REVITALIZING INSTITUTIONS TO ENHANCE CLIMATE FORECAST APPLICATION IN EAST NUSA TENGGARA PROVINCE, INDONESIA

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ABSTRAK

Prakiraan iklim sangat penting dalam pelaksanaan pembangunan secara keseluruhan. Data dan informasi tentang iklim ini sangat dibutuhkan di wilayah Provinsi Nusa Tenggara Timur. Wilayah ini perlu mengoptimalkan program pembangunannya dengan memanfaatkan prakiraan iklim yang lebih baik. Informasi yang tersedia saat ini belum sepenuhnya digunakan sebagai informasi peringatan dini dalam perencanaan dan pembangunan pertanian. Peralatan dan perlengkapan iklim ternyata dimiliki dan dikelola oleh beberapa lembaga dan data yang dipunyai hanya digunakan untuk kepentingan sendiri. Makalah ini menyarankan agar kualitas data dan informasi tentang iklim dapat ditingkatkan, termasuk pemutakhiran peralatan dan perlengkapan terkait dengan pengukuran iklim. Pembentukan Forum Iklim diusulkan untuk merevitalisasi lembaga terkait dengan memanfaatkan data dan informasi iklim yang tersedia serta untuk mengintegrasikan berbagai sumberdaya yang ada untuk pembangunan.

Kata kunci : *prakiraan iklim, Forum Iklim, akuntabilitas lembaga, pembangunan regional*

ABSTRACT

Climate prediction is important in the overall development. NTT Province is considered as the area to which climate data and information are very critical. This region needs to optimize its programs to enhance climate forecast application for better regional development. The available climate information is not adequately used for early warning information for agricultural planning and development. The climate equipment and tools are owned and maintained by several institutions with the data used for their own purposes. This paper suggests that the quality of climate information is necessary to improve, so are the climate equipment and tools. The establishment of Climate Forum is required to revitalize related institutions dealing with climate information and to integrate various related resources for development.

Key words : *climate forecast, Climate Forum, institutional accountability, regional development*

INTRODUCTION

East Nusa Tenggara Province (NTT Province) is located between 8° to 12° South latitude and 118° to 125° East longitude with 47,349.9 km^2 of total and area consisting of 566 islands (BPS-Statistics of East Nusa Tenggara Province, 2004). Most of this area is mountainous and hilly and only 42 islands are inhabited. The major development sector in NTT Province is agriculture and most of the farmers are trapped in a structural poverty circle due to low handholding area, unskilled labor, limited capital, and particularly because of the extreme climate conditions (flood and drought). In 2000, about 36.52% (1,425,942 out of 3,937,602) of the people were living below poverty line (Universitas Nusa Cendana, 2003). This information indicates that poverty lead the people to food inaccessibility and, obviously, malnutrition could easily happened at any time in the region.

The total population was 4,088,058 (reported in 2003) with Sikka Regency as the most populous area (total production 276,590 and total area 1,631.92 km^2). Manggarai Regency is the largest area (6,403.92 km^2 with total population 661,337). The average population density is 86.56/km^2 and the Province's capital, Kupang city, is obviously the most densely area (1,732/km^2). The NTT Province comprises of 15 regencies and one municipality with 197 sub-districts and 2,569 villages. More on population, the total number of female is 1.42% higher than that of male (2,073,155 and 2,014,903, respectively). The number of population between 0 to 15 years is 1,503,909 (36.92%) and 60 years and over is 273,805 (6.75%); the rest (2,295,535 or 56.35%) is between 16 to 59 years old. This implies that most of the people are in an energetic condition, and related to agriculture sector activities, such information indicates that manpower in NTT Province is available. In fact, agriculture sector is the main sector that absorbs most of the labor. In 2003, the average per capita income was recorded 2.2 million rupiahs. Kupang City had the highest per capita income (6.4 million rupiahs) and Lembata and West Sumba Regencies were the lowest (1.5 million rupiahs). All of these basic data and information are provided to understand general background about NTT Province.

Food crops sub sector employs most of the labor followed by estate or perennial crops. Roles of forest production, livestock and fisheries are also increasing and continuously developing. Rice and maize are two most important food crops cultivated by the farmers, and production of the two crops increased in 2002-2003. Production of rice (dry unhusked paddy) and maize increased by 8.8% and 0.6%, respectively (from 468 thousand tons of unhusked paddy in 2002 to 509.4 thousand tons in 2003 and from 580.9 thousand tons of maize in 2002 to 583.4 thousand tons in 2003), due to the increases in harvested area (rice) and productivity (maize). Other secondary crops that need less water are also grown by the farmers, such as mungbean and vegetables.

Similar to the other parts of Indonesia, NTT Province has two seasons, namely wet and dry seasons. However, the region has relatively wet for four months (December, January, February and March) and the rest of eight months (April to November) are dry. This condition is a challenge for those concern in agricultural development and in fact, this is the most difficult situation in dealing with agricultural programs in the region. The rainfall is not equally distributed. Eastern part of Flores, Alor, East Sumba and other regions are relatively dry with the average rainfall rate between 800 to 1000 mm per year. The western part of Flores and Sumba islands and in Central Timor are relatively wet with average rainfall between 1,200 to 3,000 mm per year. Given the situation of the Province's biophysical condition, the regional development always with all of its limitations and problems, especially climate change and deals pattern. Agriculture, perhaps, is the most influenced sector by this climate risk in which the future of majority of the household is accounted.

Climate forecast information is usually released and submitted to a number of institutions at provincial level and its lower administrations appear to apply at minimum level. Bappeda (2005) reported that most of the climate data are not prepared with detailed interpretation and mainly used for emergency programs. It is also acknowledged that awareness on the importance of climate data is very low among the officials. In fact, problems come repeatedly every year with various magnitudes at different regions in the province. The recent malnutrition problem may be taken as the best time for adequately using climate information.

Unpredictable climate behavior that varies between regions has been observed for a long time in NTT Province. Official data explain that from June to September the wind flowing from Australia to Nusa Tenggara contains little moisture causing a long dry season. In contrast, from December to March, the wind flows from Asia and Pacific Ocean with massive moisture content causing rainy season. The transitional period of the two seasons takes place in April-May and October-November. Therefore, NTT normally has relatively wet for four months (December to March) and dry for about eight months (BPS, Statistics of East Nusa Tenggara, 2004). The long dry spell has been considered as the main problem causing many natural hazards, including forest fires, water availability, community health degradation, and most recently hunger and malnutrition.

Climate information, therefore, is a base knowledge to launch various programs and its timely availability would affect many activities of different group of the society. At present, application of climate information is important to reform and the information itself is necessary to be standardized for readable technical interpretation and ready for dissemination. All climate stakeholders are expected to actively participate in this new approach. Related institutions would play their respective role to share their knowledge and to apply the information accordingly.

There are two objectives of this paper, namely (1) to present the results of preliminary observation based on two reconnaissance visits to NTT Province and to describe climate forecast applications conducted by several climate stakeholders, and (2) to elaborate efforts to improve climate-related institutions through the integration of their respective resources. These objectives aimed at enhancing climate management in NTT Province to achieve certain level of regional development.

CLIMATE FORECAST APPLICATIONS

Source of Rainfall Data and Information

NTT Province has at least four sources of climate data and information, i.e., BMGD (*Badan Meteorologi dan Geofisika Daerah*/Agency for Meteorology and Geophysics, at provincial level located in Lesiana), Office of Food Crops, Office of Water Resources (SDA/Office of Settlements and Regional Infrastructure), and BPTP (*Balai Pengkajian Teknologi Pertanian*/Assessment Institute of Agricultural Technology - a research center) as shown in Table 1. BMGD is regularly distributes its forecast data to all stakeholders in NTT Province, however, each of these institutes provides their own climate forecast according to their own objectives and claims to be official. It also means that they have their own data format using certain information flow on data distribution. This is considered as ineffective use of climate forecast applications taking into account that these institutions are dealing with the same issue (rainfall data) for regional development according to their own objectives. It appears that such data and information are arguable in terms of accuracy and timeliness and are used separately by the users (regional policy makers and rarely by the farmers) leaving climate forecast applications far from its target.

Table 1. Number of Rainfall Station in NTT Province, 2005

Ownership and managed by	No. of station	Location	Remark
BMG	Cl. 2, Me. 13, Rf. 40	Scattered over NTT region	60% broken; poor knowledge of field worker
SDA	Cl. 19 Wm. 49 Cm. 65	Scattered	30% broken; poor knowledge of field worker
Office of Food Crops	Me. 4	Scattered	n.a.
BPTP	Cl. 10 AWS 3	Scattered in three regencies	Good condition; adequate knowledge of field worker
Total	205		

Note: Cl. = Climate station; Me. = Meteorology station; Rf = Rainfall post; Wm. = Water measurement post; Cm. = Climate monitoring post; A WS = Automatic Weather Station; n.a. = not available.

Source: Raya, F. L. (2005).

The ownership and management pattern of climate stations (climate, meteorology, rainfall/AWS, water measurement tools) are not meaningful in terms of its applications, not to mention maintenance cost, data accuracy and timeliness of information flow. The integration of all rainfall stations in NTT Province into a more professional management has been lately considered to improve coordination and better forecast applications.

The Application of Rainfall Information

It is reported that the rainfall data released by BMGD are unreadable in a sense that data are provided in a certain format without further details on data interpretation. It seems that officials at the lower levels fail to make use of such data for natural calamity preparation. They might not be blamed, but important to look deeper how the data could provide useful information, what is not supplied, and how the data suppose to be interpreted. In fact, the available data could only be used to support publication to express the cause of any local hazard or for emergency condition. It is only use in time of natural hazards such as for critical and immediate decision due to natural disaster. On the other hand, although many offices are negligible to such information, regular data is continually released by BMGD with similar format both for wet season and dry season. Other institutions use their rainfall data and information for their own purposes.

The separate rainfall data ownership and utilization is also reflecting maintenance cost inefficiency. In one hand, broken or degraded equipment without immediate repair should affect data accuracy. On the other hand, to maintain their respective field workers who take note on daily rainfall data is critical due to low delivery time. Moreover, it is unfortunate that most of the active field workers are not supported by adequate knowledge on climate.

Based on interview and secondary data at hand, the past experience of natural calamities in NTT Province has brought some related institutions with implementation of crash programs to help reduce the victims' suffering (food, health, etc.) or help eradicate from the disaster locations (resettlement, shelter, etc.). These efforts are temporary programs that could only effective for a short period of time. In fact, the people need preparation to prevent them from a worse situation; they need an early warning notification before the hazard takes place. In agricultural sector, for instance, the Office of Food Security reports the picture of natural disaster up until August 2004 (Badan Bimas Ketahanan Pangan, 2004). There are 11 regencies including one municipality (covering hundreds of villages) had been affected by the disaster causing the damage of farm and its crops. Rice and maize are two crops mostly damaged causing a great loss and affecting the farmer's income. The Office of Health (2004) admitted that the cause of this disaster is the climate anomaly, drought, typhoon, flood, landslide, and the return of pest's explosion *(kembara* grasshoppers). They were also part of the institutions involved in disaster eradication program. This implies that the local authority

should prepare a substantial amount to support many crash/immediate programs to help the victims. With many similar disasters with different magnitude and coverage the burden of the local administration would be increasing from time to time. So far, there is no indication that this office uses the available climate data and information to overcome or to find a way out of the unfavorable situation. This means that the need of climate information in an integrated and readable format is increasingly important.

In this context, to only point out the institutions that are not using climate data and information for early warning system, may not absolutely correct. Look at the condition of the rainfall equipment and tools, for instance. Based on a recent report by the BMGD, Lasiana Station, the evaluation of rainfall post in Kupang City and Kupang Regency has its main result as follows: 10 out of 17 units of rainfall equipment are heavily damaged. This equipment is recommended to be replaced, not to repair. With this information, nobody will expect the accurate data and information. In addition, some of these posts have no field workers to take daily note and send the data regularly. Three out of seven of the good equipments have no field worker; meanwhile one out of 10 of the broken equipment also has no worker. Taking into account this situation, a replacement of some of this equipment and the appointment of field workers should be taken into account in the first place for better use of climate information.

INSTITUTIONAL ACCOUNTABILITY ON CLIMATE FORECAST APPLICATIONS

Food security resilience has been recently tested all over the country in terms of its availability, stability, and accessibility. Many regions have been affected by the fact that people, particularly those residing in remote areas, were unable to maintain their food availability causing malnutrition or under nourishment with the impact of typical illness especially among their children. They are mostly poor people in rural areas. The long drought in some parts of Indonesia has also come to a real negative impact. It appears that East Nusa Tenggara Province is experiencing food vulnerability following the evidence that many children suffered from malnutrition or even worse that the central government has to pay more attention to overcome the situation. The local government has "rice for the poor" (*beras untuk masyarakat miskin/raskin*) program launched to help people out of the food crisis, but the implementation of this program probably inadequately and ineffectively reached the poor. According to Local Logistic Bureau (Dolog), this is not because of out stock of the food (rice), meaning that rice is available in their warehouses. It is not free of charge, and it seems that poor people were not capable to afford its low price level that enforced them to buy small amount or less than the available quota. It seems that the situation is also triggered by low sense of awareness of those responsible at the

implementation level and lack of food distribution strategy. Pusat Analisis dan Kebijakan Pertanian (2005) reported that rice was also distributed to poor people at non-rice main food regions. If rice is not the staple food for certain local community, it is suggested that other crops that traditionally taken as the main food by the local community would replace rice.

The annual repetition of similar situation has enforced the local government to seek alternatives to anticipate more carefully the behavior of such phenomenon. With the help of scientific knowledge and expertise in climate along with indigenous knowledge, the government has to be equipped with a more reasonable answer to prepare the people facing various climate impacts. More specifically, the shortage of food is in concerned that need a justifiable solution to cope with long dry season in the region. Cultivation pattern should be adjusted to the local climate behavior and grew those crops that need less water, such as corn and sorghum. Climate phenomenon is considered as one of the problem roots and need to immediately study to provide more accurate climate information. This desire is currently under preparation and has been progressing quite remarkable. BMG, IPB, CARE, ADPC, the experience of Indramayu Regency, West Java, and the active participation of related offices both at provincial and regency levels, are the many concern to think and find out the best way to reduce food security crisis. It is realized that the natural long dry spell in NTT Province should be linked to the climate behavior itself. BMG at central level and BMGD at regional level have mandate to provide data and information about climate condition and its change. Rainfall is the most important factor to measure since it will affect many parts of alternative solutions. It is obvious that the more water available, the better farming system management and hence it will increase food production. In this context, rainfall data and the role of BMGD in data preparations are very critical to anticipate what should be done in an earlier certain period of time. It is also valuable to determine the overall policy to respond to the effect of climate change condition in the region.

Other related institutions, such as food crops and food security offices, research institute, university and farmer's group are expected to play their respective capacity to arrive at policy planning and implementation under the coordination of the province's development planning office. The mandate of each of these institutions needs to be carefully considered to avoid overlap functions and to hinder from unnecessary duplication activities. The scope of work of three climate stakeholders, i.e., Office of Food Crops, Office of Food Security, and Office of Settlement and Regional Infrastructure (Water Resources and Irrigation) is prepared to show how climate has been included in the organizational structure of the regional administration (Appendices 1, 2, and 3). Their accountability on their functions and tasks are encouraging and also challenging to reach certain level of actual climate information application.

Rainfall data are among the most important climate information needed in farm management. Their availability is critical in especially determining planting

time, crop pattern, and crop selections. Related institutions, including NGOs and progressive farmers, are essential to take part in the decision making process to ensure the effectiveness of climate forecast application programs, not only for food crops but also for other sectors development in the region.

Planning for Implementation: Institutional Cooperation

With all experienced problems in using climate forecast for regional development, all climate stakeholders have to look forward to a better data presentation and detail information for a wider use of such information. In terms of food security, the farmers are the target users of climate forecast. The data are very useful to determine planting time and crop selection, and to assess water available for the next planting season. The rainfall information will also be useful for crop calendar planning and other agriculture activities, including raising livestock and development of inland fisheries. Planning for rain harvest is allowed by the accuracy of rainfall forecast. In this connection, within the three months of rainy season, the harvested rain could be stored in the scattered ponds for later use to cultivate different crops in different season.

For sustainable climate information, all stakeholders are encouraged to establish institutional cooperation and avoid self-purpose rainfall information. Working together and plan for implementation using a more accurate and reliable climate- forecast information are encouraging and also more challenging to benefit the region. Each institute has its own mandate and the role of each of them is very important to discuss to draw better solution. Tasks and budget are among the difficult issues to solve but there is always way out when each institution gives their support to enhance the whole development system.

The following institutions are the stakeholders important to work together in respect to climate forecast applications in NTT Province: BMGD, Bappeda (*Badan Perencanaan dan Pembangunan*/Planning and Development Agency at province level), SDA (*Sub Dinas Sumberdaya Air pada Dinas Pekerjaan Umum*/Office of Public Works), Office of Food Crops, Office of Food Security, Nusa Cendana University, BPTP, BPS, KTNA (*Kelompok Tani Nasional Andalan*/National Progressive Farmers' Group), and NGOs. The latter is instrumental in regional development considering its function to oversee (even without authority) the implementation of certain programs/projects and to perform institutional negotiation for higher development achievements. BKSDA (*Balai Konservasi Sumberdaya Alam pada Dinas Kehutanan*/Natural Resources Conservation Institute of the Office of Forestry, Office of Health, and Bapedalda (*Badan Pengendalian Dampak Lingkungan Daerah*/Province's Office of Environmental Impact Control Agency) are also stakeholders and important to take part in the climate management.

Establishment of Climate Forum: Coordination Function

When several institutions working together and anticipating certain goals, they have to group in certain forum where they can interact and share their information to produce common interest. The forum is considered on the basis of similar vision and mission and climate forecast is their base for which this forum will be established. The "Climate Forum", a name that might familiar to many, is probably unique in terms of its objective settings but this institution is very important for better planning development in the region. The Climate Forum is basically working by improving the past for better future results.

Referring to each mandate of all stakeholders involve in climate issue, the function of Bappeda as the regional office for planning and development is very strategic to coordinate the implementation of Climate Forum programs. Other agencies/offices will perform their respective activities according to their capacity and expertise adjusted to the Climate Forum objectives. Based on interviews with many stakeholders in NTT Province, the Climate Forum will be divided into two strategic levels as shown in Figure 1. Firstly, policy group that consists of directors/heads of related offices with main task to determine a set of objective on climate issues along with inherent costs as a consequence of Climate Forum establishment. All matters related to climate development policies are in the hands of the members of this policy group. Secondly, technical group which comprised by a number of scientists/experts, planners, and practitioners representing their own institutions with main task to share and translate climate data into a readable information, ready to use by the users (particularly the farmers). They are also responsible to prepare as much as they can the accuracy of climate information and to maintain its information flow (the faster, the better) reaching the users in time. In short, the members of this technical group will carry out all technical-related issues. The secretary of this Climate Forum at coordination level will represent both groups to link and bridge any decisions into real activities.

Progress of the Climate Forum

The two-day workshop on "Institutionalizing Climate Forecast Application for Mitigating the Impact of Climate Hazards" held recently in Kupang had come up with a number of policy recommendations. One of these recommendations is to accommodate all climate related institutions in a forum at provincial level to communicate the climate forecast application and to establish Climate Forum with secretariat at the Bappeda due to its coordination function in the Province's planning and development programs. To follow up this recommendation, the ADPC (Asian Disaster Preparedness Center), the Bangkok-based international organization dealing with climate-related affairs, had conducted several visits to meet many climate stakeholders at provincial level, to communicate the Climate Forum plan and to seek their support. All of the offices

visited were very cooperative and very supportive. Their enthusiasm had been revealed by their eagerness to looking forward to an immediate action.

On 5 July 2005, the first Climate Forum meeting was initiated by Bappeda. The purpose of the meeting is to inform climate stakeholders about the future agenda related to climate information and to prepare the Climate Forum establishment. This plan had been reported to the Governor of NTT Province from whom the Bappeda had obtained an approval for further implementation steps. To follow it up, the initial budget for operation has been proposed for the year 2006 program. The next steps would be to formalize the forum and resume the activities.

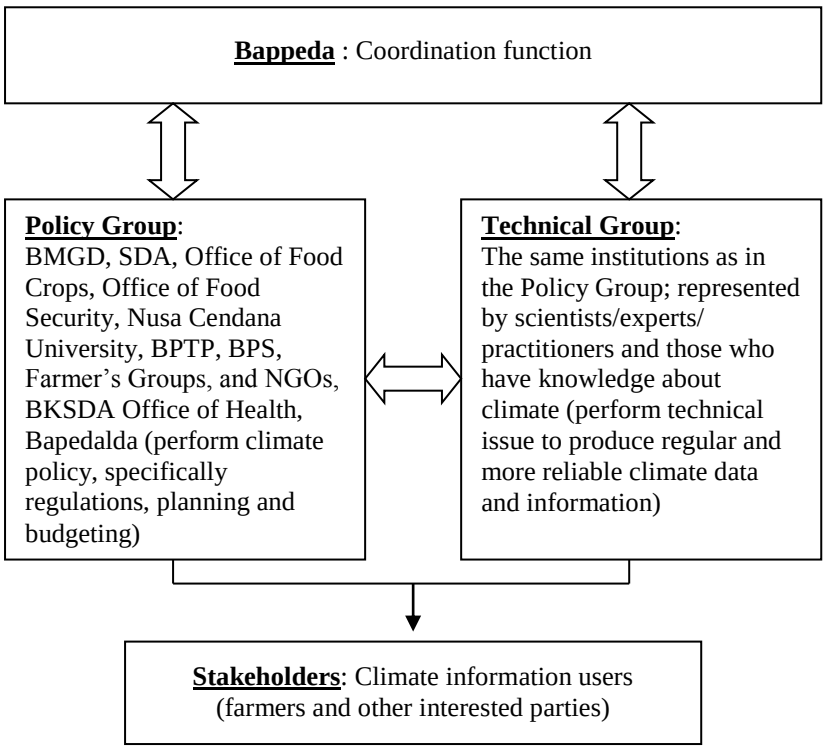


Figure 1. Proposed Organization Scheme of Climate Forum

CLOSING REMARKS

It is strongly adviced to use climate forecast to anticipate better preparation not only for natural hazards and other negative impacts but also for strengthening food security in the future. The costly recovery programs in natural disaster management indicate the importance of early knowledge of such climate

change and its behavior in order to avoid not only huge expenses but most importantly to prevent the community from a long suffering.

Damaged climate measurement tools and equipment are necessary to replace and the appointment of field workers is immediately important for the improved quality of data and for better use of climate information. In respect to field data collection activities, it is unfortunate that most of the active field workers are not supported by adequate knowledge on climate. Poor field workers are part of the limitations the stakeholders have and to improve the quality of these workers, hands-on training combined with excursion to other developed places are necessary. Climate field school would be even benefit the region in the attempt to educate people (farmers or other workers) to achieve certain level of self-support in maintaining climate information knowledge.

The establishment of Climate Forum would revitalize related institutions/other stakeholders at provincial and the lower levels of administration. This forum is expected to provide good quality of climate information to be regularly used by related stakeholders. Reliable climate information would encourage better regional and rural planning and development. Climate Forum, however, is not the ultimate objective of climate forecast affairs. Climate uncertainty and the prolong drought are also influenced by the deforestation in the region. Therefore, reforestation is also suggested to be planned and developed to help reduce the impact of climate uncertainty and preserve more water in NTT Province.

REFERENCES

Bappeda. 2005. Program untuk Meningkatkan Penggunaan Informasi Prakiraan Iklim Hingga ke Tingkat Petani. Bappeda Provinsi Nusa Tenggara Timur. 4 pp. (Unpublished)

Badan Bimas Ketahanan Pangan. 2004. Laporan Bencana Alam Sektor Pertanian Periode Januari sampai dengan Agustus 2004. Badan Bimas Ketahanan Pangan Kupang. 25 pp. (Unpublished)

Badan Bimas Ketahanan Pangan. 2000. Uraian Tugas Jabatan Struktural pada Lembaga Teknis Daerah Propinsi Nusa Tenggara Timur. Badan Bimas Ketahanan Pangan Provinsi Nusa Tenggara Timur. Kupang.

BPS, Statistics of Nusa Tenggara Province. 2004. NTT Province in Figures 2003. BPS, Statistics of Nusa Tenggara Province. Kupang.

Dinas Pertanian Tanaman Pangan. 2000. Uraian Tugas Perda No.9 Tahun 2000. Office of Food Crops, Nusa Tenggara Timur Province. Kupang.

Dinas Sosial Provinsi Nusa Tenggara Timur. 2004. Laporan Koordinasi Penanganan Bencana Alam dan Antisipasi Rawan Pangan Dinas Sosial Provinsi Nusa Tenggara Timur. 11 pp. (Unpublished)

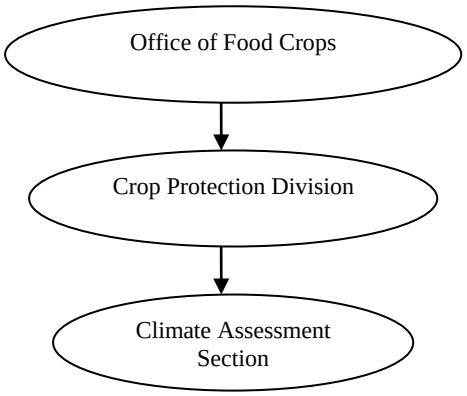
Pemerintah Propinsi Nusa Tenggara Timur. 2000. Pembentukan Organisasi dan Tata Kerja Dinas Propinsi Nusa Tenggara Timur. Pemerintah Propinsi Nusa Tenggara Timur. Kupang.

Raya, F. L. 2005. Proposal Pembentukan Forum Iklim untuk Meningkatkan Pemanfaatan Prospek Iklim Dalam Pembangunan Provinsi Nusa Tenggara Timur. Office of the Governor of NTT Province, Kupang. 16 pp. (Unpublished)

Universitas Nusa Cendana. 2003. Profil dan Rencana Pengembangan Pertanian serta Optimalisasi Irigasi pada Waduk Tilong dan Daerah Irigasi (DI.) Mena. Research Report. Kupang. viii+75 pp. (Unpublished) .

Appendix 1. Mandate of Office of Food Crops in NTT Province Related to Climate Information and Management

Personnel assigned at Climate Assessment Section are working under the supervision of personnel in charge at Crop Protection Division of the Province's Office of Food Crops. The Climate Assessment Section is dealing with climate information and management and is the lowest level within the hierarchy of the Office of Food Crops in NTT Province.

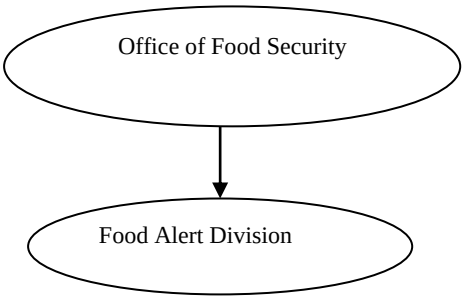


Mandate of the Office of Food Crops in relation to climate information and management are as follows:

- Evaluating and analysis rainfall data
- Providing climate type covering certain areas
- Preparing monthly prediction onset and duration of wet and dry seasons, flood, and drought in the year to come
- Providing inventory of rainfall tools/equipment and prepare procurement planning necessary for climate tools/equipment
- Providing services for better climate management and recommend land preparation activity based on climate prediction

Appendix 2. Mandate of Office of Food Security, Nusa Tenggara Province Related to Climate Information and Management

Personnel assigned at Food Alert Division are working directly under the management personnel of the Province's Office of Food Security.



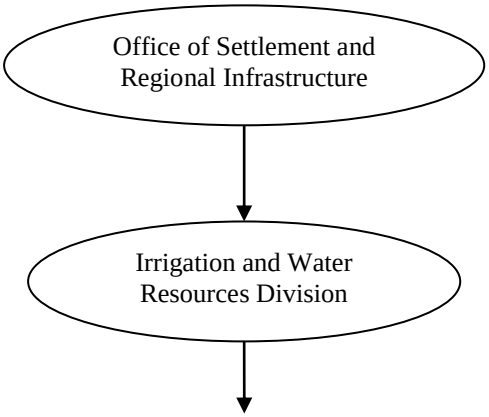
Mandate of the Office of Food Security in relation to climate information and management are as follows:

Main : Controlling, evaluating and monitoring the dynamic implementation of food availability; coordinate hunger risk management and control the delivered food quality

Specific :
- Preparing policy guideline and technical guidance for food alert
- Intensively monitor food crops production and its availability
- Proposing alternative policies to resolve the impact of food shortage
- Monitoring, collecting and processing data and information in specific food risk regions (drought, natural disaster, pest attack).

Appendix 3. Mandate of Office of Settlement and Regional Infrastructure Related to Climate Information and Management

Personnel assigned at Irrigation and Water Resources Division is working directly under the management personnel of the Province's Office of Settlement and Regional Infrastructure.



Mandate of the Office of Food Security in relation to climate information and management are as follows:

Main : Formulating operational steps and program for irrigation and water resources development covering conservation, water resources development, water distribution, flood and erosion control, coastal line management, and surface irrigation and groundwater development.

Specific :
- Planning and carrying out: a guidance, control function, and operation and maintenance management, natural disaster alleviation, irrigation service fee, and WUA extension
- Providing inventory of water resources and its area and irrigation facilities.
- Recommending C-level quarry area located at river and coastal line.