THE IMPACT OF NATURAL HAZARDS AND DISASTERS ON AGRICULTURE AND FOOD AND NUTRITION SECURITY

A CALL FOR ACTION TO BUILD RESILIENT LIVELIHOODS

March 2015
This brochure presents the preliminary findings of an FAO study on the impact of natural hazards and disasters on the agriculture sector and sub-sectors in developing countries. The core findings of the study are:

- The agriculture sector — including crops, livestock, fisheries and forestry — absorbs approximately 22 percent of the economic impact caused by medium and large scale natural hazards and disasters in developing countries;
- The high impact of natural hazards and disasters on agriculture calls for enhanced mainstreaming of disaster risk reduction (DRR) and resilience building within the agricultural sectors;
- There are major data gaps on the impact of natural hazards and disasters on the agriculture sectors in developing countries. This sector-specific data must be systematically collected and included in national and international disaster loss databases to better inform appropriate risk reduction policies and investments for and within the sector;
- Humanitarian aid and official development assistance to the agriculture sector is small when compared with the economic impact and needs in the sector. More investment is needed in DRR to build resilient livelihoods and food production systems;
- The agriculture sectors need to be mobilized as proactive implementation partners for the delivery of the post-2015 framework on DRR so as to enhance local action and build resilience of the most vulnerable, which are often also the most food insecure.
Between 2003 and 2013, natural hazards and disasters in developing countries affected more than 1.9 billion people and caused over US$494 billion in estimated damage. How much of this damage was on the agriculture sector is unreported and is therefore unknown.

Global statistics on the economic impact of disasters are collected and reported as a total sum for all sectors, and do not capture the impact on individual sectors. National and international disaster loss databases typically report populations affected and damage to housing and other infrastructure, but seldom report damage or losses in the agriculture sector. As a result, there is no clear understanding of the extent to which natural hazards and disasters impact the agriculture sector and sub-sectors in developing countries.

Yet, sector-specific quantitative data on disaster losses is necessary to understand the breadth and scope of disaster impact on agriculture and livelihoods. Disasters destroy critical agricultural assets and infrastructure, and they cause losses in the production of crops, livestock and fisheries. They can change agricultural trade flows, and cause losses in agricultural-dependent manufacturing sub-sectors such as the textile and food processing industries. Disasters can slow economic growth in countries where the sector is important to the economy and where it makes a significant contribution to national Gross Domestic Product (GDP). Agriculture contributes as much as 30 percent of national GDP in Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Ethiopia, Kenya, Mali, Nepal, Niger and Mozambique among others.

When disasters strike, they have a direct impact on the livelihoods and food security of millions of small farmers, pastoralists, fishers and forest-dependent communities in developing countries. Agriculture employs over 30 percent of the labour force in countries such as Bolivia, Cambodia, Cameroon, Guatemala, India, Indonesia, Nicaragua Niger, Philippines, Sri Lanka, and Vietnam, and over 60 percent of people in Burkina Faso, Ethiopia, Kenya, Madagascar, Mali, Tanzania, Uganda and Zambia.

However, there is a critical information gap in terms of the quantitative economic impact of disasters on agriculture and on the livelihoods and food security of populations affected. FAO has undertaken a study to help fill this information gap, and to quantify where possible the impact of natural hazards on the agriculture sector in developing countries over the past decade. This brochure presents the first preliminary findings of the study.

The goal of FAO’s study is to contribute to a better understanding of disaster impact on the sector and help inform appropriate sector-specific disaster risk reduction (DRR) policies and financial investments that build resilience in agriculture and livelihoods. Resilience is understood as the ability to prevent disasters and crises, and to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving food and agricultural systems under threats that impact food and nutrition security, agriculture, and/or food safety/public health.

Ultimately, the adoption of agricultural technologies that help prevent, mitigate or reduce the underlying risks needs to be informed by a clear understanding of the way in which disasters impact on crop, livestock, fisheries or forestry production, or the type of hazards which have the greatest impact on each sub-sector. It requires a better understanding of how disasters compromise food and nutrition security, sector growth and national economies.
Given the lack of global statistics on disaster losses in agriculture, FAO applied a combination of methods and used several sources of information to estimate the economic impact on the sector. The study covered natural hazards, namely drought, floods, storms such as cyclones and hurricanes, earthquakes, tsunamis and volcanic eruptions, affecting developing countries between 2003 and 2013, and focused on the following five key areas of analysis:

1. Calculating the trends in damage and losses caused by medium to large-scale disasters in the sector, based on a review of post-disaster needs assessments (PDNAs) that were undertaken during the last decade in developing countries; and estimating the damage caused by natural hazards on crops and livestock based on data from DesInventar;
2. Estimating losses in crop and livestock production in developing countries affected by medium to large-scale disasters during the same period;
3. Estimating changes in trade flows, particularly increases in the value of imports and decreases in the value of exports;
4. Estimating the impact of drought on Sub-Saharan Africa, particularly in terms of populations affected and crop and livestock production losses over the past decade. A more in-depth analysis was done on droughts and their impact on food insecurity in the Horn of Africa;
5. Calculating the humanitarian aid invested in the post-disaster recovery of the agriculture sector over the past decade, reflecting in part the economic cost to the international community.

The preliminary results of the study reveal high economic losses in the sector due to disasters, as evidenced in the following five sections. Yet, the figures computed may still be underestimating the full economic impact on the sector.
To identify trends in the economic impact of disasters on crops, livestock, fisheries and forestry, FAO reviewed 78 post–disaster needs assessments (PDNAs) undertaken in the aftermath of medium to large–scale disasters in 48 developing countries in Africa, Asia and Latin America over the past decade (2003–2013). FAO calculated the damage and losses reported in these PDNAs.

The findings show that the 78 disasters caused a total of US$140 billion in damage and losses on all sectors, of which US$30 billion was on the agriculture sector and sub–sectors. On average, agriculture absorbs 22 percent of the total economic impact caused by natural hazards. For climate–related disasters such as floods, droughts and tropical storms, 25 percent of all damage and losses is on the agriculture sector. Agriculture is the single most affected sector by droughts, absorbing on average about 84 percent of all the economic impact.

The 78 PDNAs reviewed also indicate that, within agriculture, 42 percent of all damage and losses is on the crops sub–sector, followed by livestock with 36 percent.

**1. TRENDS IN DAMAGE AND LOSSES CAUSED BY MEDIUM AND LARGE–SCALE DISASTERS ON THE AGRICULTURE SECTOR AND SUB–SECTORS**

The distribution of damage and losses by sub-sector is as follows:

- **Crops**: 42.4%
- **Livestock**: 35.8%
- **Fisheries**: 5.5%
- **Forestry**: 2.4%
- **Irrigation**: 3.5%
- **Other**: 10.3%

Source: FAO based on data from PDNAs, 2003–2013
Based on the PDNAs reviewed, the crop sub-sector is the most affected by natural hazards. Total damage and losses to the crop sub-sector amount to about US$13 billion. Almost 60 percent of these damage and losses were caused by floods, followed by storms with 23 percent.

Livestock is the second most affected sub-sector after crops, accounting for US$11 billion, or 36 percent of all damage and losses reported in the PDNAs.

Out of the 78 disasters reported in the PDNAs, 45 of these caused damage and losses to the fisheries sub-sector totaling US$1.7 billion, which represents almost 6 percent of all damage and losses within the agriculture sector. Over 70 percent of this economic impact was caused by tsunamis which is an infrequent event, yet storms such as hurricanes and typhoons cause roughly 16 percent of the economic impact on fisheries followed by floods with 10 percent.

Source: FAO based on data from PDNAs, 2003–2013

Source: FAO based on data from PDNAs, 2003–2013

Source: FAO based on data from PDNAs, 2003–2013
The forestry sub-sector is also negatively affected by natural hazards. Twenty-six disaster events that took place between 2003–2013 caused US$737 million in damage and losses to forestry, which represents 2.4 percent of all damage and losses within the agriculture sector. Hurricanes, typhoons and similar storms have the greatest impact on the forestry sub-sector.

Average percentage share of damage and loss to forestry by type of hazard

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Storms</td>
<td>89.1</td>
</tr>
<tr>
<td>Floods</td>
<td>5.0</td>
</tr>
<tr>
<td>Droughts</td>
<td>3.2</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>2.7</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Source: FAO based on data from PDNAs, 2003–2013

However, the impact of natural hazards on forestry is not always reported in the PDNAs or other types of assessments, and there is therefore limited data on damage to forests and on forest production losses caused by disasters.

In addition, forest fires cause significant damage yet the impact is seldom measured. To estimate the damage caused by forest fires FAO calculated the damage reported in the DesInventar database between 2003 and 2013, and found that forest fires damaged a total of 4.9 million hectares of crops, valued at roughly US$689 million, the vast majority in Latin America.

Taking into account the protective functions of forests such as soil, water and biodiversity conservation, the indirect impact of disasters on forestry and the livelihoods of forest-dependent people is much higher than the data available and the figures reported here.

THE DAMAGE TO CROPS AND LIVESTOCK - A COMPARISON WITH DESINVENTAR DATA

In order to add an additional layer of analysis on the damage that disasters – including small-scale disasters – cause to crops and livestock FAO used the DesInventar database, which reports damages to crops in hectares, and to livestock in units lost on the basis of 56 national databases.

According to the data reported in DesInventar, 58 million hectares of crops were damaged and 11 million livestock lost due to disasters occurring between 2003–2013. FAO used the same data, and the formula applied in the UNISDR Global Assessment Report 2013 to calculate the monetary value of this physical damage, which sums up to approximately US$11 billion.

This figure is comparable with the results from 78 PDNAs, which covered medium and large-scale events in 48 countries, indicating a total damage to crops and livestock of around US$7 billion.

Both DesInventar data and the PDNAs analysis represent an underestimate of the overall damage caused by natural hazards and disasters on agriculture since they cover 48 to 56 countries only.
Given the lack of global data on losses in agriculture, FAO attempted to estimate crop and livestock production losses in countries affected by disasters during the past decade (2003–2013). For the analysis, a first selection was made of disasters affecting 250,000 people or more, and a second selection made of disasters when the population affected was above the ten–year average for that country. This allowed for a selection of medium to larger–scale disasters that are likely to have an impact on production at the national level.

National crop production losses were estimated by comparing decreases in the yield, during the year when disasters occurred and the subsequent year, with the yield linear trend (2003–2013). This calculation was applied to cereals, pulses and other primary food and cash crop commodities. Yield losses were multiplied by the area harvested to obtain production losses in tons. These were converted into monetary losses using producer prices.

National livestock production losses were estimated by comparing decreases in total production of livestock commodities (cattle and goat meat; cow and goat milk) in the year of disaster and in the subsequent year, with the production linear growth trend (2003–2013). Work is underway to update figures taking into account other livestock sub–sectors as well.

The result was a total of 67 developing countries that were affected by at least one medium to larger–scale disaster between 2003 and 2013. In these 67 countries, disasters caused US$70 billion in crop and livestock production losses.

In addition, the results of the analysis show that 82 percent of crop and livestock production losses are caused by drought (44 percent) and floods (39 percent).

In terms of the regional distribution of production losses, Asia is the most affected region, with total crop and livestock production losses amounting to US$28 billion or 40 percent of total losses, followed by Africa with US$26 billion. In relative terms, Africa is the most affected region, having lost 3.9 percent of total expected crop and livestock production, followed by Central Asia with 3.8 percent.
The impact of natural hazards on trade flows was estimated by comparing increases in the value of imports and decreases in the value of exports of primary crop and livestock commodities during the year when disasters occurred and the subsequent year, with the linear trend (2003–2013)\textsuperscript{12}. The results show that the value of agricultural imports increased by US$ 18.9 billion and the value of agricultural exports decreased by US$ 14.9 billion after major hazards in the countries analyzed between 2003 and 2013.\textsuperscript{13}

<table>
<thead>
<tr>
<th>Changes in trade flows after major disasters (US$ billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL CHANGES IN TRADE FLOWS</strong></td>
</tr>
<tr>
<td>$33.7 B</td>
</tr>
</tbody>
</table>

Source: FAO based on data from FAOSTAT, 2003–2013
Between 2003 and 2013, there were a total of 61 drought years in Sub-Saharan Africa affecting 27 countries and nearly 150 million people. FAO estimates that crop and livestock production losses due to these droughts amount to US$23.5 billion. This represents approximately 77 percent of all production losses caused by droughts worldwide during the same period.

It is likely that production losses due to drought in Sub-Saharan Africa are considerably higher. The above figure is considered to be an underestimate, particularly because of the limited statistics available for the study on the livestock sub-sector. In this analysis, livestock production losses are estimated only for four commodities, namely cattle and goat meat and milk, while the livestock sub-sector is large in many African countries.

### TOTAL PRODUCTION LOSSES

<table>
<thead>
<tr>
<th>Crop and livestock production losses after major droughts in Sub-Saharan Africa between 2003-2013 (US$ billions)</th>
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<tbody>
<tr>
<td>TOTAL PRODUCTION LOSSES</td>
</tr>
<tr>
<td>CROP LOSSES</td>
</tr>
<tr>
<td>LIVESTOCK LOSSES</td>
</tr>
<tr>
<td>$23.5 B</td>
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<tr>
<td>$19.3 B</td>
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<tr>
<td>$4.2 B</td>
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Source: FAO based on data from FAOSTAT, 2003–2013

In relation to the Horn of Africa (HoA), FAO estimates that between 2003–2013 there has been a total of US$4.9 billion in crop and livestock production losses caused by droughts in the Horn of Africa. This represents over 20 percent of production losses in Sub-Saharan Africa. However, production losses are likely to be much higher. For example, the post-disaster needs assessment reported US$10.7 billion in production losses due to the 2008–2011 drought in Kenya alone.

In order to analyze the impact of droughts on food security in the HoA, total production losses due to droughts occurring between 2003 and 2013 in the Horn of Africa were converted into losses in calories per capita per day, and compared with national Dietary Energy Supply (DES). The results show that, on average, Kenya has lost 3.7 percent of per capita Dietary Energy Supply after each drought, followed by Ethiopia with 3.3 percent, Somalia with 1.9 percent, and Djibouti with 0.2 percent.

However, in the Horn of Africa food insecurity is typically due to a combination of drought, soaring food prices, animal disease and insecurity affecting millions of people every year. On average, 9.6 million people required humanitarian assistance on an annual basis in the Horn of Africa.
Between 2003 and 2013, US$671 million of humanitarian aid has been spent on the agriculture sector and US$8.3 billion on food aid in response to food insecurity crises in the sub-region.17

Not surprisingly given the trends in drought and food insecurity in the Horn of Africa, a positive shift was made towards more resilient drought response in the sub-region, marked by the Nairobi Summit held in 2011 in which the most recent drought crisis was discussed by the Heads of State and Government of the Intergovernmental Authority on Development (IGAD) and the East African Community (EAC) member states. The Summit was convened in response to the grave concern over the magnitude of the crisis in the HoA, the worsening re-occurrence of drought disaster emergencies in the region, and their “dire humanitarian, environmental and productivity consequences”. More important, however, was the “acknowledgement of the ineffectiveness of past drought response approaches and the need to find more enduring solutions”.18

The Summit led to the development of the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI), which proposed to “do things differently by combining preventive (rather than reactive) methods, acting regionally (rather than as individual Member State) and using twin-track (rather than only emergency) and holistic (rather than silos) approaches”. The Strategy identifies 7 priority intervention areas where the necessary investment and action will help build resilience, and calls for increased commitment by affected countries and development partners to support sustainable development.


In Kenya, agriculture accounts for 30 percent of national GDP, it provides 60 percent of total employment and accounts for 65 percent of the country’s total exports. Droughts in Kenya have a considerable impact on livelihoods, agriculture and the national economy.

The 2008–2011 drought in the country caused a total of US$10.7 billion in damages and losses, of which nearly US$9 billion was on the livestock sub-sector alone, US$91 million on the food processing industry, US$1.5 billion on crops, US$53 million on fisheries, and US$85 million on nutrition.

The post-disaster needs assessment undertaken by the government and the international community estimated US$2.2 billion in recovery costs for the agriculture sector. In addition the assessment estimated US$2.9 billion for sector-specific measures to reduce risks and build resilience, a good example of how resilience can be built into disaster response and recovery for the sector. However, the sector received just under US$42 million in humanitarian assistance between 2008 and 2012 (OCHA FTS).
Over the past decade, about US$4 billion has been spent on humanitarian assistance to the agriculture sector, averaging about US$375 million annually.19

During the same years, roughly 3.4 percent of all humanitarian aid went to agriculture, while the sector absorbs about 22 percent of total damage and losses caused by natural hazards.

FAO estimates that it has spent about US$3.16 billion in post–disaster recovery assistance to farmers between 2003–2013.20 Approximately one–third of this investment was in response to disasters caused by natural hazards.

In terms of Official Development Assistance (ODA) to developing countries, the agriculture sector received US$65.5 billion between 2003 and 2013. As a percentage share, the agriculture sector received an average of 4.3 percent of total ODA, less than half of the UN target of 10 percent.21
THE COST OF NATURAL DISASTERS ON PHILIPPINE’S AGRICULTURE SECTOR

Disasters in the Philippines have a high impact on its agriculture sector. Between 2006 and 2013 the government estimates that disasters damaged over 6 million hectares of crops. During this period, the total losses in the agriculture sector were estimated by the government to be US$3.8 billion, caused by 78 natural disasters (2 droughts, 24 floods, 50 typhoons/tropical storms, 1 earthquake, and 1 volcanic eruption).

Most of the production losses were caused by typhoons/storms, amounting to US$ 3.5 billion or 93 percent. The majority of the losses in the agriculture sector were in the crop sub-sector with US$ 3.1 billion. Central Luzon (Region 3) has been the most affected by natural hazards during the period of 2006–2013, followed by region 11, 8 and 2. In Bicol (Region 5) alone, the total agriculture losses were about US$260 million, which is 6.8 percent of total losses for the country as a whole. Also in Bicol region, typhoons and tropical storms resulted in losses of US$ 221 million or 85 percent of all agriculture losses in this region.
While there are clear indications that natural disasters have a high impact on the agriculture sector, there are major gaps in the data and information available worldwide. National and international disaster loss databases seldom report losses in the sector. As a result, little is known on the types of hazards that cause the greatest sector losses. While droughts affect many countries in Sub-Saharan Africa and appear to be increasing in frequency, there is little data on the losses they cause to the agriculture sector and sub-sectors, and on the full extent of their impact on food security and poverty. The impact on sub-sectors such as fisheries and forestry is typically under-reported as well. Yet, quantifying and reporting such sector losses is fundamental to understand the challenges and to address them.

Disaster risk reduction measures are necessary to reduce, prevent and mitigate the significant impact of disasters on agriculture. Agricultural growth and productivity depend on food production systems that are resilient against production failure due to shocks and climate variability. This requires a strong emphasis on sector-specific disaster risk reduction measures, technologies and practices, as well as on a more sustainable use and management of vital resources such as land, water, soil nutrients and genetic resources.

Yet progress in mainstreaming DRR into the agriculture sector is limited. Many countries have national platforms, legislation and policies on DRR, but few address agriculture and food and nutrition security with sector-specific DRR policies and objectives. Reducing risks and building resilience within agriculture requires a policy environment that is conducive to the full mainstreaming of DRR within the sector. Sector-specific DRR planning is needed and must be included in national agriculture development plans to proactively reduce disaster losses in the sector, enable sector growth and protect the food and nutrition security of vulnerable populations.

The four priority areas of disaster risk reduction in the post-2015 DRR framework should be applied within the agriculture sector and sub-sectors; they need to be specified as part of national goals to achieve sustainable and productive agriculture systems, including farm technologies and practices that help prevent, mitigate and reduce disaster risks, and sector-specific vulnerability assessments and early warning systems.

Financial resources for DRR within the sector are needed to enable actionable results. This is true also at sub-national levels, where financing and concrete actions are needed to support local farming communities.

In addition to national DRR platforms, an institutional architecture is needed within the agriculture sector and sub-sectors, where key ministries/departments, research institutions, civil society and other relevant national actors contribute to DRR planning and implementation within the sector.

Recognizing the critical importance of resilience in agriculture for food and nutrition security, some countries have started to adopt clear policies to mainstream DRR across key sectors, such as Pakistan where mainstreaming risk reduction is one of its nine priorities within the National Disaster Risk Management Framework including mainstreaming within the agriculture sector. Other countries such as Tanzania have developed national agriculture development plans that explicitly integrate risk reduction as part of their strategy to achieve sector growth while also building resilience. These examples reflect good practices that need to be replicated and up-scaled more broadly in countries where the damage and losses to agriculture caused by disasters is high and therefore compromises sector development objectives for growth and productivity, and undermine national goals to achieve food security.

A CALL FOR ACTION TO BUILD RESILIENT LIVELIHOODS
ENDNOTES

1. In this study, the agriculture sector is understood to include crops, livestock, fisheries and forestry.
2. Based on data from the EM-DAT CRED database. The damage reported in this database is an under-estimate, since it reports economic damage in less than 30 percent of its records, as noted in the 2013 Global Assessment Report by UNISDR.
3. Out of the 78 PDNAs reviewed only three PDNAs assessed the impact of drought.
4. The PDNA methodology assesses “damage” in terms of the total or partial destruction of physical assets and infrastructure in the disaster-affected areas, in terms of their monetary value expressed as the replacement costs; and “losses” in terms of changes in economic flows arising from the disaster which continue until economic recovery and reconstruction is achieved. For example, in the agriculture sector losses refer to the decline in output in crops, livestock and fisheries production associated with the damage to infrastructure and assets.
5. In this study, the damage and losses calculated for the sector includes data on irrigation systems often reported under the water and sanitation sector in PDNAs, as well as on forestry typically reported under the environment sector.
6. Based on PDNAs in Kenya, Djibouti and Uganda.
7. The “other” category in the analysis of PDNAs refers to damage and losses to agricultural infrastructure such as offices, which are not specific to sub-sectors.
8. DisInventar is a conceptual and methodological tool for the generation of National Disaster Inventories and the construction of databases of damage, losses and the effects of disasters. The methodology was developed in 1994 by researchers and institutional actors linked to the Network of Social Studies in the Prevention of Disasters in Latin America and is supported by, among others, UNDP and UNISDR.
9. FAO estimated the monetary value of crop and livestock damage using the same formula used in the GAR 2013 report by UNISDR. The formula is: Number of crop hectares damaged and livestock units lost * (GDP per capita 2012 * 0.01 + 90). The formula results from regression analysis against GDP per capita, conducted using data on crop and livestock costs in a number of developing countries.
10. Disaster years were based on the EM-DAT CRED database. All droughts affecting 250,000 people or more were included in the analysis. In the case of Djibouti, all droughts reported in the EM-DAT CRED database were included.
11. In addition to cereals and pulses, the analysis focused on Top 10 commodities by production quantity and Top 10 commodities by production value at the national level.
12. The indicators used for estimating changes in trade flows measure the total annual monetary value of imports and exports of primary crop and livestock commodities in each country. Source: FAOSTAT.
13. Countries and disasters are the same selected for the estimation of production losses. However, 45 out of 141 disasters were excluded from the trade analysis due to lack of data on agricultural trade.
14. Drought years refer to the number of years in which a drought is reported in Sub-Saharan African countries in the EM-DAT CRED database, and therefore does not refer to drought events or drought episodes.
17. Data based on OCHA Financial Tracking Service.
20. FAO estimates refer to all crises (natural hazards and conflict).