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C2 Direct Agricultural Loss Indicator: FAO's Methodology, Application, Data Requirements

Figure 1. Damage and loss in agriculture as share of total damage and loss in all sectors (2006-2016)

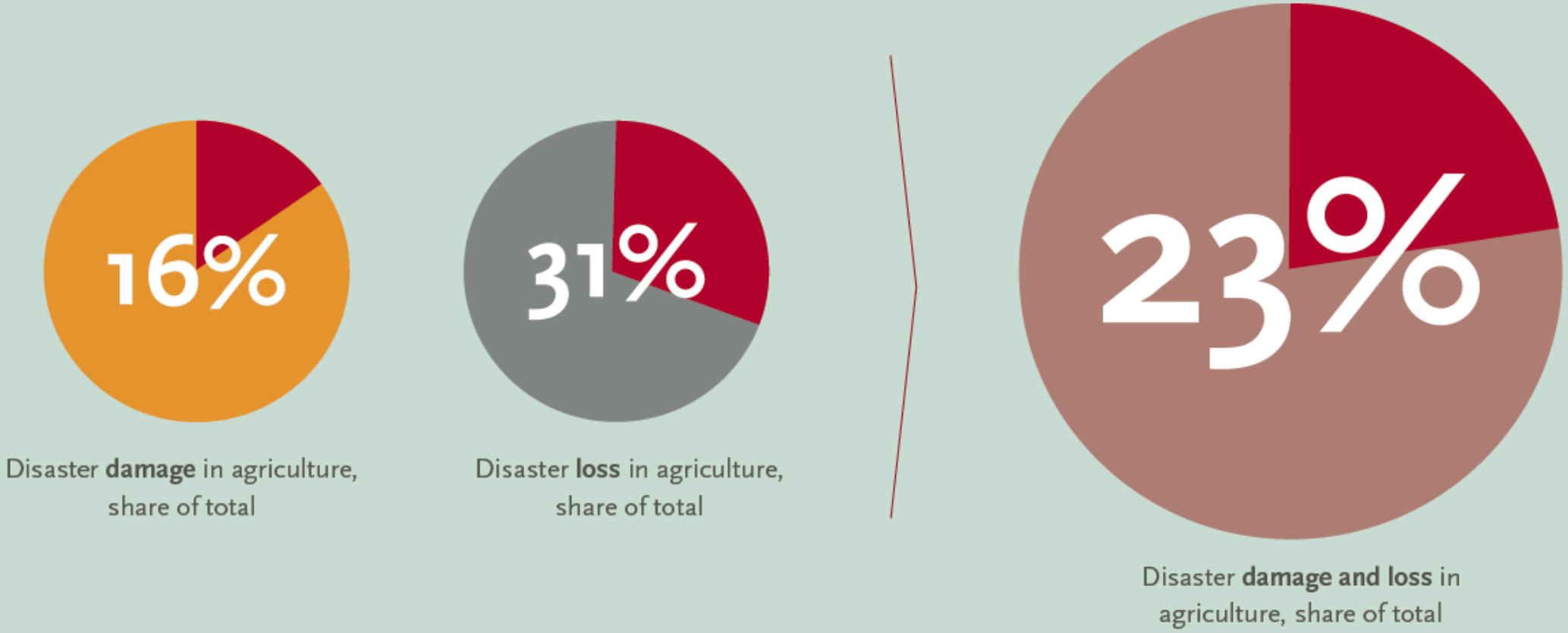


Figure 2. Damage and loss in agriculture as share of total damage and loss in all sectors (2006-2016), by type of hazard

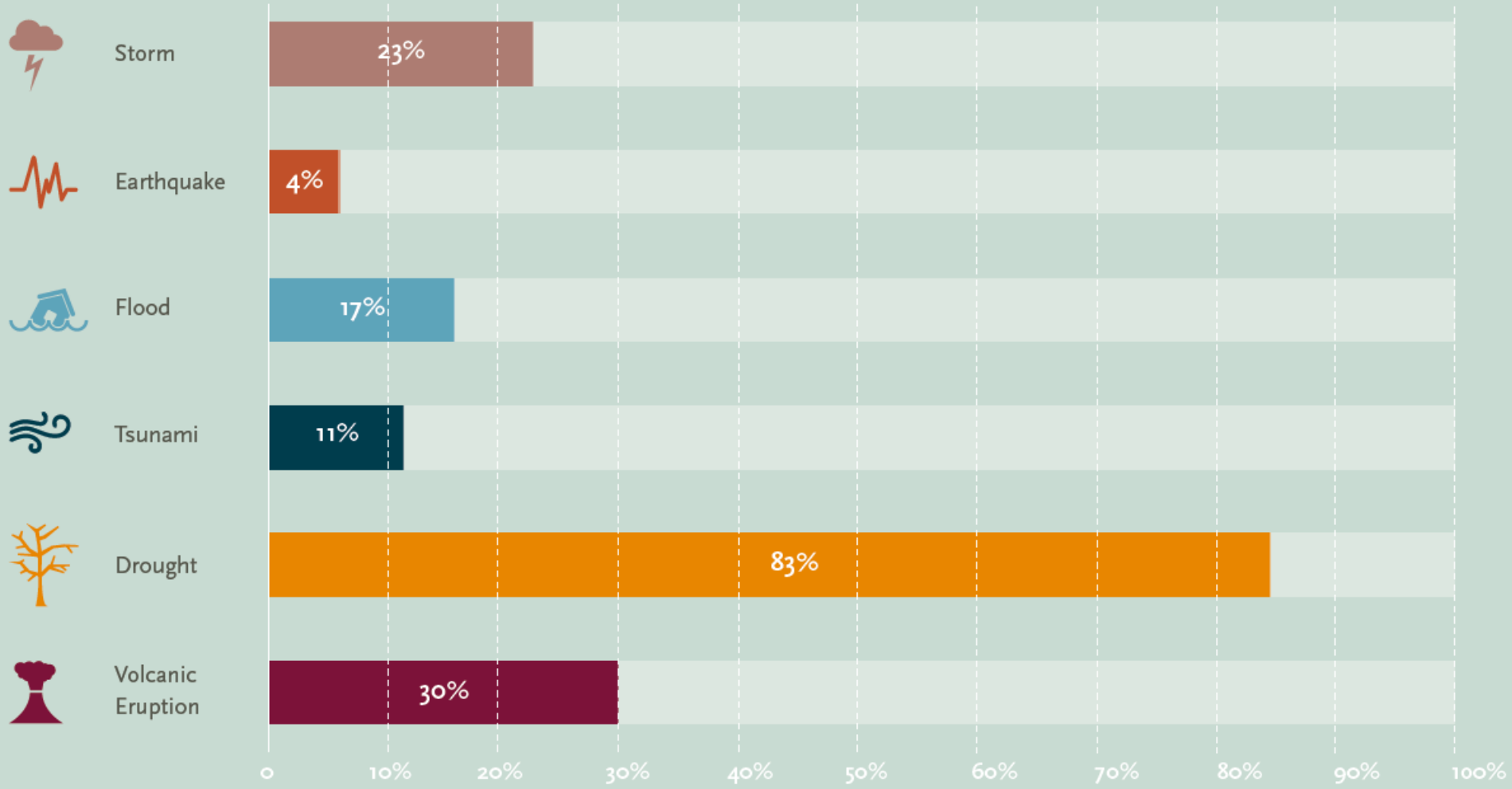
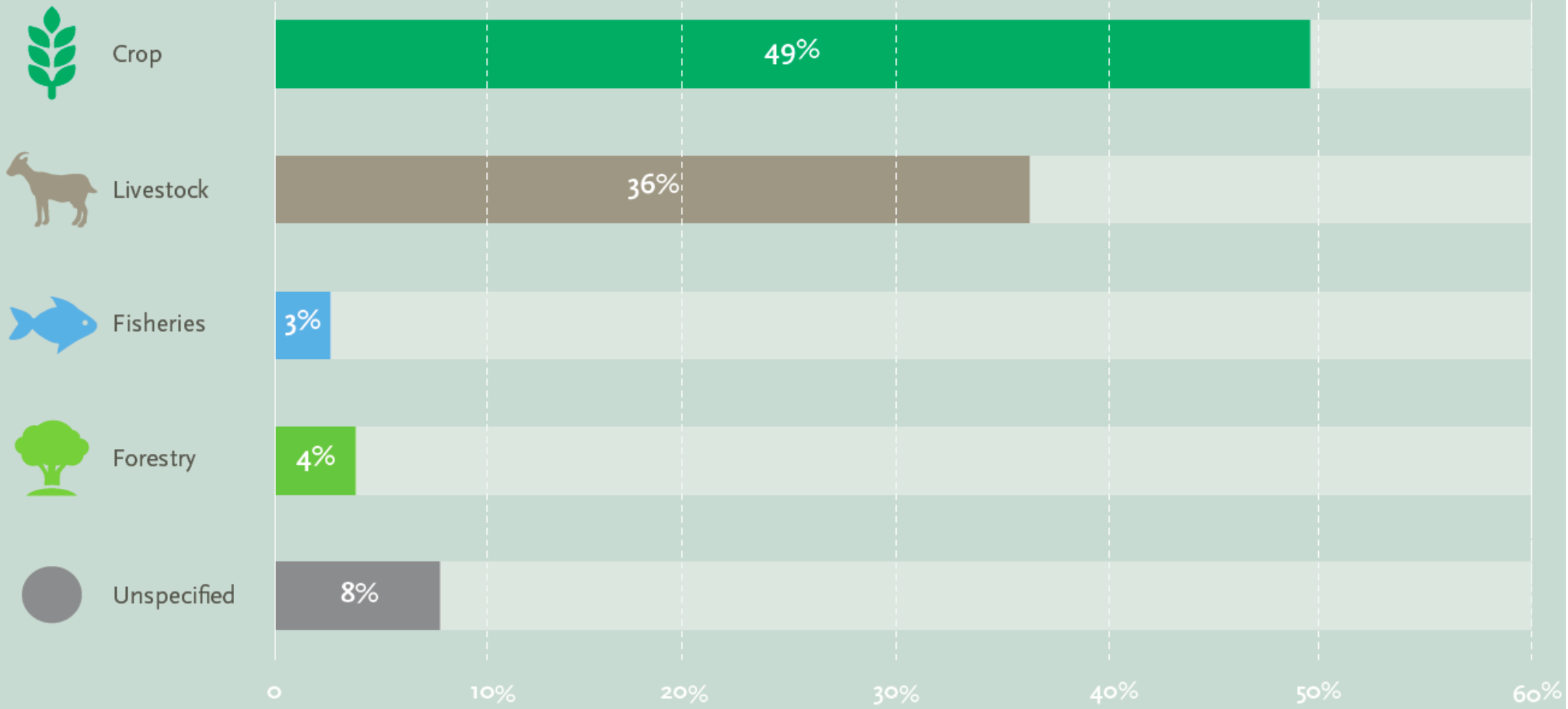


Figure 3. Damage and loss in agriculture by agricultural sub-sector, percentage share of total (2006-2016)



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I.
FAO's Methodology for Assessing Direct Loss from Disasters in Agriculture

No.	Indicator
C-1	Direct economic loss attributed to disasters in relation to global gross domestic product. (compound indicator)
C-2	Direct agricultural loss attributed to disasters *Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture and forest sectors as well as associated facilities and infrastructure.*
C-3	Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. *Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata.*
C-4	Direct economic loss in the housing sector attributed to disasters. *Data would be disaggregated according to damaged and destroyed dwellings.*
C-5	Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. *The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant*
C-6	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.

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This indicator is calculated based on five sub-indicators:

- C2(C): Impact to crops
- C2(L): Impact to livestock (and apiculture)
- C2(FO): Impact to forestry
- C2(AQ): Impact to aquaculture
- C2(FI): Impact to fisheries

$$\boldsymbol{Impact\ to\ Agriculture}:\ \boldsymbol{C2} = C2(C) + C2(L) + C2(FO) + C2(AQ) + C2(FI)$$

		Loss in Physical Stocks & Assets	Loss in Flows
Crops **Livestock** **Fisheries** **Forestry**	**Production**	Pre-disaster value of **destroyed stored production and inputs**	**Difference between expected and actual value** of crop production Short-run post-disaster maintenance costs
	Assets	Replacement or repair value of **destroyed assets** – machinery, equipment, tools	

C2-C (Crop loss) = *Loss in annual crop stocks + Loss in perennial crop stocks + Annual crop production loss + Perennial crop production loss + Crop assets loss (complete and partial)*

- ***Loss in annual crop stocks***
  - 1) Pre-disaster value of destroyed stored annual crops and inputs
- ***Annual crop production loss***
  - 1) Difference between expected and actual value of crop production in non-fully damaged harvested area in disaster year; 2) Pre-disaster value of destroyed crops in fully-damaged areas; 3) Short-run post-disaster maintenance costs
- ***Loss in perennial crop stocks***
  - 1) Pre-disaster value of destroyed stored perennial crops and inputs; 2) Replacement value of fully damaged perennial trees;
- ***Perennial crop production loss***
  - 1) Difference between expected and actual value of crop production in non-fully damaged harvested area in disaster year; 2) Pre-disaster value of destroyed standing crops in fully-damaged areas; 3) Short-run post-disaster maintenance costs
- ***Crop assets loss***
  - 1) Pre-disaster value of partially or fully destroyed assets

C2 In the Online Monitoring System -- Under development

- C2(Crops): by crop type
- C2(Livestock): by livestock type
- C2(Forestry): overall hectares damaged
- C2(Aquaculture)
- C2(Fisheries)

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II.
Data Requirements – Addressing Data Availability and Limitations

Data Requirements
C2 -C (Annual Crop Loss) – Optimal Data

Annual crop stock

xxx tons of stored organic fertilizer
xxx tons of stored nitrogen-based fertilizer
xxx tons of stored phosphate-based fertilizer

$$$ per ton of organic fertilizer
$$$ per ton of nitrogen-based fertilizer
$$$ per ton of phosphate-based fertilizer

xxx tonnes of stored wheat
xxx tonnes of stored maize
xxx tonnes of stored potatoes

$$$ per ton of wheat
$$$ per ton of maize
$$$ per ton of potatoes

Annual crop production

xxx tons of wheat (or t/ha) – expected
xxx tons of maize – expected
xxx tons of potatoes – expected

xxx tonnes of wheat (or t/ha) – actual
xxx tonnes of maize – actual
xxx tonnes of potatoes – actual

$$$ per ton of wheat
$$$ per ton of maize
$$$ per ton of potatoes

Short-run post-disaster maintenance costs

Crop assets

- xxx tractors
- xxx combined harvesters
- xxx water pumps

- $$$ per tractor
- $$$ per harvester
- $$$ per water pump

Annual crop stock

Annual crop production

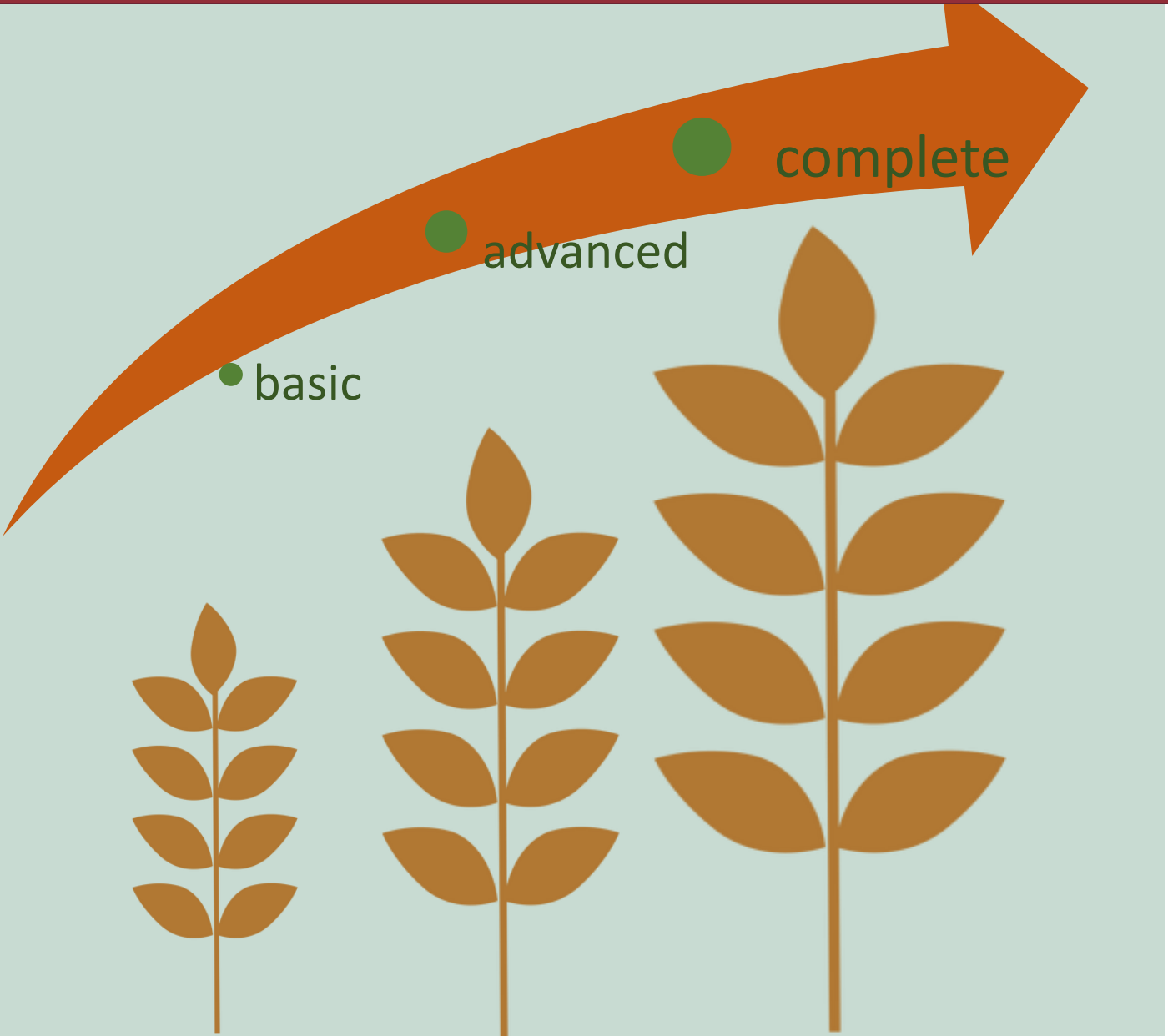
xxx tons of wheat (or t/ha) – expected
xxx tons of maize – expected
xxx tons of potatoes – expected

xxx tonnes of wheat lost
xxx hectares of wheat affected
xxx tonnes of maize lost
xxx hectares of maize affected
xxx tonnes of potatoes lost
xxx hectares of potatoes affected

$$$ per ton of wheat
$$$ per ton of maize
$$$ per ton of potatoes

Short-run post-disaster maintenance costs

Crop assets



- The C2 Indicator Methodology works with a range of data availability scenarios
- The Online Monitoring Tool is to accommodate different data availability

Disaggregation by crop / livestock type is key

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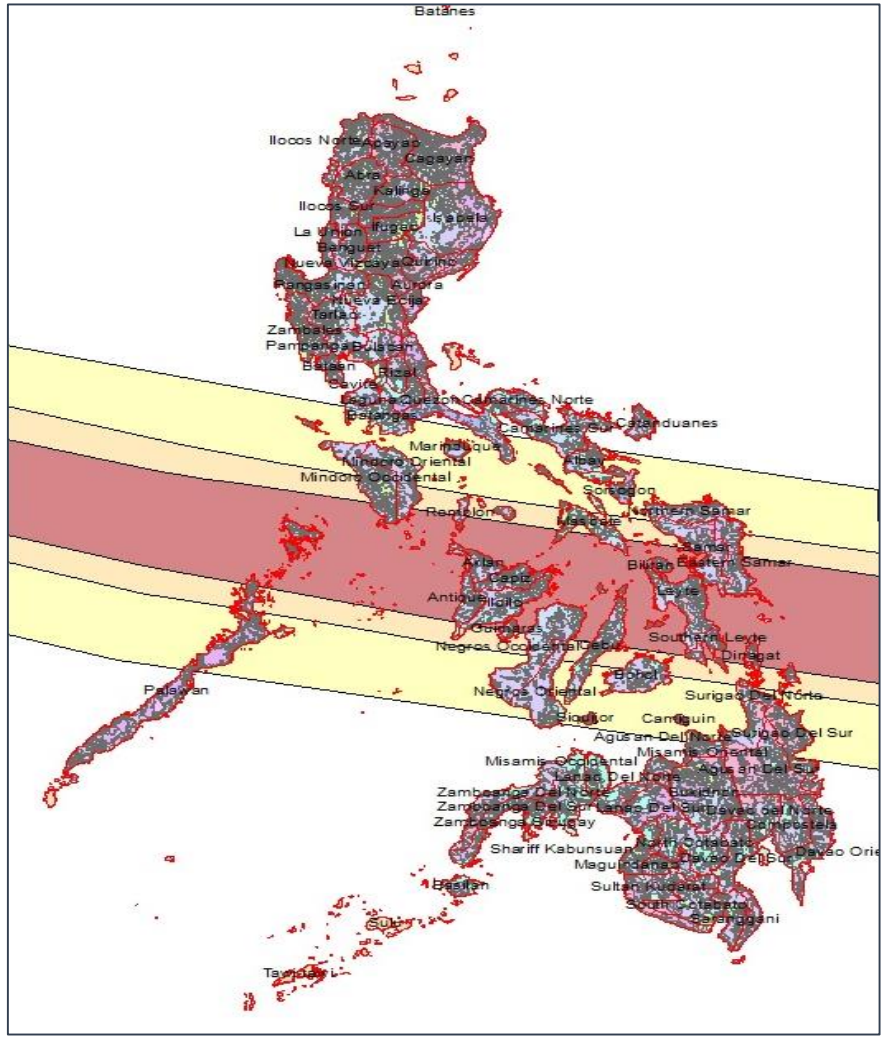
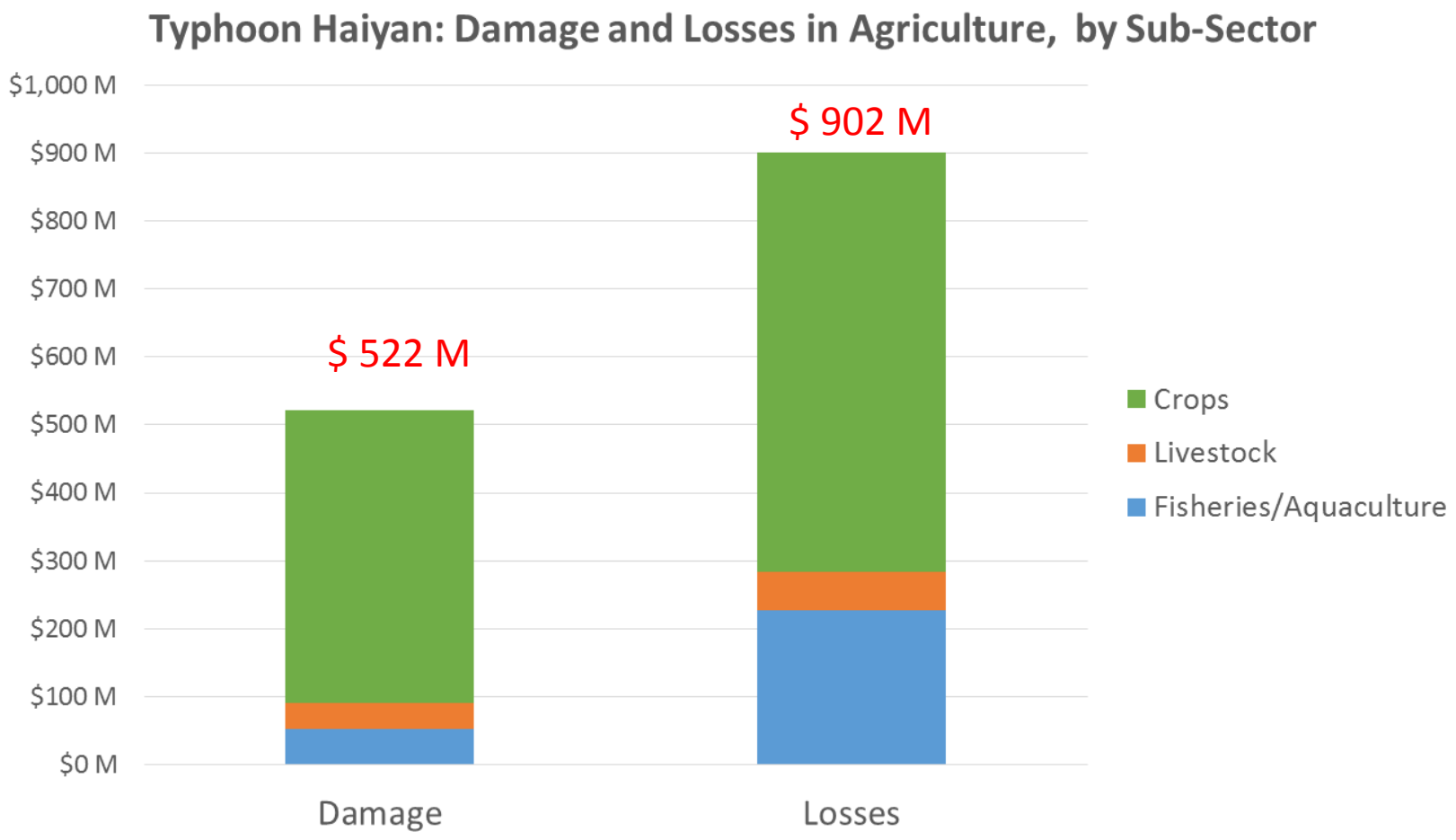
III. Applying the Methodology

Typhoon & Drought



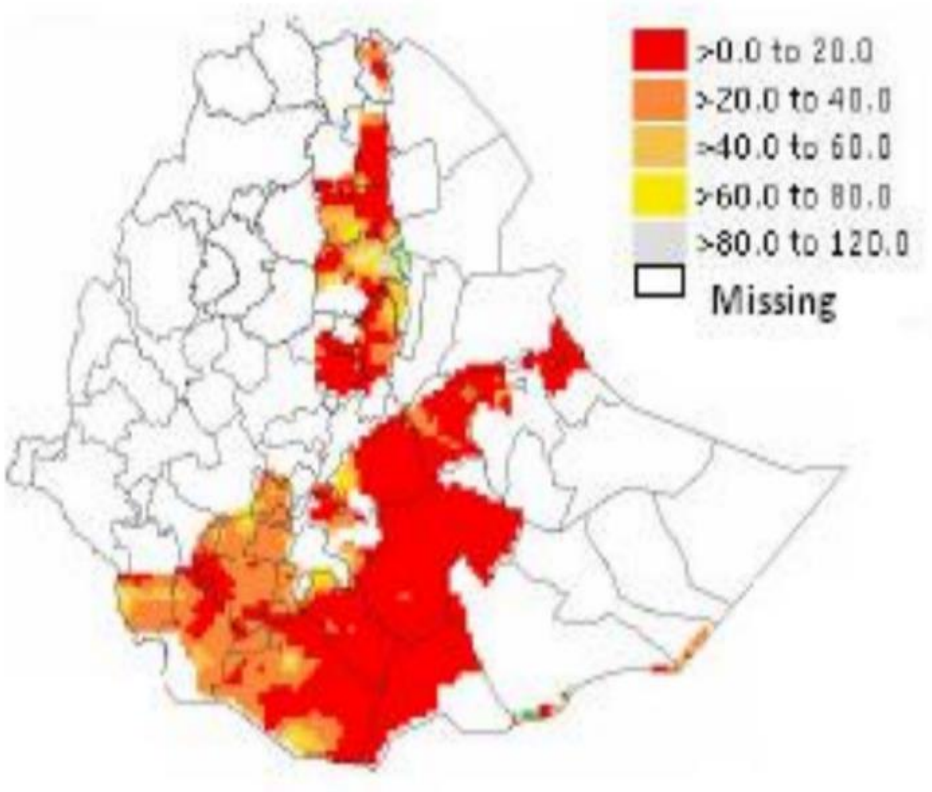
- Typhoon Haiyan hit central Philippines in Nov 2013
- Wind speed of over 300 km per hour -- strongest on record
- Storm surges up to 5.3 meters in height
- Over 6,300 deaths recorded (Nov 2013)
- Over 16 million people affected
- Over 1.1 million houses damaged/destroyed

Crops	Annual	→ Corn → Sugar cane → Tobacco → Palay (rice) → White potato → Cassava → Abaca	- Per region: yield / quantity produced (t/ha) - Per region: hectares affected - Per region: price at pre-disaster level (p/t) - Stored crop loss only available for: rice and corn - Asset loss: irrigation facilities and buildings; disaggregated by crop type and weighted according to the number of hectares affected for each crop type
	Perennial	→ Banana → Mango → Coconut → Papaya → Pineapple	
Livestock		→ Hog (pig) → Cattle → Goat → Poultry → Duck → Carabao (water buffalo)	- Per region: yield / quantity of meat produce - Per region: price at pre-disaster level - Asset loss: disaggregated by LS type and weighted according to the value of production damage for each LS type
		→ Commercial fisheries → Marine municipal fisheries → Inland municipal fisheries	- Per region: yields and quantity produced - Per region: price at pre-disaster level - Asset loss: disaggregated by FI and AQ and weighted according to the value of production
Aquaculture		→ Aquaculture	



Key Results

- **Total D&L in Agriculture**: USD 1.4 billion – in line with government assessment
- **Most affected sub-sectors**: crops, followed by fisheries and livestock
- **Loss is almost 80 percent higher than damage** – in government assessment the shares of damage and loss are almost equal (different computation methods)

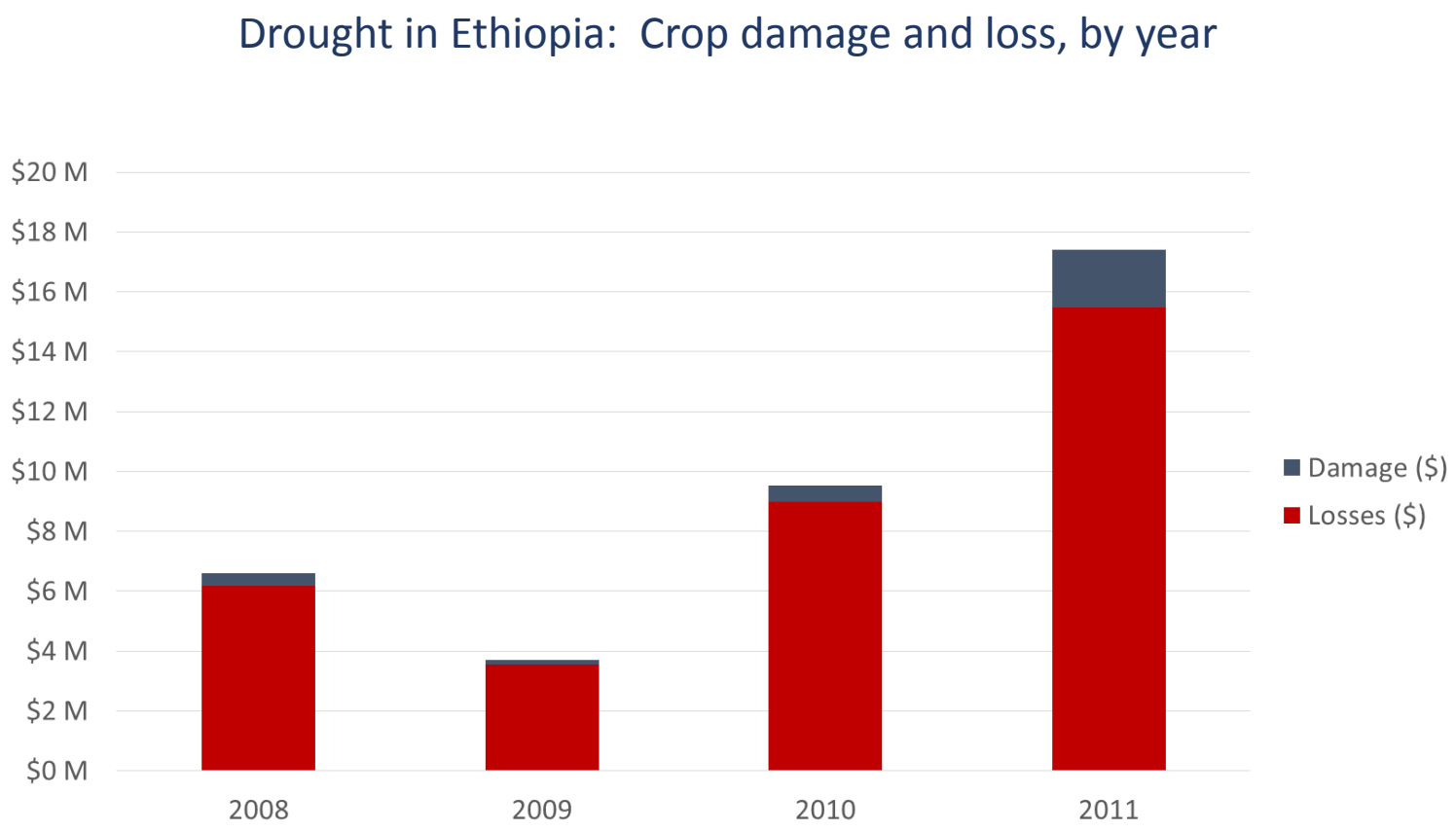


Unfolding of 2011 Drought in Ethiopia:

- failure of two consecutive rainy seasons in 2011; La Niña-triggered
- delayed seasonal rains and erratic distribution, but also highly reduced rainfall – less than 30% of 1995-2010 avg in some areas
- Areas most affected: southern highlands &arid and semi-arid lowlands in southeast
- Far-reaching consequences

Rainfall anomalies during the 2011 belg and meher seasons; Source: FEWSNET, 2011.

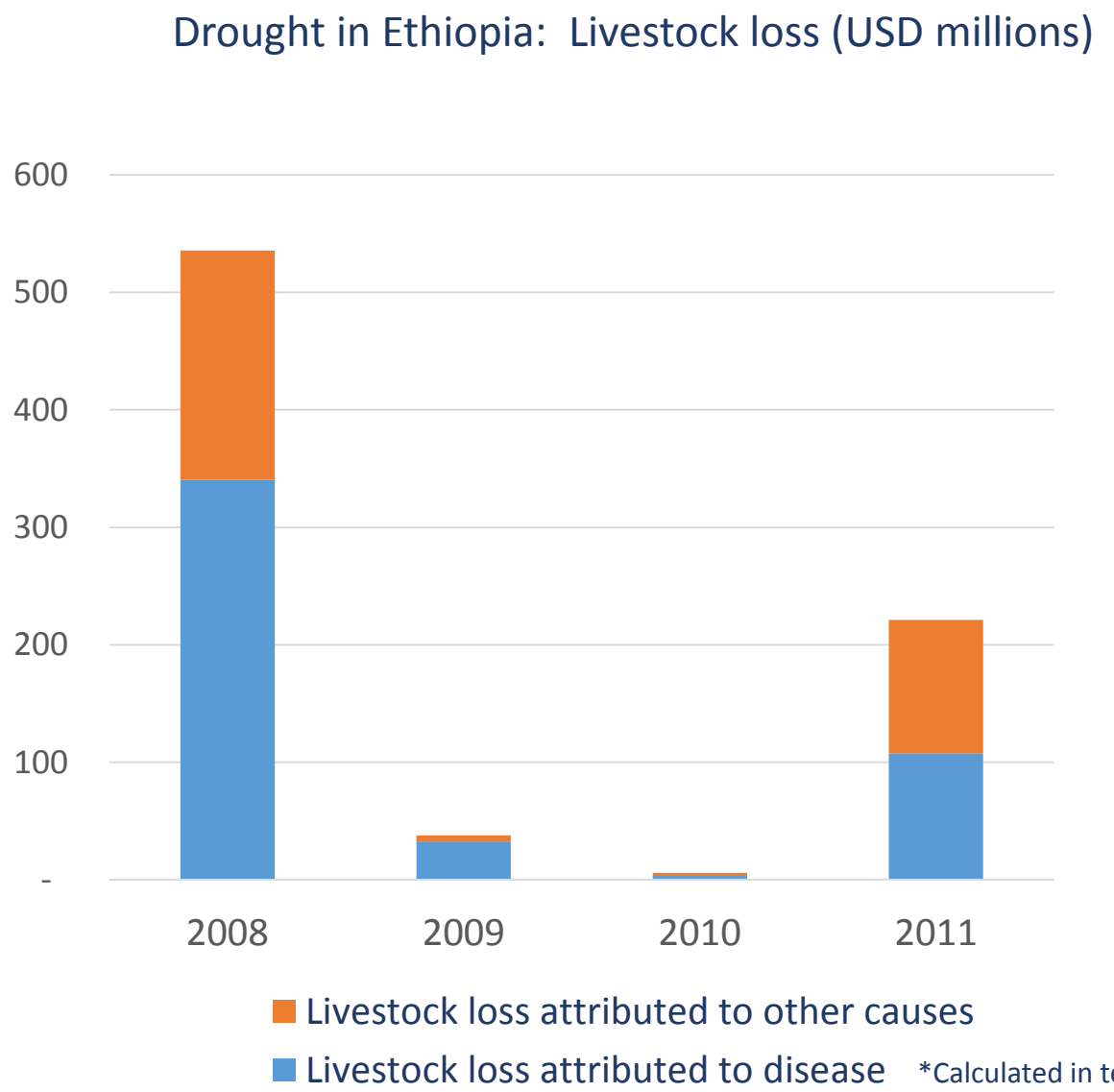
Crops	- Wheat - Teff - Maize - Sorghum - Barley - Coffee	- Number of hectares damaged from "lack of rain" - Yield per hectare - Price per ton
Livestock	- Cattle - Sheep - Goats - Horses & mules	- Number of LS deaths from disease - Price, meat live weight (by LS type)



Key Results

- **Total loss in crops sector**: USD 34 million
- **Total damage in crops sector**: USD 3 million

  (in line with government assessment)
- **Most affected crops:** teff, wheat and coffee
- **Loss comprises 90 % of all impact:** drought causes little impact on assets
- **Damage** consisted on impact of perennial crops, such as coffee



Calculated in terms of the difference between expected and actual value of livestock production

Key Results

- **Total loss in livestock sector**: USD 800 million
- **No damage in livestock sector**
- **Most affected livestock types:**
  - cattle (12 million deaths or 11 % of national cattle herd),
  - sheep (8 million deaths or 35% of national sheep count)
- Overall, Ethiopia lost 21% of livestock count in 2008 and a further 16% in 2011

FAO is working towards:

- developing countries' capacity to monitor the implementation of the Sendai Framework indicator C2
- institutionalizing a global mechanism to monitor and report on damages and losses caused by disasters and crises to the agriculture sectors
- rolling out an innovative EWEA system in 30 disaster-prone countries over the next five years
- scaling up support on resilience and vulnerability mapping, measurement and analysis
- generating greater evidence on the returns of investing in resilient agriculture practices

Thank you for the attention