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# The Return of Locust Outbreak in Sumba, Indonesia: A Rapid Situational Analysis

**Jonatan A. Lassa**[1,2]

[1]Senior Lecturer, Emergency and Disaster Management, Charles Darwin University, Australia

[2] Senior Fellow at Institute of Resource Governance and Social Change, Indonesia

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# The Return of Locust Outbreak in Sumba, Indonesia: A Rapid Situational Analysis

Jonatan A. Lassa[1,2]

[1]Senior Lecturer, Emergency and Disaster Management, Charles Darwin University, Australia

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***Abstract.*** *After the catastrophic locust outbreaks during 1997-2003, the outbreaks come back again in Sumba Island, Indonesia. On 10 June 2017, local and national news as well as social media mentions have highlighted locust invasion on a local airport where millions of the pests caused flight disruptions due to lower visibility around the airports. This paper provides a rapid explanation on what has happened, the scale of the events, where are the hotspots and what emergency action have been taken by the stakeholders, and what needs to be done in short and longer term. It briefly highlights fifty year of history of locust outbreaks in Sumba Island. It further highlights lessons learnt from these events while providing insights what can be done to deescalate the outbreak today and in the future. This paper also calls for cheaper technology such as unmanned aerial systems for monitoring pests that can be fit for the job of monitoring and control pest outbreak. The challenge is how to transform local governance system to be more adaptive and responsive not only to the dynamic changes in local environmental condition but also in making use of new technology for efficient monitoring and effective intervention.*

Keywords *Locust outbreak, climatic shocks, El-Nino, disaster risk, risk management, outbreak prevention*

## Introduction: The return of Locust Outbreak in Sumba

Recent locust outbreaks in East Sumba, Indonesia has created a local crisis where without early warning, the pests invaded and disrupted services at the local airport namely Umbu Mehang Kunda airport in Waingapu town, East Sumba on June 10th 2017. It immediately hits nationwide news coverage because of the widespread images in both media and social media. More than a hundred Facebook postings and updates during 10-14 June 2017 have explained the situation where the locusts have been invading several places including several houses and neighbourhoods in Waingapu City (e.g. Killa 2017, Pada 2017; Maubokul 2017). One visual post reported that only “in one night, the locust could have cleared all the leaves of the bamboo trees” in a neighbourhood (Lodji 2017).

The outbreaks have been in fact occurring since 2016 as they occupied gardens, bushes and trees. According to the local authority, **the hotspots for the present outbreak** have been in “only six” (out of 22) sub-districts namely Pahunga Lodu, Rindi, Umalulu, Kambata Mapambuhang, Pandawai and Kambera. The local authority made similar statement concerning the same hotspots in June 2016 (VOA Indonesia 2016). And a month after the first outbreak, the head of district declared a local emergency on 13 July 2016 (Dengi 2016). Due to reduced escalations in August 2016 and the following months, the local authority relaxed their nerve (Lintas NTT 2016b). Therefore, the scale of invasion a year later could have reached wider areas beyond the areas where the local authority believed to be the only hotspots.

One of the problems is these six sub-districts account for 27 per cent of the whole East Sumba district (7000km2) with only ten entomological related staff in the local Agricultural Department, who have been working "day and night" to deescalate the outbreaks (Yiwa 2017). Lack of technology to monitor the pests adds more weights to the crisis. The key approach from the local government to control the plague has been spraying pesticide within the outbreak areas. Similar approach has been used since last year. For example, the Indonesian Armed Forces (TNI) has been even involved in the fight to deescalate the outbreak using sprays in nearby bushes (Lintas NTT 2016a).

**Observed impacts** can already be seen by the recent crops' losses and damages in the aforementioned sub-districts. Both paddy and corn have been affected. However, conflicting reports have been made from within the local governments. One version is good news suggesting the attack occurred after the last harvest so the catastrophic impacts have been delayed till further notice (Aziz 2017). Another good news is that unlike the catastrophic outbreaks during 1998-2003 (See Figure 2A and 2B), most growing paddy are still unaffected. Therefore, a detail calculation is yet to be further made. The question is how? And who should be doing it?

**Some of the actions by local government include: First,** inter-agencies coordination and response have been promptly made. Local agricultural office, social work and local disaster management offices and other local government units have been in the field to both monitor and respond (Yiwa 2017). **Second,** the local governments have been distributing pesticides to the local communities to fight the larvae. With the help of the TNI, the entomological officials have been spraying the suspected breading as well as invasion areas. This approach could slow down the outbreak in certain ways especially in a more isolated place where concentrated locust population at earliest stages of their lifecycles can be controlled. **The third** strategy announced by the local authority was to use the 100 mt stockpiled rice - i.e. a standard SOP stipulated by the Food Security Strategy, where each district is to have an emergency rice reserve of 100 mt (Bere 2017). **Fourth,** vertical coordination with provincial and national governments have been made to mobilise more supports anticipating further escalation.

**Community level actions** include some of the following intervention: First, each farmer drove the pests away from their leftover green gardens using canes or the likes (MaxFM 2017). Second, on top of the individual household interventions, some local communities and volunteers have been using the distributed pesticides to spray the bands and swarms as well as adult locusts. Local agricultural department have been working together with some communities to spray the migratory locusts (MaxFM 2017).

The local authority combined these efforts and used themas key crisis communication strategies to calm down the local communities. However, concerned social networks and social media groups have been concerned with the use of pesticide. The concern has its own legitimacy as some responders from the local communities who have been using the sprays did not use safety measures (e.g. using bare feet and without masker when spraying the swarms). However, equally, the local government has been concerned with how to prevent the crisis from becoming a disaster. Similar strategy has been made last year.

## Locust Outbreak Patterns: What We Know So Far?

Earlier understanding of the locust outbreak depends on three stages namely CMG. C points to concentration of locust, M is multiplication and G is gregarisation (a point where solitary insects or pests transformed into a swarm (gregaria) due to sudden rise of population). The shifts from concentration to multiplication to gregarisation depend on local ecological context. The impacts of strong El-Nino droughts often create long dry period where the drought magnitude and scale could have been beyond the ability of some biological resources (such as natural predators of locusts e.g. birds and parasitoid flies) to disappear allowing locusts to multiply uncontrollably (Roffey and Popov 1968) especially when the rain comes back (Magor et. al. 2008).

Some experts suggested that "dry periods must be especially important under these excessively humid environmental conditions, because rainfall levels are more in line with the normal ecological needs of this insect. Moreover, drought must lead to a sharp drop in populations of the natural enemies, which are responsible for normal locust population control" (Lecoq and Sukirno 1999:155). Informed by the 1997/1998 phenomenon in southern Sumatra, Lecoq and Sukirno (1999:159) hypothesised that population dynamics of oriental migratory locusts and the effects of natural enemies on locust population control (B) (See Figure 1), possibility of increasing populations through breeding; C, possibility of densation by limiting the inhabited area; G is the threshold of gregarisation is at 2000 adults locust per ha. D (Figure 1) is the gap between natural enemy and locust population where the bigger the distance the more catastrophic of an outbreak.

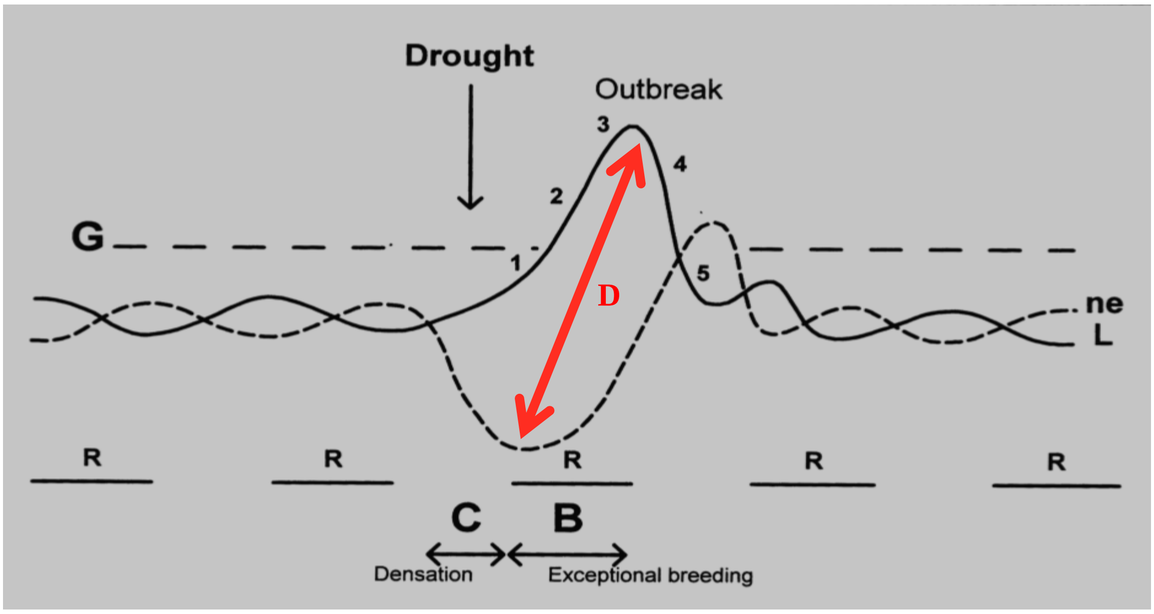


Figure 1. Pattern of Locust Outbreak [Source: Adapted from Lecoq and Sukirno 1999:159]
[Note from Lecoq and Sukirno 1999:159] B is possibility of increasing populations through breeding; C, possibility of densation by limiting the inhabited area; G, gregarization threshold (2000 adults/ha); L, migratory locust population; ne. population of the natural enemy complex; R, rainy season; 1-5. Successive generations of migratory locusts (3 in the rainy season, 2 in the dry sea). **D is added by the authors indicating that the bigger the gaps between ne and L**

**could lead to greater outbreak.**

Cisse, S. et. al. 2015 show an empirical work where gregarisation threshold could be more complex than the rather speculative/hypothesised thresholds by Lecoq and Sukirno 1999). What is more interesting is the fact that gregarisation depends on several factors including ecological context and changes in environmental conditions. Cease et. al. (2012) suggests that "heavy livestock grazing promotes outbreaks of locust through the mechanism of plant nutrient content shifts toward lower nitrogen conditions favourable to a type of locust namely *Oedaleus asiaticus*. Whether this is also the case for migratory locusts in Sumba, more observation is needed to suggest firmer conclusion concerning the threshold.

Several models of preventing locust outbreaks have been identified in the last century. One of the oldest models is "in situ" approach where local teams are formed to monitor and control the invasion area. This model has been used by the local government in 2016 and 2017. This approach has its merits when invasion areas are small and therefore can be controlled to some degree. However, this approach is rather reactive and less effective for larger scale invasions (Magor et. al. 2008).

Research also suggests that having an early intervention can prevent some of the outbreaks (Magor et. al. 2008). Such interventions can be done before the return of rain after dry spells or droughts. This requires incentives created by national and local governments to create conditions where higher mortality of bands and swarms can be made before rain comes back.

Technological innovation for monitoring the pests is not new. The use of remote sensing have been common in many countries.. While the use of remote sensing technology can help informing farmers and local governments regarding potential outbreak (Mahlein, AK. 2016). These technology can be expensive and foreign to such local government officials in Sumba. In the context of desert-locust activities, the idea of using remote sensing has been around for 30-40 years (see Tucker et. al. 2005; Despland et. al. 2004. Bryceson 1989; Tappan et. al. 1991).

## Brief History of Locust Outbreak in East Sumba

Pest attacks including locusts and mice have been part of traditional belief systems in Sumba. For example, Kapita (1976:362) highlighted that locals have been praying to God to send owls to prevent the disasters from pests especially mice, locusts and Wereng. Empirical observations also suggest that controlled burning has been used as key livelihoods strategy for controlling locust (Russell-Smith, J. et. al. 2007). However, how could controlled burning can be always made by farmers and how can it solve locusts in the long run needs further explanations. Unfortunately, most social science research on Sumba has been often silenced of issues of locust outbreaks.

A few literatures have recorded some recent experiences concerning migratory locust outbreaks especially in the last 60 years. Lecoq and Sukirno (1999) noted that locust outbreak occurred during 1973/1976. Oral history from villages such as Napu, Haharu, East Sumba, suggested that 1957 Wereng explosions were catastrophic leading to famine (Table 1). NOAA included the year 1957/1958 as strong El-Nino period.

The puzzles of these communities based stories (and/or oral history) complied from unpublished documents such as participatory processes by PMPB Kupang 2003 and 2007 suggested that most of the locust outbreak in Sumba in the last 60 years have been occurring soon after strong El-Nino events (Table 1). This could mean that such strong and very strong droughts have caused the disappearance of some natural predators and as the region entered the first rain period, the pests had been left unattended and thus grew uncontrollably.

**Table 1 History of Locust Outbreak in Sumba 1950s-2017**

| El-Nino Year [based on NOAA records] | Year of Locust Outbreak | Disaster events (hard times) | Coping and L |
|---|---|---|---|
| 1957-1958 [Strong El-Nino] | 1957 | Pest attacks (mainly *Wereng* explosion) | Famine food from local forest |
| 1963/1964 [moderate El-Nino] 1965/1966 [Strong El-Nino] | 1965 | Strong El-Nino – Drought | selling livestock and famine food from local forest |
| 1972/1973 [Strong El-Nino] | 1974 – 1975 | Locust attack | Wild tubers from local forest (iwi) |
| 1997/1998 [very strong El-Nino] | 1997/1998 | El-Nino driven drought | Famine food from local forest and *mandara* |
| 2002/2003 [Moderate El-Nino] | 1998-2003 | Locust attack | Escalation of locust outbreak starting Famine food from local forest and mandara |
| 2015/2016 [very strong El-Nino] | 2016-2017 | El-Nino – Drought – leading to Locust outbreak | Escalation of locust outbreak in 2016 and 2017. |

Source: Lassa 2011; PMPB Kupang PRA Reports in East Sumba 2003; and various sources including NOAA's classification of El-Nino and La-Nina Years.

All the four districts in Sumba have been ranked as the poorest districts not only in NTT province but also in Indonesia. One of the reasons of behind this is because of the legacy of recurrent natural hazards and risk including their susceptibility to locust outbreaks at least in the last 70 years (Lassa 2011). Some local practice and ideas to deal with local the risks of locust outbreak have been identified by by NGOs and local communities (PMPB Kupang 2003):

- During November, when the planting season is about to start and the *nyali (a long caterpillar)* emerges, the farmers decide not to plant because they think that the corn will likely fail.
- If there are big waves in September and October and the community plant their corn in November because it is perceived as a sign that the normal season will arrive, and production will be good. However, if the waves come later in October and November, the plants are likely to fail.

- From different settings, Yayasan Tananua in Waingapu conducted a risk assessment in the villages or communities where they worked. They confirmed the prevailing ideas being adaptive by diversifying livelihoods options including food diversification. These is the most creative ways in dealing with climate-related risk (Randandma 2011). For example, in Meurumba village in East Sumba, Tananua found that local communities identify options for their livelihoods to beat climate uncertainties. First, they grow food crops such as paddy, corn, tubers and nuts. Second, they grow NTFP commodities (termed as longer-term plants) such as candlenuts tree, areca nut, coffee, mahogany, gmelina and betel. Third, getting access to credits and savings. Fourth, grow and selling vegetables and finally engaged in *mandara* (barter) activities.
- In addition, local villagers in Meurumba also viewed cheap rice as optional. Community forestry and household forestry come next. The last option is efforts to increase small livestock.
- It is interesting to note that when local communities were asked to list options for adaptation and risk reduction in the context of hunger and drought, the answers have been more or less the same From the PMPB process in 2003 in Napu village.

## Impacts of Locust Outbreak in East Sumba Since 1990

The footprints of the locust outbreaks in Sumba since 1990 can be seen from Figures 2a and 2b. Formal records from the Agricultural Statistic have suggested that all crops yield including corn, rice, soybean, mung bean and groundnut have been zero (Figure 2a). Beans have been the most vulnerable groups as the local communities could not harvest any during 1998, 2001 and 2003. During 1998-2003, soybean could be harvested in 1999.

Rice and corn production during 1998, 2001 and 2002 have been totally failed. Local communities lived on alternative livelihoods as well as food aid and subsidy. Figure 2b suggests that there is widening gap between produced carbohydrates (rice and corn combined) with the total need (measured by rice equivalent of 400 gram per day). The impact of locust outbreaks in Sumba in general and East Sumba in particular have been spectacularly damaging. It implies that humanitarian crisis have been reduced so far by an imperfect but increasingly better response systems embedded in both food security and local development policies as well as disaster response system.

According to the most recent classification of disadvantaged (poverty stricken) regions in Indonesia, as of June 2017, all Sumba regions are included by the Indonesian president for 2017 and 2018 prioritised areas (GoI 2017). This reinforced the existing patterns in the last 20 years where all Sumba districts have been among “the poorest” districts in the province.

East Sumba has been often ranked number one in terms of annual crop damage and loses. For example, in the period where no locust outbreak occurred, the district experience 29.4% losses in terms of crop failures in 2009 (WFP 2011).Figure 3 presents the Food Security and Vulnerability Atlas (FSVA) 2010 produced by World Food Program (WFP) and NTT Food Security Council. FSVA food security measures include food access. High concentration of poverty can be seen in East Sumba. The last National Economic Survey in 2013 suggested that East Sumba still has 260,000 people live below poverty line (about 28 per cent of the total population).

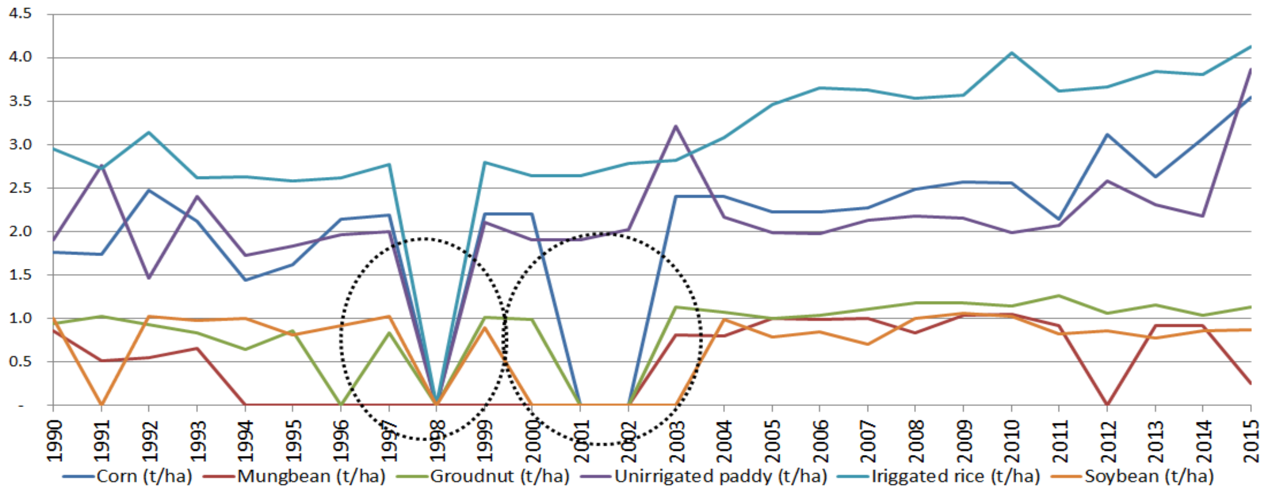


**Figure 2a Trend in Crops Yield 1990-2015.**
Source: Author, based on Agricultural Statistic 2016

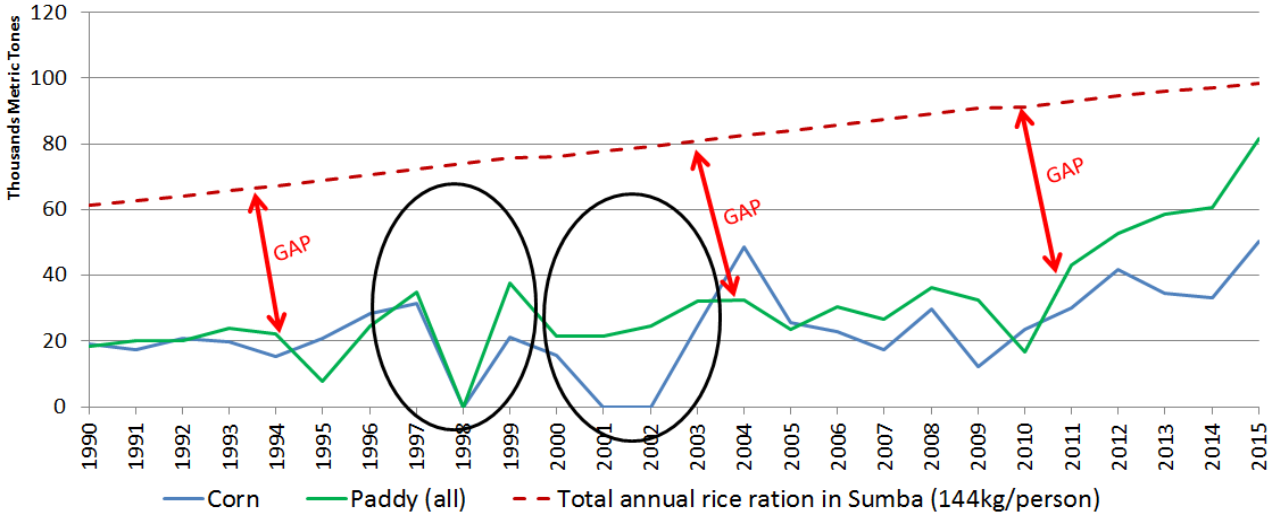


**Figure 2b. Trend in Production of corn and rice 1990-2015**
Source: Author, based on Agricultural Statistic 2016

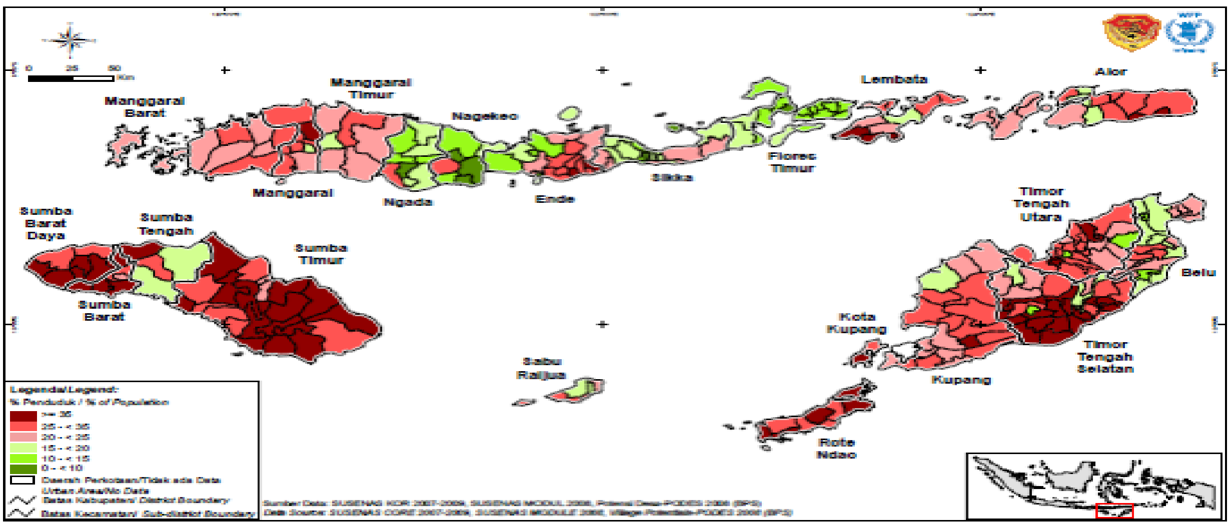

Figure 3. Food Insecurity Atlast, NTT
Source: World Food Program 2011

## Understanding Sumba's Multiple Vulnerabilities to Climatic Shocks

The erratic climate of Sumba has affected the crop production and yield. East Sumba is often classified into a climate type with a shorter wet season, i.e. only 0-2 wet months. It often has shorter rainfall days, severe events of dry spell. More than half of Sumba land is savanna, which is suitable for dry land agriculture and pastoral development. Apart from some spots in West and Central Sumba, the island has low rainfall intensity. In general, its climate is erratic (See Lassa et. al. 2013).

One of the questions is: what are long term implications of locust outbreaks have on communities' coping mechanism? The total collapse of agricultural crops seen in the last 20 years have pushed the local communities to temporarily adjust from 'crop-based livelihoods' towards 'grassland-based livelihoods' through the mutual promotion of agro-forestry (that support the cash crops through Non-Timber Forest Product (NTFP) and agriculture and horticulture (to support the food crops diversification). The author maintained the view that NTFP should be also be key to deal with climate uncertainty in the rural context. NTFP has significant contributions to the people's income and livelihoods.

Sumba is traditionally known as a society with three-tiered social hierarchy: the noble class (*maramba*), *the* middle class (*kabihu*) and the servant class (*ata*). The traditional power of the *marambas* is symbolized by their control over the *atas* and other livelihood assets such as land and livestock (such as horses, buffalos and cows) (Twikromo 2008). Although today Sumba has emerged to be a rather classless society (PMPB 2003), the class system has brought positive and negative outcomes at the same time. The good is that there has been a kind of 'informal risk sharing arrangement' where higher class can transfer their resources to the *atas* in times of emergencies. Meanwhile, the *atas* have gained their own power in food production, especially labour power in livestock and agriculture.

Unfortunately, research shows that the rates of forest cover change in the whole Sumba fell from about 50% in 1927 to 10% in 1997, and recently it has been about 8%.  In fact, the net forest cover has been probably less than 6.5% (Burung Indonesia 2009). The degradation of forest and vegetation has been associated with unsustainable consumption of forest products and unsustainable land use management (in the form of uncontrolled grassland burning).

A study from PMPB Kupang about Napu is helpful as it briefly links livelihoods, food and risks. Napu is situated at about 150 above mean sea level (MSL). The village has a typical Sumba landscape which is dominated by grassland hills at between 150 – 400 MSL. It has two hamlets. The first hamlet is Napu, a very dry area and the second hamlet is Prailangina, a mild and fertile. In total, there were 180 households (806 people) in 2003. The main livelihoods in Napu are:

- Food crops as the 'first-best option'. They include corn, dry land paddy, domesticated tubers (including cassava, sweet potato and other local variety of yams) and different kinds of nuts.
- Large livestock includes cows, horses and buffalos.
- Small livestock consists of pigs, chickens and goats.

- Subsistent fishers often harvest from the sea using traditional equipment.
- Other non-agricultural inputs such as handicrafts and weaving.

Table 2 Seasonal Calendar for all livelihoods activities in Napu, East Sumba

| No | Activities | Months in a year | | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | |
| 1 | Rainy seasons – status quo | XX | X | | | | | | | | | XX | XX | Climate variability |
| 2 | Corn - status quo | X | X | X | | | | | | | X | X | X | Business as usual |
| 3 | Dry land paddy | X | X | X | | | | | | | | | X | Business as usual |
| 4 | Cassava | | | | X | X | X | X | X | X | X | | | Lack of info |
| 5 | Groundnuts | X | X | X | | | | | | | | X | X | Business as usual |
| 6 | Black nuts | | | | | | | | | | | | | Business as usual |
| 7 | Candlenuts harvest | | | | | | | X | X | X | X | X | | NTFP |
| 8 | Tamarind harvest | | | | | | | | X | X | X | X | | NTFP |
| 9 | Kutu lak harvest | | | | | | | | X | X | X | X | | NTFP |
| 10 | Food crisis | | | | | | | | X | X | X | X | X | Business as usual |
| 11 | New school season starts | | | | | X | X | X | X | | | | | Business as usual |
| 12 | Selling bigger livestock | | | | | X | X | X | X | | X | | | Business as usual |
| 13 | Selling small livestock | | | | | | | X | X | X | X | | | Business as usual |
| 14 | Mandara (barter) | | | | | | | X | X | | | | | Business as usual |
| 15 | Selling labor | | X | X | X | X | X | | X | X | X | X | X | Business as usual |
| 16 | Burning grassland by *ata* | | | | | X | X | X | X | X | | | | Business as usual |
| 17 | Sweet potato | | | | | | | | | | | | | Business as usual |
| 18 | Plant domesticated tubers | | | X | X | X | | | | | | | | Anticipate drought |
| 19 | Harvest wild tubers | | | | | | | | | X | X | X | | Anticipate drought |

Source: Lassa et. al. 2011, adjusted from PMPB Kupang and Sandelwood 2003

Barter, namely *mandara*, is often used as means of exchanges mainly during July-August after the end of food crop activities in Napu village. Mandara is often transacted in Lewa, an agricultural field. Anecdotal information suggested that food gained from Mandara often stored and consumed during hard times, especially in December-February when the last food saving begins to deplete (PMPB Kupang 2003). It is important to note that based on an in-depth observation (Killa 2011 in Lassa 2011), that Mandara is often activated and practiced by those whose stronger ties of social network (as it is barely done with strangers). Therefore the key feature of *mandara* transaction and resource transfer is basically kinship relationship and social trust.

Based on a different baseline survey by World Vision and East Sumba Government (with 2,134 respondents), it was found that rural communities have five options for access to food: (1)

- Food crops 79.7%
- Buy from local markets 88%
- Get from forest 14%
- Mandara 13%
- Others 2%

From the same survey, it was found that 65% households can only rely on their food crops only for three months, and 22% can last only 6 months. The respondents also noted that the main constraint of access to food is due to production failure (48%) and no access to land (41%).[1]

The *ata* (servant class) often sell their labor as livestock keeper (Table 2, #16). The income is often set as 'shared benefit' with ratio of 1:5. In reality, it means that for every 5 livestock service, the *ata* will get 1. There are other mechanisms such as incentives for those successfully managed to increase the weight of the livestock (especially cows). This often leads to the process of land grass burning, because by burning the land grass, the *ata* will gain through faster re-growing of young grass, the source of livestock feeding.

A recent study by Tacconi and Ruchiat (2006:72) in East Sumba (Lukuwingir-Kiritana village) shows that the typical structure of household income in East Sumba is as follows:

- Food crops 36%
- Tree crops 4.2%
- Livestock 23.8%,
- Non-Timber Forest Products 30.7%
- Grasslands 5.3%

**Table 3 Non-Timber Forest Product: lac production 2010-2014 -**

| Year | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| Seedlac (mt) | 20 | 80 | 117 | 96 | 360 |

[1] A joint baseline survey World Vision Waingapu and East Sumba Government 2007 [Unpublished]

Dinas Kehutanan Sumba 2011, Sumba Timur in Figures 2016 and Lassa 2011.

Local governments in Sumba recognised three main major sources of NTFP namely tamarind, candlenut and lac/seedlac (from *kutu lak* or *laccifer lacca*)[2]. East Sumba produced 791 mt and 899 mt candlenut meat respectively in in 2007 and 2014. It produced 592 metric ton of *kutu lak in 2007*. As of 2011, each kg of *kutu lak* is priced at Rp 12,000 (A$1.2) (Lassa 2011). Despite some decline in recent production (Table 3), *Kutu Lak* has been consistently contributing to the local economy together with other NTF products.

## Final Remarks

Monitoring and control the pests require technology and innovation. Going forward, what has been more plausible today is with the use of drones for monitoring pests (Tammen 2015). This is obviously possible as the price of drones are getting cheaper and new generation of drones can be potentially fit for the job of monitoring and control pest outbreak. The concern is not about whether local government can access and use such technology. The question is how local government can use such technology to inform early warning for early action and response.

What makes remote areas like East Sumba and others vulnerable to climatic risks is low performance from local formal institutions. For example, based on personal experience, local climate data have been collected inconsistently in the last 20 years. The quality of climate data collection is too poor to inform early action. Furthermore, there is systematic error in climate data entry at district level (Lassa 2011). There are always missing data from more than a half of the rainfall stations and this has been associated with the high staff turnover, sub-standard performance of human resources, and ignorance of the importance of climate data for agricultural policy in East Sumba.

In dealing with both prevention of and responses to locust outbreaks, existing local government capacity needs significant improvement. This requires strategic crisis response in operation 24/7. The question is how to make agricultural department work more strategically and responsive to disaster risks. How to make decentralisation work for the poor and the most vulnerable? How to make the newly elected officials to comprehend the complexity of local problems and the challenges of rural development? How interagency coordination and joint response pontentially contribute to weather the situation today needs to be studied.

Furthermore, prevention of locust outbreaks must also mean improvement in the quality of ecosystem services including both natural and community forest protections. This suggests that regulating and governing the risk of locust outbreak means both territorially and administratively beyond the technical mandates of local entomologists and agriculturalists.

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[2] *Kutu lak* or seedlac is the secretion of an insect named Laccifer. It is used as raw materials for cosmetics, paints and other uses.

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Annex 1. Photos of migratory locusts occupied in East Sumba

Annex 1.1. Runway at Waingapu Airport occupied by millions of locusts on 10 June 2017

Photo Credit: Kompas/Zainal Ismail
[http://regional.kompas.com/read/2017/06/12/11460031/jutaan.belalang.serang.bandara.waingapu.di.sumba.timur]

Annex 1.2. Military member helps local government to combat swarms and bands

Photo credit: Kompas/Letnan Kolonel Infanteri Elvin T Saragi

http://sains.kompas.com/read/2017/06/14/160500023/dilema.sumba.timur.hadapi.serangan.belalang.10.tahun.sekali

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Author(s): Jonatan A. Lassa

(corresponding author: jonatan.lassa@cdu.edu.au)

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Institute of Resource Governance and Social Change
RW Monginsidi II, No 2B Kelapa Lima
Kupang, 85227, NTT, Indonesia
www.irgsc.org