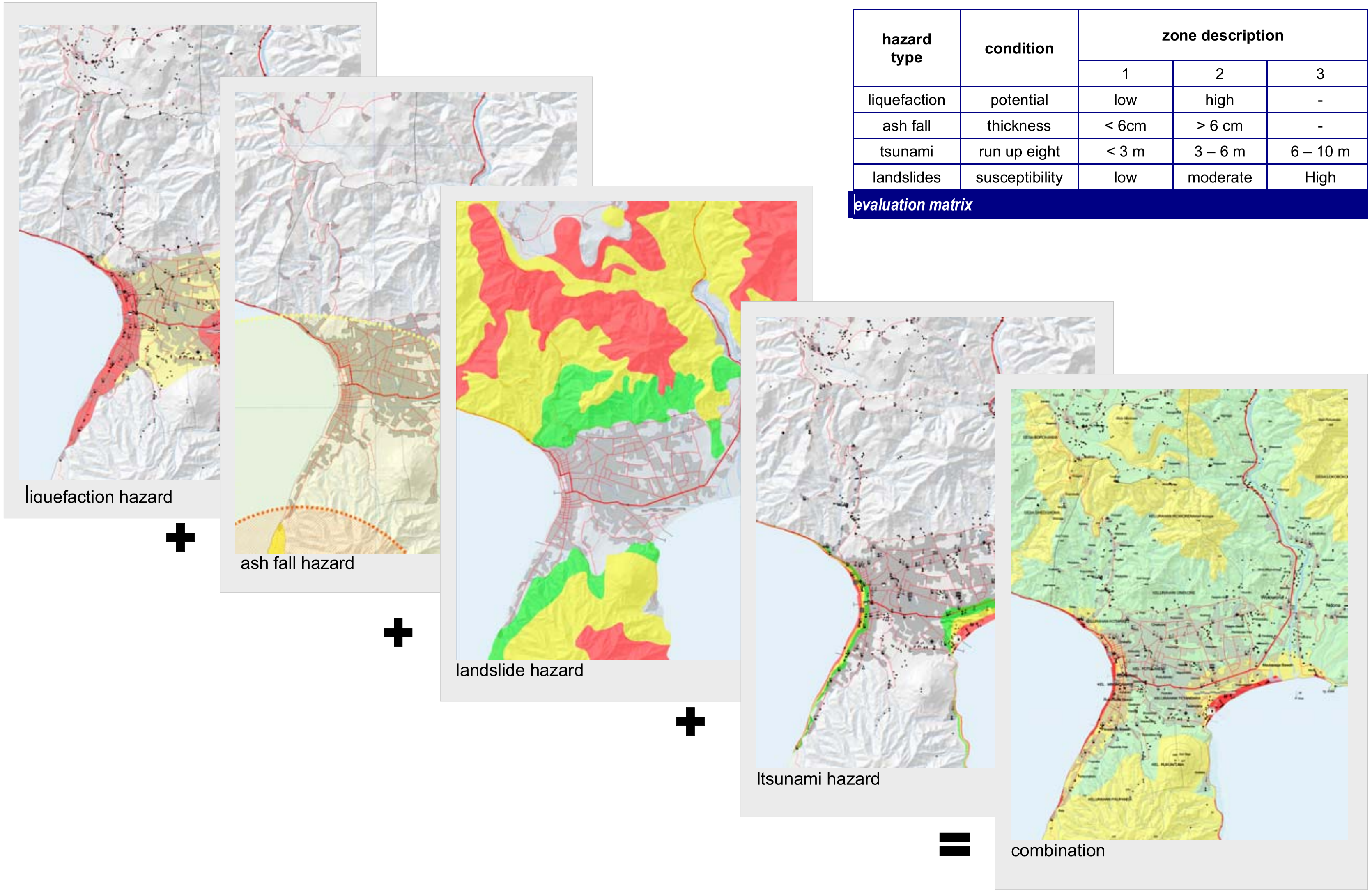
Potential source (dark red) and target areas (red circles) for debris flows



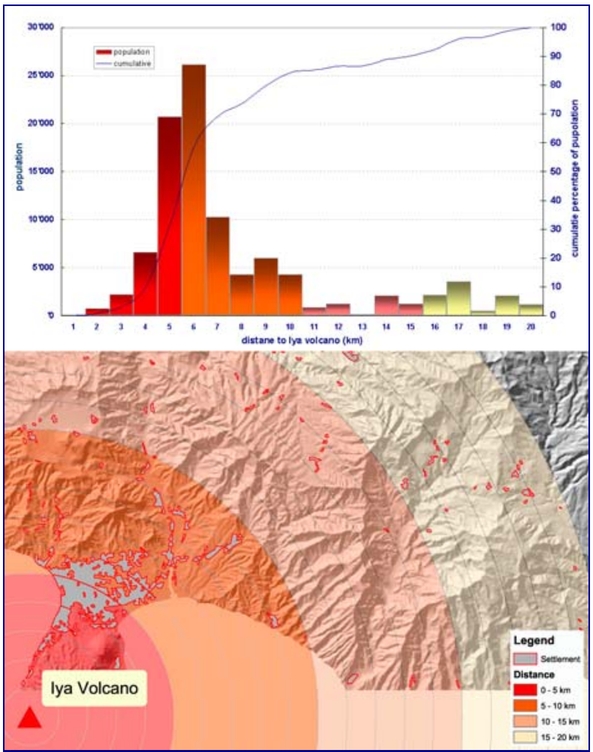
Visual simulation of potentially tsunami generating landslide mass

hazard type	condition	zone description		
		1	2	3
liquefaction	potential	low	high	-
ash fall	thickness	< 6cm	> 6 cm	-
tsunami	run up eight	< 3 m	3 – 6 m	6 – 10 m
landslides	susceptibility	low	moderate	High

evaluation matrix

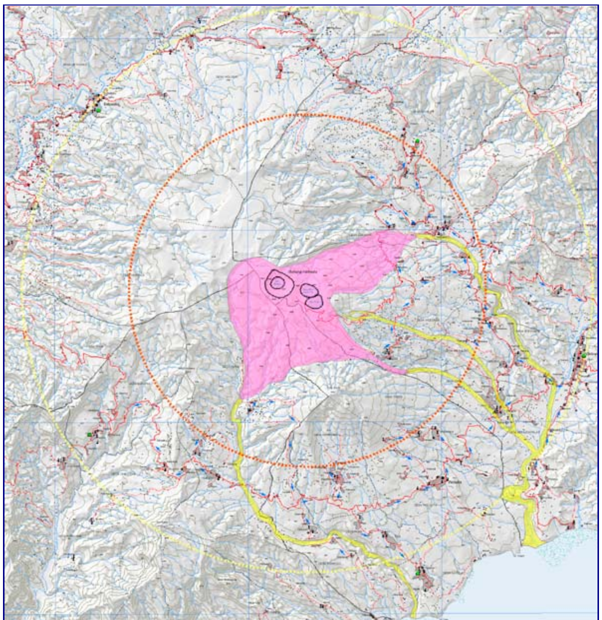


Conceptual view of the combination procedure for the synthesized hazard map



Map and graph showing the population distribution around Iya volcano.

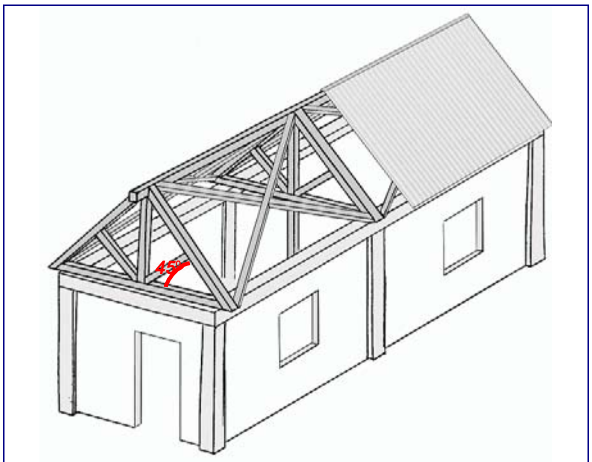
Mount Kelimutu on the contrary is not known for any disastrous eruption in the past. The last phase of activity dates back to a time when the area was still sparsely populated. Still today the three adjacent crater lakes are of high spiritual importance in the local myths and are one of the main tourist attractions in the region famous for its different colored crater lakes. Nevertheless the volcano is still considered as active and investigation of past eruption products revealed, that many settlements are located in the mountain's hazard zones.



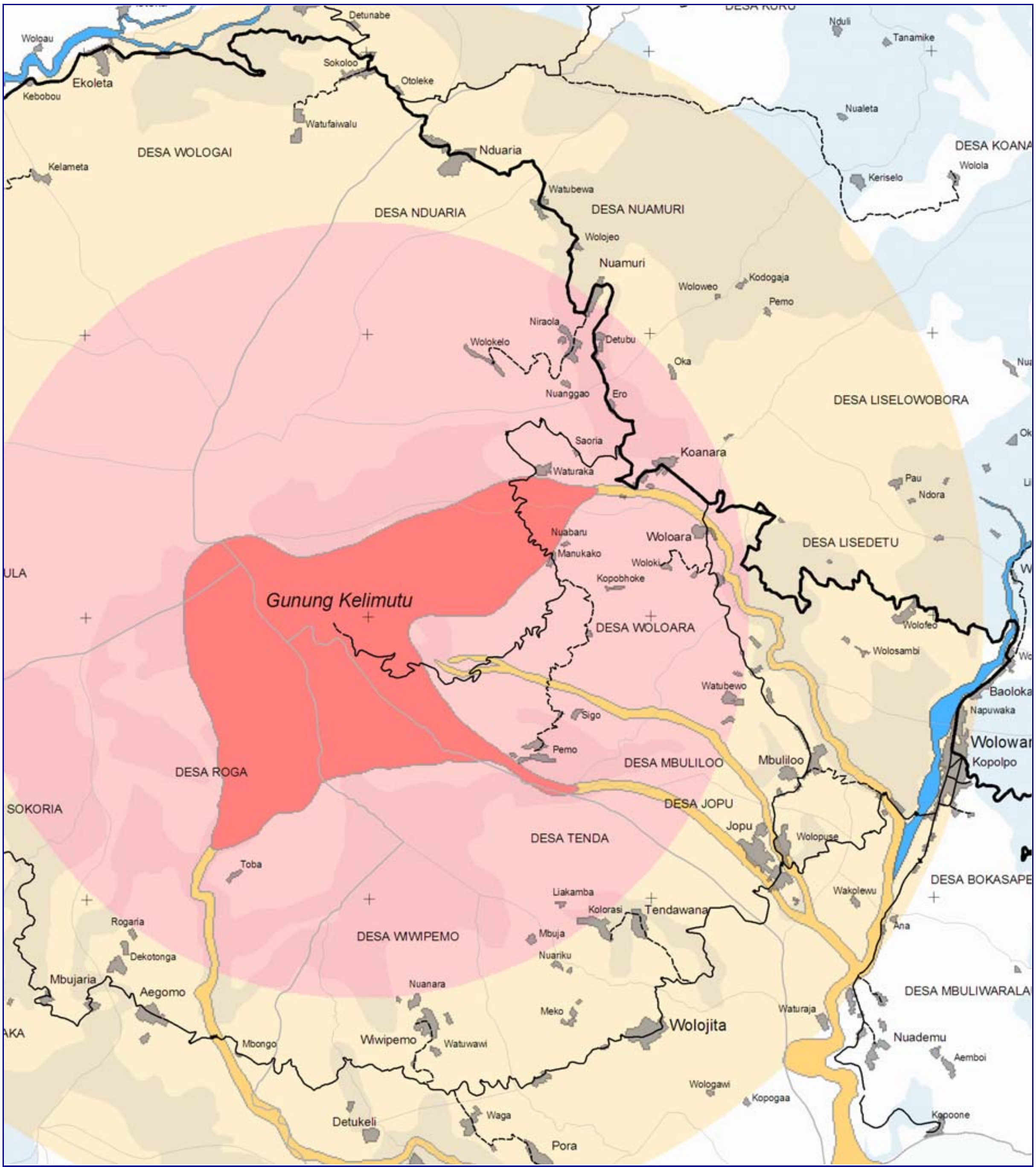
Volcanic hazard map of Mount Kelimutu (reduced scale)

For both volcanoes, Mount Iya and Kelimutu, specific volcanic hazards maps supplemented with mitigation recommendations (evacuation routes, safe places, hospitals, etc.) for different eruption scenarios were developed.

This information was disseminated and discussed with local decision-makers, representatives from the civil societies and key personnel in disaster mitigation and management. It was agreed, that the early warning systems for both volcanoes have to be optimized and that a clear organizational structure is needed in order to quickly respond to any volcanic activity. Furthermore the district administration will use the Georisk information to implement emergency trainings with the local population on a regular bases. For the city of Ende also a special building code was recommended in order to prevent e.g. the collapse of house roofs under the upload of rain soaked volcanic ash.



Roof designed to withstand heavy ash fall.



Example from the Geological Hazard Map for Spatial Planning

Earthquake Hazards

The region is highly prone to earthquakes. And especially the great earthquake of 1992 showed how vulnerable the region is to such extreme events. The quake revealed that the modern urban architecture using steel reinforced concrete and bricks is much more vulnerable to ground shaking then the traditional wooden houses in the villages. Therefore the municipal authorities there see a big demand on guidelines and building codes on earthquake resistant construction in the urban context.

The Georisk Project provided information on the construction principles for single story buildings, which are still the dominant type of houses in Ende City. Furthermore, organizational issues like the technical and medical equipment in hospitals and the necessity for sufficient manpower and machinery in the case of a disaster were discussed with all major stakeholders. Another hazard closely related to earthquakes, tsunami waves might also occur on Ende's south coast. Fortunately, the Ende District Administration transferred the lessons learned in 1992's Tsunami disaster in the neighboring district and set up an effective spatial plan to prevent further housing areas close to the coast. Nevertheless, there are still many settlements located close to shore that might be subject to tsunami waves. As laid out in the previous chapter, Tsunami mitigation strategies are important regarding the situation of the Mount Iya volcano.

Steps towards a Comprehensive Hazard Mitigation

Since the beginning of the cooperation between the District Administration and Georisk Project several steps towards an improved hazard mitigation strategy were conducted. In 2004 the Head of the District signed a regulation on the establishment of a disaster mitigation and disaster management committee. This committee already has taken up its work, but still lacks information, knowledge and skills. To overcome the lack of information, the Georisk Project provided detailed maps and evacuation plans to carry out mitigation activities and emergency response for hazards from heavy rainfall and volcano eruptions.

Especially for the purpose of regional planning, the Georisk Project provided a Geological Hazard Map for Spatial Planning that helps the local governments to identify disaster prone areas and to select appropriate mitigation measures. These mitigation measures are laid down in the Guidelines for Geological Hazard Mitigation in Ende District, which were tailor-made to the District's needs by the Georisk Project. This set of information will be incorporated into the District's official regional development plan and will be backed by regulations on hazard mitigation measures. Also regular fiscal allocations are envisaged to be taken up in the yearly development budget.

Field training for key personnel in hazard mitigation and disaster management.

To improve the skills of the key personnel in hazard mitigation and disaster management a three-day training course was given by the Georisk Project, which enabled 20 staff member from all relevant local government institutions, including Police and Military Forces to identify hazard situations and how to apply effective mitigation measures.

Future tasks to further strengthen the local disaster mitigation efforts include institutional reforms to guarantee a smooth and effective emergency response. The need for such a clear organizational structure could be visualized in regular emergency trainings involving decision-makers, independent experts and the local population.

Successful debris-flow mitigation in the village of Wolosoko.

Another task is the establishment of more effective early warning systems especially in the field of volcano observation. Therefore it should be considered, that the technical equipment is only one link in the chain of early warning. At least as important as sophisticated technology is the ongoing human observation and maintenance of this equipment in order to guarantee its permanent functioning and to pass on all relevant information to the decision-making personnel.

District of Sikka (City of Maumere)

The north coast of Kabupaten Sikka (Flores, NTT) with the district capital of Maumere was chosen as study area for assessing the "Vulnerability of coastal areas in Indonesia to Tsunami".

In 1992, this area experienced a major earthquake and a tsunami with run-up heights exceeding more than 20 meters; more than 2000 people lost their lives. Since this was one of the most recent tsunami events in Indonesia, it was taken as the most suitable place for a tsunami hazard and risk assessment. Both, the fact that this event has occurred relatively recently and thus the perception of the population is still very vivid, and that some mitigation measures were put in place, Maumere provides a good example for studying all aspects of the mitigation process.

Wuhring village, damaged by the tsunami

Aims of the fieldwork

The fieldwork in Maumere was conducted with the purpose to

- gather relevant tsunami related information (topographical, geological, technical, economical, and social),
- assess the institutional response of the 1992 tsunami disaster,
- identify the relevant key institutions, stakeholders and decision makers regarding tsunami risk mitigation,
- assess the social and economic vulnerability of the city and surrounding areas,
- propose recommendations for Tsunami mitigation measures to stakeholders and decision makers .

Activities during the fieldwork

To achieve the envisaged results, the following activities were carried out:

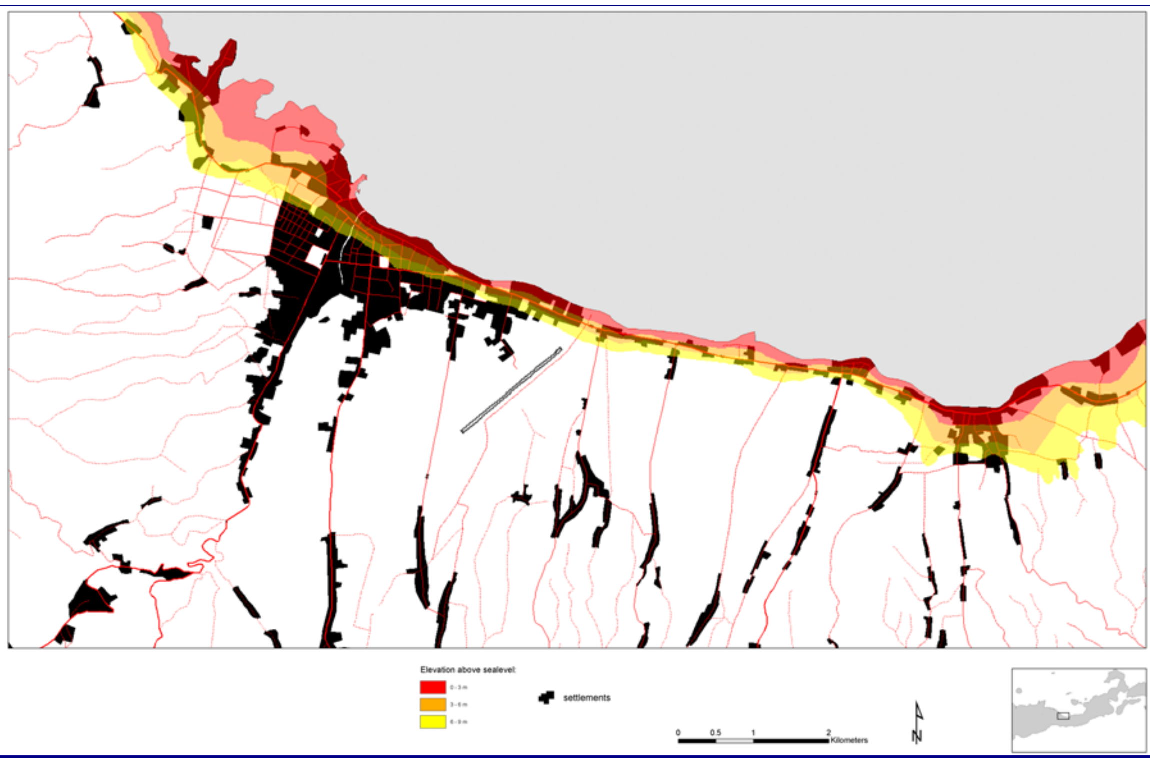
- **Mapping in tsunami threatened areas**
  Mapping and assessing the building structure of the coastal areas of the city of Maumere, concerning type of building (predominantly stone, wood or bamboo), number of storeys, use of buildings (residential, business) as well as the density of the buildings.
- **Interviewing of local institutions, stakeholders and decision makers**
  Identification of responsible institutions concerning tsunami risk mitigation on district level government and private institutions, and inquire about:
  - emergency and relief actions of the local government during and after the 1992 event,
  - overall economic impacts of the 1992 tsunami,
  - tsunami risk mitigation measures officially implemented since 1992,
  - evaluation of the coping capacity on possible future tsunami hazard,
  - actions / measures required for proactive mitigation,
  - information on the tsunami event from local newspapers, archives and reports,
  - the official economical and social data on the district (collected at BPS), tourism office .
- **Interviewing the tsunami exposed population**
  The main focus of the fieldwork was to interview the local people who are living in tsunami prone areas. Around 100 households in the coastal area were visited and questioned. The aim was to get information from people living in tsunami prone areas based on a standardized questionnaire about their:
  - social and economic background,
  - experience and knowledge about geohazards, especially Tsunami,
  - personal reaction during the Tsunami event in 1992,
  - risk perception of a possible future threat from a tsunami.
- **"Sosialisasi" of preliminary results**
  Preliminary results from the ongoing study including recommendations on how to better protect themselves and their assets from tsunami hazard as well as knowledge about possible precursors of tsunami and the appropriate self help actions were distributed among and discussed ("sosialisasi") with selected groups of representatives from the local government and from the civil society groups. Among the stakeholders were also politicians, decision makers as well as representatives of all religious groups.

The 1992 Tsunami event

The Tsunami in 1992 hit the north coast of Kabupaten Sikka almost unprepared. Although small to medium size earthquakes occur every 3 to 5 years in the regency they normally don’t cause much damage. The last big tsunami event that was reported from Sikka district occured in 1928 after the eruption of the Rokatenda volcano. This tsunami hit the island of Palue around 60 km west of Maumere. Due to this fact the people in Sikka regency had almost no memory or experience of a tsunami event. Although there is a term for the event Tsunami existing in some native local languages (Sikka and Buginese language) there was no perception of risk from this threat.

The earthquake which triggered the Tsunami reached a magnitude of 7.5 on the Richter scale and happened on the 12th of December at noon. The main shock caused severe damage to many houses. Especially masonry buildings could not withstand the horizontal and vertical shaking and many of them collapsed. For minutes, the shaking was so intense that people were not able to stand by themselves. People fled the buildings and had only little time to organize themselves and to help others. Outside the houses people felt safe and they began to search for relatives and friends. Five to ten minutes after the shocks (depending on the location) the first of the three ocean waves approached the shore. As people realized the incoming waves they started to run uphill for higher ground.

Fortunately the run-up height of the tsunami in the densely populated area around the city of Maumere was only 2 to 4 m, and thus significantly lower than the maximal observed of 26 m to the west. For this reason, many people were able to flee some distance before the tsunami could reached them with an already weakened force. The tsunami destroyed wood and bamboo houses on the coastline and washed them with the surge current to the sea. Boats were pushed inland or swept away totally. Objects floating in the water, like logs or roofs, were turned into perilous projectiles by the force and speed of the wave. Most of the damage and casualties occurred in Wuhring, a densely populated Buginese fishing village located on a flat peninsula that was totally covered by seawater, and on Babi Island where the tsunami hit the complete perimeter of the island. The waves rolled around both sides of the island, superimposed and amplified on the leeward side, and washed away two villages on the flat sand beach.



Tsunami hazard map of Maumere and vicinity

As a first step the project prepared a tsunami hazard map showing the coastal areas of Maumere and vicinity with potential run-up heights derived from a digital elevation model.

Prior to this map and as the result of a field mapping activity in the aftermath of the event, in 1993 staff of DGMAE prepared a map showing the liquefaction potential of Maumere and its vicinity.

Disaster Management

During the tsunami event in 1992 the emergency and relief actions were hampered by local specific disadvantages. Even more than ten years after the disastrous event is has to be acknowledged hat almost all of them are still holding true for today and are seen as serious obstacles for a pro-active disaster mitigation.

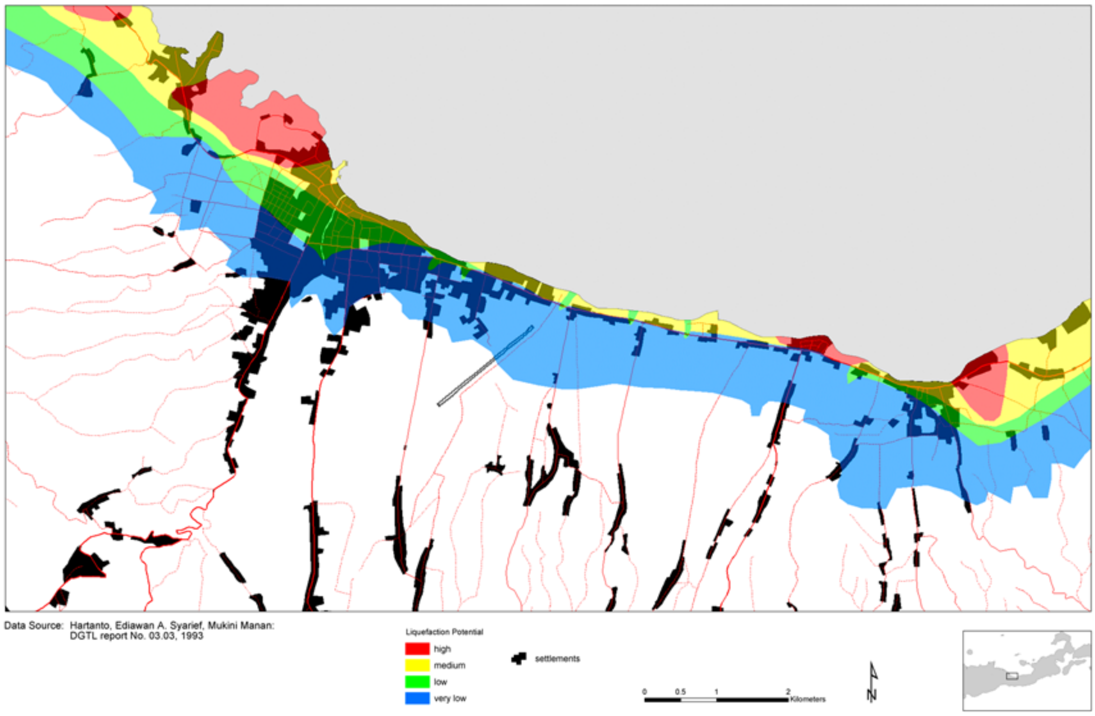
- **Roads**
  The roads from Maumere to the villages along the north coast are located almost directly at the coastline and these roads (especially secondary ones) were interrupted by erosion, landslides, or rock falls. For this reason, the access of aid and rescue teams was hampered.
- **Communication**
  The availability and quality of communication infrastructure decreases rapidly from Maumere towards the remote villages. Even nowadays there is no phone line or cell phone coverage in some of the villages. Thus, information about the situation in the remote areas has to be delivered personally. It is still a common practice that the head of the village sends someone by foot to report the situation to Maumere if villages are disconnected.
- **Remoteness**
  The islands belonging to Sikka district represent a special case. They can only be reached by boat in three to six hours. In 1992 only Palue island was equipped with a radio transmitter connection to the north coast of the neighboring district. Therefore the situation on the islands could be assessed only days after the event occurred. On many islands the people had to take their own actions like evacuating by boat to Maumere which caused some chaos as they did not know that the situation in Maumere was worse.
- **Unclear responsibilities**
  No central institution was responsible to keep and distribute to other authorities the information and data from previous tsunami and other geohazards events. As a result, almost all the knowledge and advice given after the 1992 tsunami is no longer available, neither with the population nor with the official administration.
- **Weak law enforcement**
  Based on the recommendations from a Japanese research team there were actions taken by local institutions after the 1992 event like signposting dangerous and safe areas. But until 1995, these signs have disappeared, probably due to vandalism. Another action by the local government was the relocation of the population from areas that suffered the most severe tsunami impacts like Babi Island or Wuhring and some other coastal villages to Nangahale and Nangahure. However, after some time the people moved back to their original places mostly because of economic reasons (e.g. their “old place” has a better harbor, lies closer to the sea). This is quite understandable as there is a lack of suitable living alternatives for these fishermen and no enforcement of the relocation decision took place.
- **Insufficient advice**
  There is a lack of knowledge about protection measures in local institutions as well as local communities, although there is a demand for information about tsunami hazard and risk from local officials. For this reason they do not take any actions against the tsunami threat.

Vulnerability

The social vulnerability of the local population to tsunami has to be rated still very high despite the disastrous experience the people of Maumere made during and after the 1992 event. This is related to their cultural, religious, educational and economic background.

Interviews and personal observations showed that still a lot of people live in Tsunami prone areas, very close to the coast. Even if people know that they are living in a dangerous area, they do not think of moving away as living in such an environment is traditional. They make their living from fishing, and they see the sea as part of their cultural background.

Only a few of the interviewed people have ever thought about moving further inland and those who did, mentioned the economic barrier of high costs for land and houses as one reason to stay in their original place. Another inhibiting factor is religion. The people on Flores are generally very religious with animism still playing an important role in their faith. They bury their ancestors close to their homes or villages and keep a close relationship to the dead. The graves and burial sites are places of worship and therefore not easily left behind by moving away.



Liquefaction potential map of Maumere and vicinity

Most of the Islamic people in coastal regions form close communities with strong inter-family relations. They are often descendants of migrants from other parts of Indonesia, mostly from Sulawesi. They usually don't mix with the Christian majority on Flores.

Only very few people knew the relationship between the strong ground shaking from an earthquake and the possibility of an approaching tsunami. This knowledge was derived through oral transmission from ancestors. Only a very low percentage of people received any education about geohazards in school. Those persons who were aware of a tsunami threat, evacuated inland directly after the earthquake in contrast to most other people who started to evacuate inland only as they saw the rise of the sea. Some people were even drawn to the shore by curiosity about the phenomenon of a far receding sea.

Widespread knowledge about the possible relation between strong ground shaking and a tsunami could save many people's lives in future events. Sources of information are mostly the media (TV and newspapers).

Although there are cases of a basic understanding about where safe areas are to be found in case of a tsunami, people don't see this as a threat for their personal future. A strong relationship could be recognized between the personal risk perception of a possible natural disaster and religion. People normally believe that these kinds of disasters are up to a higher power and that their faith can protect themselves. Consequently they think that there is no need to take precautionary measures. Many persons who survived the tsunami of 1992 often assumed "I survived once and I will survive in the future."

The economical vulnerability of the population in this part of the Kabupaten Sikka is rated moderate. The base of income for most of them is based on subsistence. A serious destruction of their life base, for example their boats, their harvest or fishing tools would leave them without any reserves.

The Gross Domestic Product (GDP) of the Kabupaten in general in 2001 shows a strong dependence on the agricultural sector (43% of GDP) and a strong public sector (44% of GDP). The few industries (13% of GDP) in Sikka are mostly related to the processing of marine products They are usually located in the proximity of the coast and therefore highly endangered by tsunamis. A destruction of the facilities would result in the closure of activities as happened to fish and sea grass processing plants after 1992.

Semarang

Geohazard facts

The harbor city Semarang is the capital of the province Central Java and the most urbanized partner community of the project. It is split in 16 sub-districts and covers the size of 373 km² and has a population of approximately 1.3 million people, corresponding to a population density of 3850 people per km². The population has doubled within the last 60 years and is currently growing by roughly two percent each year. This growth rate has created a high demand for settlement areas, particularly since the nineties. The sub-districts are quite diverse in terms of their degree of urbanization. Whereas the central sub-districts of Semarang have densities of up to 17 000 people per km², the southern parts are much less urban. However, while in the nineties development took place more in the northern flat sections, the center of developing has now shifted to the hilly southern parts.

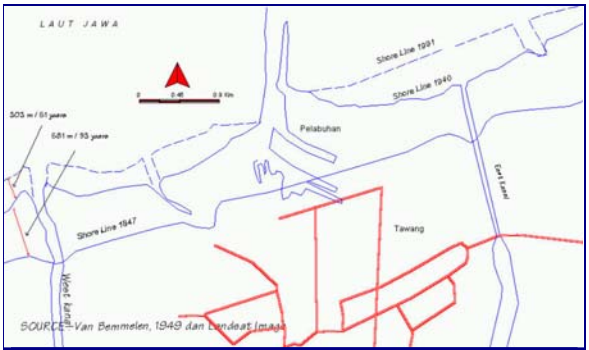
Land subsidence problems at the Semarang main railway station, built in 1882 at 2m above sea level, it is now regularly submerged by sea water

According to regional development planning, the function of Semarang as a harbor for the region should become more important in the future. Some 2 800 hectares of industrial areas in the subdistricts Genuk and Tugu have been prepared for future development of trade and transport facilities. Currently, around 5 000 enterprises are operating in Semarang, of which about 100 are large industrial plants and some 1 800 are small industry firms. Industrial production focuses on the food sector, hardware, chemicals, and textiles. Semarang is also an important education center with many universities.

In terms of geohazards, the city can roughly be divided in two parts; one with land subsidence problems and one with landslide problems. In the northern part, close to the coastline, the city has been subject to land subsidence for many years.

District	Subdistrict	Date of occurrence	Damaged houses	People killede	People injured
Lempongsari	Gajahmungkur	19-Oct-96		1	
Lempongsari	Gajahmungkur	19-Oct-96		1	
Jomblang	Candisari	19-Oct-96			6
Candisari	Candisari	20-Oct-96			6
Sadeng	Gunungpati	09-Jan-96	5		
Pongangan	Gunungpati	02-Apr-98	16		
Pongangan	Gunungpati		16		
Beji	Ngalian	27-Jan-00	1		
Sukorejo	Gunung Pati	2-Feb-02	13		
Gombel	Banyumanik	8-Feb-02	20		
Lempongsari	Gajahmungkur	16-Feb-02	6	7	2
Kalipancur	Ngalian	16-Feb-02	2		3
Ngemplak	Semarang barat	6-Mar-02	3		
Sendangdowo	Tembalang	2003	3		
Tinjomoyo	Banyumanik	2003	1		
Bendungan	Gajah Munngkur	2003	1		
Bojongsalaman	Semarang Barat	2003	1		
Lempongsari	Gajahmungkur	2003	2		
Kalibanteng	Semarang Barat	2003	1		

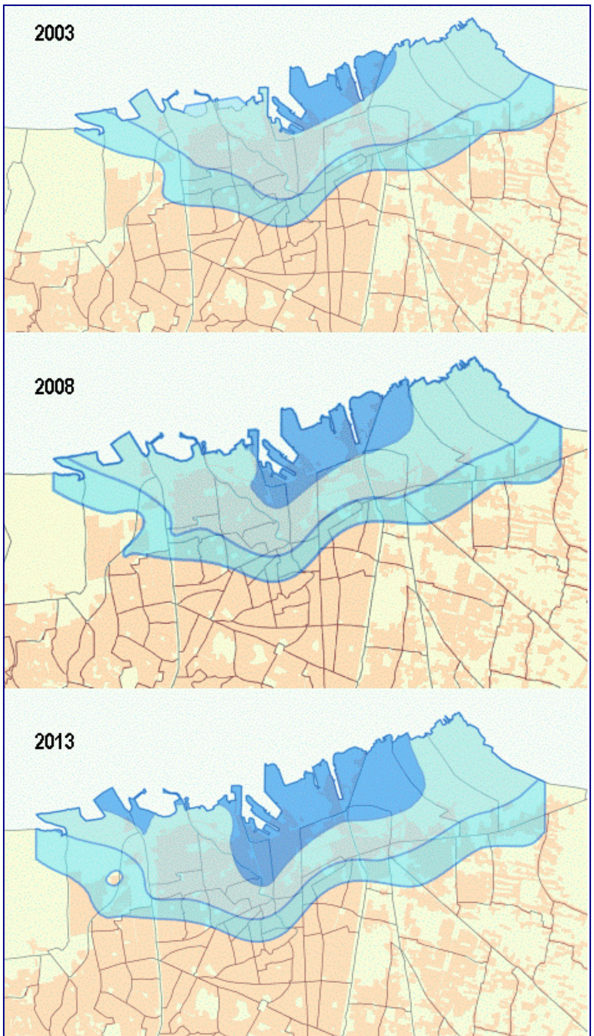
List of the most recent landslides in Semarang



Progression of shoreline between 1847 and 1991

The main railway station, built in 1882, is subject to flooding almost every year. Although more than 75 cm of sand and gravel have already been accumulated in recent years, the problem persists. The areas around the main station and close to the harbor are almost constantly flooded. Most of the infrastructure in the central city, like roads, bridges, and utility lines has been affected, and annually the city must spent large amounts of money on their maintenance. Many of the buildings in that area are already lying more than 50 cm below the current, i.e. the already elevated surface. Thus, many of these buildings have to be protected by surrounding walls. Every day life is also hampered in the others parts of the city lying close to the coastline, not only in the rainy season.

Land subsidence has been subject to intensive analysis for many years. In the central harbor area rates up to four cm per year could be observed. In about 50 % of the city rates between one and two cm can be seen. The main cause for the subsidence is over-extraction of groundwater from the over-saturated alluvial sediments deposited by the river Garang. Annually, around 40 million m³ groundwater are extracted, resulting in a drop of the groundwater level at about one meter per year. In 1998 the private demand for groundwater resources was about 58 million m³, in addition to ten million industrial demand. The water supply for roughly 40 % of the population or 35 % of the buildings is distribute by PDAM, the local water management authority. Eleven percent of the houses draw their water from public wells, whereas the rest has dug their own wells and take water from the uppermost aquifer system. Many of these wells are dug without permission. In addition to this, the city's groundwater resources are subject to significant seawater intrusion and contamination by industrial and private sewage. The seawater intrusion is progressing inland on a steady level; in some water samples taken from wells close to the coastline, values of up to 1 300 mg/l Cl were found. There is no sewage system in place; garbage and sewage are washed to the sea during river floods. Less than 50 % of the households have septic tanks, garbage collection only reaches about 40 % of the households, and the rest is disposed of in open trenches or elsewhere. The operation of three landfill sites was stop some years ago and just one is left. In addition to the above-mentioned land subsidence the city is confronted with increasing sand deposition along the shoreline and the related coastline progression. In an sketch map from 1847 the .harbor was located more than 880 meters further inland from its present location, which results in an average progression rate of approximately 6m/a. A figure of more than 6 km total progression of the coastline in the last 400 years seems to be realistic. Most of the sediment load is originating in the catchment of the river



Elevation projections (dark blue: below sea level, moderate blue: 0 - 50cm, light blue: 50 – 100 cm) for Semarang, pale red color indicates areas used for settlement, yellow color indicates the sub-districts

Ganga, which also drains the slopes of the Ungaran volcano.

The city of Semarang is a good example to show the vulnerability of the society to two types of geohazards and their inter-relation: because of the land subsidence problems in the city center, many wealthy people have decided to move further south in the hillier areas – only to experience landslide problems due to the geological disposition of that area. The vulnerability is revealed by the insufficient water supply, a cost increase for water supply services, in reduced real estate prices, and in limitations for trade and industrial production.

Activities

The main activities in Semarang are concentrated on the assessment of the risk potential. Both, the socio-demographic situation, as well as the economic risk are assessed. The target is a cost-benefit analysis. By utilizing the tools outlined above in the chapter on risk and exposure assessment, already important steps towards this goal could be made. First, the measured subsidence rates were used for elevation projections. In a second step, these projections were then intersected with infrastructure, administrative areas, and land use information.

For the first time in the country, the idea to use projections of future developments is used for disaster risk assessment. This is seen as an important issue, because prevention and preparedness are an integral part of any mitigation strategy.

By methods outlined in the risk assessment chapter, figures about the population and building infrastructure exposed to subsidence problems could be derived. The figures show a dramatic increase in the portion of the population that will be affected by land subsidence. Considering the already critical situation, the conclusion that the problems described above are worsening, is evident and immediate action is a necessity.

Not only the figures for the population and housing situation show this trend, but also other critical infrastructure is affected, as shown in the table below.

elevation zone	description	length (km)
below sea level	railway	2.5
	road class 1	12.5
0 - 0.5 m	food path	4.1
	railway	8.9
	road bridges	12.6
	road class 1	135.6
	road class 2	6.2
0.5 – 1 m	food path	4.6
	railway	2.5
	road bridges	6.6
	road class 1	94.3
	road class 2	12.4

infrastructure line features exposed to subsidence (current situation)

elevation zone	year	exposed population	exposed houses
< 0 m	2003	8000	1600
	2008	24000	5000
	2013	42000	8700
0 – 0.5 m	2003	88000	19000
	2008	93000	20500
	2013	90000	20000
0.5 – 1 m	2003	66000	15500
	2008	60000	14000
	2013	58000	13500

Development of population exposed to land subsidence

elevation zone	feature type	count
below sea level	government office, village	1
	house of worship, unclassified	2
	house of worship, Mosque	7
	house of worship, Church	1
	school	1
	hospital	1
	gas station	15

infrastructure point features exposed to subsidence (current situation, below sea level, only)

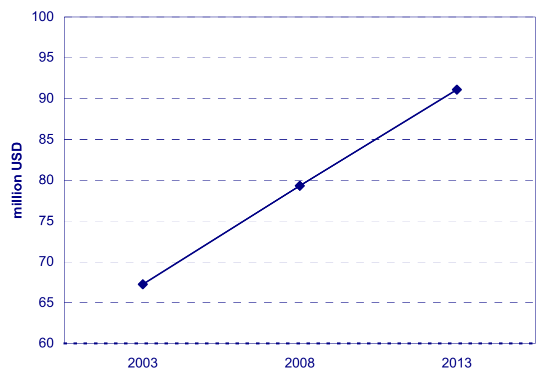
During several visits in Semarang and consultation of relevant municipal authorities, figures unit process for real estate and other land use could be derived.

land use class	description	unit price (USD / m²)
1	settlement	120.00
2	agriculture	0.10
3	forest	0.25

Unit prices for various land use types

In combination with estimations for the damage ratio, i.e. the proportion of a structure affected by a hazard, potential damage figure could be derived. Based on international experience the damage ratios were set to 0.1 in the elevation zone below sea level, 0.07 in the zone below 50 cm, and 0.05 in the zone up to one meter. By multiplying the affected area with the unit prices and the damage ratio the potential monetary damage, i.e. the direct economic risk can be calculated.

The resulting graph shows the increase of the direct economic costs due to land subsidence hazard. Although this first assessment s still of a provisional character, the order of magnitude at which the risk is estimated clearly indicates, that actions to reduce this problem is required. Considering, that the land subsidence risk is



Trend of direct economic cost due to land subsidence risk

accompanied by additional ones, the pressing need for risk reduction is clerkly shown. With the help of these estimates, there is now good basis for comparing the costs of disaster risk reduction to the costs for not acting accordingly.

List of laws and regulations related to natural disaster management

Year	Number	Title
1990	20	Government Regulation concerning Control of Water Pollution
1993	51	Law regarding Environmental Impact Assessment
1997	23	Law concerning Environmental Management
1999	22	Law regarding Regional Governance
1999	27	Government Regulation concerning the Environmental Impact Assessment
1999	41	Law concerning Forestry
2000	10	Presidential Decree concerning Environmental Impact Assessment
2000	25	Government Regulation concerning Government Authority and Provincial Authority as an Autonomous Region
2000	62	Presidential Decree concerning the National Spatial Planning Coordination
2000	88/Kpts/M /2000	Decision of the Minister of Settlement and Regional Development concerning the Establishment of Working Group in the National Spatial Planning Coordination Board
2001	2	Decision of the Secretary of the National Coordination Board for Natural Disasters Management and Matters of Refugees concerning General Guideline on Disaster Mitigation and Treatment of Refugees
2001	3	Presidential Decree concerning the National Coordination Board for Natural Disasters Management and Matters of Refugees
2001	22	Law concerning Petroleum and Natural Gas
2001	56	Government Regulation regarding the Reporting of Realization of Regional Administration
2001	82	Government Regulation concerning the Management of Water Quality and Water Pollution Control
2001	111	Presidential Decree concerning the Amendment of the Presidential Decree number 3 of 2001 concerning National Coordination Board for Natural Disasters Management and Matters of Refugees
2001	1279/MenKes/ SK/XI/2001	Decision of the Minister of Health concerning the Guideline on the Evaluation of Disaster Risk at Provincial and Regency/Municipality Levels

Abbreviations and Acronyms

ADB Asian Development Bank, Philippines, Manila

ADPC Asian Disaster Preparedness Center, Thailand, Bangkok

BAKORNAS PBP Sekretariat Badan Koordinasi Nasional Penanggulangan Bencana Dan Penanganan Pengungsi

National Coordination Board for Disaster Management and Handling of IDPs/Refugees

BAKO-SURTANAL Badan Koordinasi Survei dan Pemetaan Nasional.

National Coordinating Agency for Surveys and Mapping

BangDa Direktorat Bina Bangda, Departemen Dalam Negeri

Division or local development Ministry of Home Affaires

Bappeda Badan Perencanaan Pembangunan Daerah

Regional development planning board at provincial, district and municipal level

Bappenas Badan Pembangunan Nasional

National development planning board

BGR Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover, Germany

Federal Institute for Geosciences and Natural Resources

BMG Badan Meteorologi dan Geophysik

Meteorological and Geophysical Agency National Seismological Center

BMZ Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung

Federal German Ministry for Economic Cooperation and Development

BPD Badan Perwakilan Desa

Village representative council

BPPTK Balai Penyelidikan dan Pengembangan Teknologi Kegunungapian

Volcanological Technology Research Center

BPS Badan Pusat Statistik

National Bureau of Statistics

Bupati Head of a District/ Regent of a Regency

Camat Head of a Subdistrict

CBDRM Community Based Disaster Risk Management

DGGMR Direktorat Jenderal Geologi dan Sumberdaya Mineral

Directorate General of Geology and Mineral Resources

in the

Department of Energy and Mineral Resources

DGMAE (DTLGKP) Direktorat Tata Lingkungan Geologi dan Kawasan Pertambangan

Directorate of Geological and Mining Area Environment

in the

Directorate General of Geology and Mineral Resources

DPR Dewan Perwakilan Rakyat

House of Representatives/ national level)

DPRD Dewan Perwakilan Rakyat Daerah

House of Representatives at provincial-, district and municipal level

DVGHM Direktorat Vulkonologi dan Mitigasi Bencana Geologi) Directorate for Volcanology and Geological Hazard Mitigation

in the

Directorate General of Geology and Mineral Resources

ECLAC United Nations,

Economic Commission for Latin America and the Caribbean

GBHN Garis-Garis Besar Haluan Negara

National policy guidelines

GIS Geographic Information System

GTZ Deutsche Gesellschaft für Technische Zusammenarbeit

INGO International non-governmental organization

ISDR United Nations - International Strategy for Natural Disaster Reduction

ITB Institut Teknologi Bandung

Institute of Technology Bandung

Kabupaten Regency district

Kepala Desa Head of a Village

KIMPRASWIL Departemen Permukiman Dan Prasarana Wilayah

Direktorat Jenderal Tata Perkotaan Dan Tata Perdesaan

Directorate General for Spatial Planning

in the

Ministry for Public Works

Kota City / town

LAPAN Lembaga Penerbangan Antariska

National Institute of Aeorspace and Aeronautics

LINMAS Lingkungan Masyarakat

Task force at local community/village level especially for disaster management

LKMD Lembaga Ketahanan Masyarakat Desa

Village community resilience board

Lurah Head of municipal subdistrict (Kelurahan)

MPR Majelis Permusyarawatan Rakyat

National Consultative Assembly

NGO Non-governmental Organisation

NTB Nusa Tengara Barat

West Nusa Tengara

NTT Nusa Tengara Timur

East Nusa Tengara

Oxfam Oxfam GB - Indonesia Office

Polisi Pamong Praja Regional government regulation enforcement agency

PP Peraturan Pemerintah

Government Regulation

PROPEDA Program Pembangunan Daerah

Five year development plan at provincial-, district and municipal level

PROPENAS Program Pembangunan Nasional

National five-year development program

PUM Departemen Dalam Negeri

Direktorat Jenderal Pemerintahan Umum, Direktorat Perkotaan

Directorate General of Publik Administration

Director Urban Affairs

in the

Ministry of Home Affairs

PUSKESMAS Pusat Kesehatan Masyarakat

Basic Health Center

SABO Sabo Technical Center - Integrated sediment-related disaster management

in the

Departemen Permukiman dan Prasarana Wilayah / Directorate Sumber Daya Air

Yogyakarta

SATGAS Satuan Tugas

Task force at sub-district level especially for disaster management

SATKORLAK Satuan Koordinasi Pelaksanaan Penanggulangan Bencana

Provincial unit for coordination of disaster management

SATLAK Satuan Pelaksana Penanggulangan Bencana

Unit for implementation of disaster management at district-/municipal level

UGM Universitas Gadjah-Mada, Yogyakarta

Gadjah Mada University, Yogyakarta

UNDP United Nations Development Program

UN-OCHA United Nations Office of Humanitarian Affairs

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