

Handbook

for Estimating the Socio - economic and Environmental Effects
of **Disasters**

Economic Commission for Latin America and the Caribbean
ECLAC

Section Four

Economic sectors

I. AGRICULTURE SECTOR

A. INTRODUCTION

1. General comments

Each type of disaster affects the agriculture sector in its own way.¹ The sector is usually most affected by those of a hydro-meteorological nature –such as tropical storms and hurricanes, floods, frosts and droughts– whereas the impacts of disasters of a geological nature –earthquakes, volcanic eruptions and tsunamis– may only be indirect or marginal.

The extent of impact defines the scope of the work of the agricultural specialist, but agricultural issues are intimately related to all other phases of the assessment process. Cooperation and constant consultation among all sectoral specialists is therefore essential.

The agricultural specialist must first obtain a clear idea of the phenomenon's impact on the sector before asking a civil engineer to estimate damages sustained by the sector's physical infrastructure. This latter assessment should include damage to, or destruction of, livestock-raising facilities, product and input storage installations, the silting up or destruction of irrigation and drainage systems, and so forth. Therefore, close cooperation between these two specialists is essential.

As we have already suggested, agriculture is usually most affected by floods, frosts and droughts; in some instances, tropical storms and hurricanes may also affect urban areas, inflicting relatively more damage on productive sectors or infrastructure outside of agriculture. Disasters caused by earthquakes might only affect the agricultural sector by destroying or damaging such infrastructure as silos, warehouses and irrigation and drainage systems. Mudslides might affect both agricultural and urban areas.

Considering the environmental toll of most disasters, the agricultural specialist must also work in close cooperation with the environmental specialist so that the latter may include all the relevant information in his/her assessment. Such coordination assumes increasing relevance because the widening degree of degradation of natural resources prevailing in Latin America and the Caribbean is magnifying the current and future effects of natural phenomena. Losses of agricultural land through erosion and mudslides, destruction of flood control levees, changes in the course of rivers and the effects on the flora and fauna are some such factors to be considered.

¹ For purposes of this Handbook, the sector comprises the subsectors of agriculture, livestock, fisheries and commercial forestry development.



It is equally important to identify the differential impact of the disaster on women. The ultimate aim is to determine damage in monetary terms, and since impact varies by sex, the design characteristics of rehabilitation and reconstruction tasks generally must be fashioned accordingly. Once again, the agricultural specialist must work in close cooperation with the gender specialist for the purposes of the assessment, providing him or her with the relevant information.

Agricultural sector products are normally processed and sold by persons or companies other than rural producers, so the agricultural specialist must also cooperate with the trade and industry sector specialists.

The preceding paragraphs make obvious the need for agricultural specialists to maintain a broad vision and define intersectoral ramifications.

In addition, she or he must analyze the post-disaster situation in connection with the immediate availability of food and whether shortages may arise. Sometimes a disaster forces farmers and pickers to abandon fields and focus on dealing with the emergency and repairing or rebuilding their dwellings. Earthquakes may curtail access to food supplies by damaging silos and warehouses. Long-duration floods –such as those caused by El Niño in Ecuador²– may prevent a crop from being planted, while prolonged droughts may seriously compromise the production and future availability of food.

- 2 The agricultural specialist must ascertain the characteristics of the phenomenon causing the disaster, because only then will he/she be able to effectively plan his/her work. Consider the case of a hurricane whose intense winds can destroy plantations and crops; the accompanying rains may lead to flooding of farmland either directly or by causing rivers to overflow their banks. Some crops that are very resistant to wind may be vulnerable to long periods of flooding, as are African palm trees. Earthquake damage, in turn, is usually limited to relatively small areas, whereas droughts frequently extend over vast regions and may even affect several adjacent countries. In other extreme cases, the natural phenomenon can give rise to widespread although temporary climate modifications, producing multiple effects on different sectors, as in the Bolivia and Peru highlands during El Niño in 1982-1983.³ Therefore, the agriculture specialist must be well informed on the characteristics of the intensity and reach of the natural phenomenon causing the disaster, as well as its major effects and the areas affected.

² ECLAC, *Natural Disasters in Bolivia, Ecuador and Peru*, Santiago, Chile, 1983; and Jovel, Roberto, et al., *Consultants' Report for the Corporación Andina de Fomento*, San Salvador, 1999.

³ ECLAC, *Natural Disasters in Bolivia, Ecuador and Peru*, Santiago, Chile, 1983.

Effects may vary significantly depending on the timing of the disaster in relation to the agricultural calendar. A tropical storm or hurricane may occur just at the time when coffee plantations are in bloom and thereby destroy or very significantly diminish the year's harvest. The situation may be different for annual crops. If a flood or a late onset of rains occurs when sowing has just begun, a new crop can be achieved by planting faster - growing varieties; however, the loss can be total if the disaster strikes when the crop is ready for harvesting and it is no longer feasible to sow a new one in the same year. Much depends on the type of crop or plantation in question. In 1979, back-to-back hurricanes David and Federico struck coffee-growing areas in the Dominican Republic. In some instances, plants were uprooted and the loss was total, whereas damage was only partial in other areas.⁴ Permanent plantations generally sustain longer-lasting damage than annual crops because their recovery is slower. When part of a plantation is lost, it must be replanted, the related infrastructure –channels, drains, transportation networks, etc.– has to be rebuilt, and producers must wait several years for plants to mature and begin producing again. Such was the case of banana plantations located on the northern coast of Honduras hit by Hurricane Mitch in 1998.⁵

The agricultural specialist must also determine the destination of lost or affected production. In an area of subsistence agriculture, a disaster may have severe social repercussions. When an area is used for commercial crops, quantification of losses is essentially done in economic terms; the assessment must include an estimate of production losses, the evaluation of the national food balance and an estimation of import requirements to cover any shortfalls in foodstuffs.

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An additional effect is felt when the production lost is a raw material for the functioning of an industry, such as sugarcane, sisal or vegetables for canning. Sugar refineries, which generally have quite a broad area of influence, may find it unprofitable to bring cane over long distances or to use damaged roads given the higher transport costs they imply.

When export-oriented agricultural production is damaged, the impact is felt both on the level of the local economy and in the balance of trade and the current account, potentially upsetting macroeconomic equilibriums. Production losses that are compensated through imports may create similar imbalances.

Finally, any decrease in the agricultural sector's production, as in all productive sectors, causes losses of employment and income for agricultural workers. These must be estimated in close cooperation with the employment specialist, making use of known ratios between the volume of production and the required use of labor.

⁴ ECLAC, *Dominican Republic: Repercussions of Hurricanes David and Federico on the Economy and Social Conditions*, Mexico City, 1979.

⁵ ECLAC, *Central America: Analysis of the Damage Caused by Hurricane Mitch*, Mexico City, 1999.

2. Description of damages

When carrying out the assessment and preparing the respective report, the agricultural specialist must clearly describe the type of crop or plantation that has been affected, as well as its geographic extension. The description must be accompanied by the most accurate quantification possible of the areas and production affected. Bear in mind that damage may vary in nature depending on whether annual crops or permanent plantations are affected.

The damage to plantations and permanent crops may vary from total loss to only partial damage. Remember that a single natural phenomenon –such as a tropical storm or hurricane– can completely destroy plantations in its path and unleash torrential rains and winds that rob plants of their blossoms (such as coffee) or flood lands used for plantations sensitive to excess water (such as bananas).

- 4 Hurricane Fifi's impact on Honduras at the end of 1974 is a good case in point. The storm made a landfall in the northeastern part of the Honduran Atlantic coast, moved along a river valley that runs east-west, and damaged an area of excellent and highly productive land that was home to livestock and primarily banana, African palm, maize and rice. Banana plantations were located directly in the path of the hurricane and were practically destroyed. On the other side of the river, however, oil-palm plantations endured strong winds and more than two weeks of flooding. The rice and maize in the flooded area practically disappeared, while those planted in the upper sections of the river basin survived. Smaller animals –poultry, pigs and goats– practically disappeared, along with cattle that did not manage to take shelter on higher ground.⁶

The agricultural specialist must prepare a comprehensive description of the effects on the entire environment: natural resources, physical infrastructure, working capital, damaged or destroyed machinery, livestock and so forth. Such reports should include the full range of disaster reverberations for agricultural land, such as when excessive rains and flooding cause mudslides or the silting of productive lands located on hillsides and neighboring plains whose recovery may be unfeasible or either economically or environmentally non-cost-effective. A volcanic eruption's wind-blown ash may cause temporary damage by destroying crops, but in the medium and long - term may give rise to benefits by enhancing the yields of future crops.

The destruction of terraced fields and flood-induced deposits or waste may provoke losses, but it may eventually be possible to return such land to its pre-disaster state. A detailed description of these problems makes it possible to estimate future production shortfalls on such lands, as well as the stored products or inputs that were destroyed. A tropical storm's winds and flooding may cause a drastic, months-long decrease in milk and egg production as farm animals become stressed. Although the specialist might not be able to completely quantify these future indirect effects, they must be noted when deemed significant.

⁶ ECLAC, *Report on the Damage and Repercussions of Hurricane Fifi on the Honduran Economy*, Mexico City, 1974.

The description of inputs or crops stored in silos is relatively easy, because it suffices to prepare a list of each one and their volume or worth, classifying damage as total or partial. This is important because sometimes damage can make a product useless for one specific end, but it can still be used for other purposes. An example of this is maize for human consumption whose presentation or attractiveness might be reduced, but which can still be used as cattle feed.

Therefore, the agricultural and the environmental specialists must carefully examine permanent or temporary damage to natural resources. In some cases, torrential rains may sweep rich hillside soils to the plains, thereby improving the fertility of alluvial soils even if they had initially been damaged by flooding. In some cases, relatively high investments may be needed to replace lost topsoil.

After volcanic eruptions, the layer of ash deposited on the soils might be quite thin and permit full production recovery. Of course, if the layer of ash deposited is too thick, the recovery cost of renewing productive agriculture could be prohibitive.

It is equally important to determine the effects on the “backyard economy” activities carried out by women for subsistence purposes or as a source of occasional and supplementary income. The backyard economy refers to relatively minor activities (producing foods or raising small animals and obtaining their by-products) common in rural and marginal urban areas. Although it does not involve high investments, backyard production is very significant for the economy and for covering the food needs of many households. Losses in this regard are usually total and make it impossible or very difficult for these women to feed their families. When such losses occur throughout large regions, obtaining food becomes difficult and costly. The situation is even worse in women-led households.

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Therefore, it is very useful to identify the affected population by sex, based on prior statistical information or, when necessary, through fast sampling procedures. For example, identifying groups of affected peasant women assists in the design of programmes and projects to rebuild their backyard economy. Identifying groups of affected men is also very useful because it is they who tend to temporarily or permanently migrate to cities or even to other countries in search of jobs or income after a disaster, leaving the women in charge of plots or farms. Rehabilitation and reconstruction programmes must take these differential impacts on women into consideration.

Although impact assessments are needed fundamentally for planning medium - and long-term reconstruction, they may allow the agricultural specialist to uncover more immediate problems or possibilities that should be reported to the respective authorities.

3. Sources of information

There is very limited time available to conclude assessment work, since its results are urgently needed in order to guide reconstruction. However, the agricultural specialist and other sector specialists must collect any additional information that may allow a description of the different types of effects and damage.

The first rough assessment that officials in affected countries generally conduct when a disaster strikes provide analysts with an initial source of information that is often extremely useful when it comes to beginning the detailed assessment. These preliminary assessments define the hardest-hit areas, the geographical scope of the disaster and its effects, and potential economic repercussions. However, the time constraints implied by the urgency of such initial reports and a number of subjective factors generally mean that the initial assessments made by officials tend to be more qualitative than quantitative in nature and to overestimate effects. Therefore, the agricultural specialist must test the validity of such preliminary assessments in the field.

After dealing with the emergency stage and initially assessing the situation, governments usually undertake a more detailed study, frequently accompanied by field surveys. This information is very useful to the agricultural specialist because it is often compiled by local experts who themselves live in the affected areas and are very familiar with local crops, their yields, prices and other information needed to carry out a detailed impact assessment.

The agricultural specialist must also collect information on long-term statistical series on production and trends in the affected region; such data make it possible to estimate what production would have been had the disaster not occurred and thereby allow for comparisons between pre- and post-disaster scenarios.

- 6 During the mission, the agricultural specialist must try to get as much information as possible from different sources, even if they are apparently contradictory. This will allow him/her to verify them in due course and use the one that, in his/her opinion, best reflects the actual situation. To do this, visits to the affected region must be as wide-ranging as possible. Field visits are normally difficult to undertake because of damage to communication routes, and in such case air transport should be obtained if possible –preferably by helicopter, given the advantages of maneuverability and the ease with which visits can be made to any place of interest– so that the visit can be made in as little time as possible. If visiting the whole region affected is difficult due to a lack of facilities, the specialist must prioritize his field visits as a function of available facilities,⁷ the extent of physical damage (if there is a large number of victims and infrastructure has been destroyed) and economic importance (e.g., if coffee plantations whose production is equal to half the country's foreign currency earnings are destroyed). In any case, he/she will have to be selective and choose to visit the areas that are most representative and most economically and socially significant.

7 At the time of the assessment mission, helicopters may still be in use for emergency work.

The field visits will permit interviews with local officials and people affected by the disaster, whose firsthand experiences and information can contribute to an understanding of the magnitude of the disaster and its effects. The agriculture specialist must also try to contact experts at different levels and in different activities; for example, the agriculture ministry's representative may have an overall view, whereas the extension agent may have a very specific view of the area in which he/she works. Contact must also be established with service providers, vendors of agricultural inputs and so on, who may know the structure and size of local food and raw materials demands, as produced and required by the agricultural sector. All of the above will allow the agricultural specialist to put together his/her own view of events.

Preliminary work must also be done to define in advance what information should be obtained during local interviews in the field. If there are no estimates on damaged infrastructure at the central government level, the field visit will provide an excellent opportunity to obtain such information. If, on the other hand, there are estimates but they have not been verified, interviews will allow such verification. In other words, the specialist must have a clear idea of what he/she wants or needs, and how to get it.

As has already been said, no information should be rejected, and no opportunity to talk about the disaster should be overlooked. Therefore, the agricultural specialist must also hold interviews with the national officials who prepared the preliminary damage assessment or who are connected with agriculture in various ways, such as agents from the sectoral planning office. They must also consult directors of specialized institutions or trade associations that have some kind of influence or work in the area, such as those of coffee and banana growers, cattle farmers or crop dusting pilots. The same is true of international officials having some activities in the affected area. (FAO, IFAD, WFP, IADB, World Bank, OAS development projects, etc.).

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The specialist should also meet with representatives of companies involved in the transformation of agricultural products in the region, such as pasteurizers, packers, canners, fertilizer manufacturers and vendors. Their experts may provide information that will give the specialist a better idea of the impact that a lack of necessary raw materials will have on such companies, as well as additional ideas related to employment, recovery time, and so on.

Finally, in the immediate aftermath of the disaster, the printed press can provide knowledge that may assist in understanding the phenomenon, especially in the first stage, although care must be taken not to take at face value any quantitative information provided by unauthorized sources.

B. QUANTIFICATION OF DAMAGE

1. Direct damage

Direct damages to the agricultural sector refer to losses of capital assets. They may be grouped under four main headings: damage to farmland, whose recovery may take many years; damage to physical infrastructure (including irrigation and drainage systems, storage facilities, silos, etc.) and to machinery and equipment (tractors, spraying equipment, etc.); losses of crops that are ready to be harvested; and losses of stock (livestock, inputs, harvested products, etc.).

A distinction must be made here between the loss of crops ready for harvest, which is considered direct damage, and the loss of future harvests, which is regarded as indirect damage or losses, as we explain in detail later in this chapter.

a) Losses of farmland

The value of farmland lost, whether through erosion or total sedimentation, is difficult to estimate. Although the soil may have been lost and there is nothing that can be done about it, a value may be assigned to that damage on the basis of what the land would have produced over ten years based on the average productivity levels of the affected area. Thus, if a hectare of bananas produced an average net annual income of 20 000 dollars, a value of 200 000 dollars per hectare can be assigned to the loss.

A rough idea of the value of damage to the land temporarily affected by flood deposits can be developed on the basis of the cost of clearing a hectare of land that has minor tree cover. These figures are always available in ministries of agriculture or may be obtained from private companies that do such work. The agricultural specialist must estimate the affected surface area and estimate the total cost of recovering the land in question together with the civil engineering specialist.

8 It is more difficult to estimate damage to land that has been invaded by external agents that do not necessarily have a permanent effect on resources, such as land covered by volcanic ash. In the short term, the soil stops producing and there is no rule for projecting how long it will take for vegetation to recover. The volcanic eruption that occurred in a Central American country just as the cotton harvest was being picked is a good example. The immediate result was a lowering in the quality of the fiber collected, with a corresponding fall in price. However, because the layer of ash deposited was thin enough to be plowed into the soil, agricultural activity was reinitiated the following year. In some cases, the content or composition of the ash leads to an increase in soil productivity, so it must be analyzed before it is folded into the soil by machine. When the ash deposits are too thick, the rehabilitation costs and period are greater. Of course, future harvests that will not take place because of this phenomenon must be registered as indirect losses.

b) Damage to agricultural infrastructure and equipment

Damage to the sector's physical infrastructure (irrigation and drainage channels, storage facilities, silos, machinery, laboratories, corrals, chicken sheds, aquaculture pools, fishing port installations, etc.) and equipment is estimated on the basis of physical units affected, whether totally or partially destroyed. The agricultural specialist must estimate the extent of the damage, using physical units such as kilometers of farm roads, length of channels in meters and number of tractors, and then co-operate with the civil engineering specialist to determine monetary values. Table 1 shows the type of estimate that must be carried out in the case of direct damages to infrastructure, and Table 2 describes damage to assets at the farm level.

In this regard, differences between present and replacement values of assets referred to in Section One of this Handbook –on valuation criteria– must be taken into consideration.

c) Production losses

Strictly speaking, only production ready to be harvested at the time of the disaster can be taken into account under this heading, because only then can it be considered an asset.

However, if the disaster occurs while annual crops are still growing, it is necessary to register the loss on investment in labor and inputs. If a crop is totally destroyed, the costs incurred by producers must be estimated in accordance with the stage of the crop. If destruction or damage is partial, estimates must be prorated accordingly. The costs of the forthcoming harvest cannot be considered as damage since that would imply double accounting. If imports are used to replace lost crops that could not be replanted, the value of those imports must be indicated so the macroeconomics specialist can take it into account in the analysis of post-disaster economic performance. In no case must they be added as direct damage.

Table 1
DAMAGE TO INFRASTRUCTURE

Item	Description of damage	Cost, millions US\$
1. Access roads	70 km of dirt access roads in poor condition.	
	(2) 22-m long Bailey bridges, destroyed.	
2. Infrastructure	6 km main channel, water intakes 14 to 27, destroyed	
	20 postes eléctricos 1 transformador, etc.	
	7 water intakes and equipment	
	800 m of power line to operate pumps	
	20 electricity posts 1 transformer, etc.	

Estimating damage to permanent plantations is more difficult. It requires an estimation of costs incurred throughout the planting and maturing period (several years in all cases) before they production is resumed. In some cases it will also be necessary to repair or replace production infrastructure, such as networks of cables to transport bananas to the packing plants or irrigation and drainage channels. These costs must be estimated under the previous heading, using information that can be provided by the affected companies.

In the case of livestock, no losses or direct damage should be registered under the heading of production. Instead, they are considered losses of stock (which are examined under the following heading) or of future production (which is taken into account as indirect damage). As noted earlier, the volume of losses of each crop or plantation must be estimated first so that they may then be expressed in monetary terms, based on prices paid to the producer.

Table 2

DAMAGE TO CAPITAL ASSETS AT THE FARM LEVEL

Item	Description of damage	Cost
1. Land affected	35 hectares silted with sand, totally lost 150 hectares flooded with waste material, but recoverable	
2. Irrigation and drainage system	100 km of main channels 750 km of secondary channels 210 km of silted drains	
3. Machinery and equipment destroyed	10 tractors 2 seeders 3 pumps 5 tow-trucks 1 truck 7 spray pumps Sundry equipment	
4. Crops and inputs lost	21 tons of maize 5 tons of maize seed 50 bags of fertilizer 1,500 liters of gasoline 17,000 hessian bags	
5. Other production goods	16 mules 70 bales of hay, etc. 1 granary, 700 m ² concrete and brick construction	
6. Buildings and installations	2 granaries, 950 m ² adobe construction 1 milking parlor, adobe	

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d) Losses of stock

Stocks of inputs and agricultural production that has already been harvested and stored may be totally or partially lost. In the case of total loss, damage must be estimated at farm prices and inputs at replacement value. Estimates of partial loss or damage are made on a prorated basis.

In the case of livestock, when estimating the value of losses, a distinction must be made between beef, dairy and breeding cattle, because prices and unit values are different. Production losses under this heading are estimated as indirect damage.

Previously harvested and stored pasture that may be lost as a result of the disaster must be included in the estimation of stock, based on a value determined in cooperation with experts and farmers in the affected areas.

In regions devoted to peasant agriculture, cattle raising usually provides only a supplement to the population's total income. Losses of larger animals, especially those used for agricultural work, must be taken into account at their market prices.

Losses of stock are included in Table 2.

2. Indirect losses

For this sector, indirect losses refers to any decrease in production throughout the recovery period resulting from direct damages caused by the disaster. Indirect damage also includes the cost of works required to prevent or mitigate damage by similar phenomena that may occur in the future.

Indirect damage to annual or seasonal crops occurs when there is not enough time to re-sow for a second harvest or when an extended flood or the absence of rain prevents the planting of one or more crops or reduces crop yields. In such cases, we recommend that future losses be estimated on the basis of their probable physical volume, taking into consideration the average productivity levels for the affected areas, broken down by each affected crop. In the case of plantations or permanent crops, productivity is reduced by damage to the plants themselves. Examples include coffee and fruit trees, whose future productivity may decrease due to the loss of blossoms.

Livestock production also decreases because of emotional stress on animals affected by natural phenomena. For example, after a hurricane or prolonged flood, hens stop laying eggs, and cows lose a lot of weight and their milk production falls. These indirect effects are difficult to estimate. They are frequently calculated as decreases of up to 20% of normal production, but one should consult local experts and affected producers who have faced similar experiences in the past, before deciding on the percentage to be applied. The disaster can also have a significant impact on the growth of pasture. Some pasture may be completely destroyed by floods –as in the case of Jaragua, Estrella or Taiwan types– or by drought. In such cases, the indirect damage caused by the disaster can be estimated as the cost of replanting pasturelands.

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Fishing or the future production in aquaculture systems can be affected in various ways. Floods or high tides may destroy shrimp - growing reservoirs or pools used in some countries, diminishing production during the rehabilitation period. Fish capture may fall when seawater temperature and salinity change, as in the case of the El Niño phenomenon along the Pacific shores of some South American countries, or when major earthquakes occur whose epicenter is located at sea. In the recent case of El Salvador, shoals withdrew to deep sea locations that could not be reached by artisan fishing boats.⁸

Note, however, that hydro-meteorological phenomena may also have positive effects on production. The El Niño phenomenon has opened up normally arid or semi-arid lands for the temporary production of highly profitable crops, and has given fisherman access to high-value fish species that normally inhabit other latitudes. These increases in production must be subtracted from losses of traditional products to obtain a net damage result.

⁸ ECLAC, *The January 13, 2001, earthquake in El Salvador*, Mexico City, 2001.

The construction of defense or mitigation works against future natural phenomena is essential. In one Central American country, significant and extensive flooding occurred on coastal plains after heavy rains exceeded the capacity of watercourses to quickly discharge runoff into the sea. Moreover, the sediments brought down by the floods were deposited in river deltas, further reducing the capacity to discharge runoff. The delta had to be dredged, and protection levees were built along major sections of the rivers. The cost of such work was registered as indirect damage caused by the disaster. Other types of indirect damages might include reforestation on the upper reaches of river basins and the training of riverbeds along certain sections.

Table 3 below is an example of how to calculate indirect production losses.

3. Total damages and losses

Total damages caused by a disaster can be obtained as the sum of direct damage and indirect losses. As an example, Table 4 describes agricultural sector losses caused by hurricane Mitch in Honduras in 1999, with a detailed explanation given in Appendix X. Total damage estimates must also be broken down between that sustained by the private and public sectors, because reconstruction might be dealt with differently in each case. Steps must also be taken to determine the geographic or spatial distribution of damage in order to provide criteria for prioritizing reconstruction programmes.

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Table 3

ASSESSMENT OF PHYSICAL AND ECONOMIC DAMAGE IN AGRICULTURE, BY AREA AND SECTOR

Region of the country	Area planted before the hurricane, hectares	Total affected area, hectares	Area with total damage, hectares	Area with partial damage, hectares	Amount of losses at the farm level, thousands of dollars ⁹	Percentage of total damage, %
Central	61,451	48,075	30,067	10,003	143,706	55.9
Southwest	56,621	17,826	9,355	6,471	13,994	5.4
South	46,317	12,253	5,232	7,021	15,010	6.2
East	34,169	21,325	6,926	14,399	10,334	4.2
North	117,393	37,301	14,303	22,998	43,392	16.9
Northeast	30,657	11,007	4,794	6,293	3,422	10.3
Northwest	128,984	54,292	13,600	40,692	26,360	1.3
National total	475,502	202,239	84,357	117,002	257,127	100.0

Source: Department of Agriculture.

⁹ Includes the cost of replacement of capital – which in the case of permanent crops will be spread over several years – but does not include losses of stock or losses due to the effect of paralysed production. That is why these figures do not necessarily coincide with those in Table 4.

Total damage and losses should not include the cost of any imports to replace lost production for internal consumption, or exports that do not take place due to lost production, as this would imply double accounting. Those figures, however, should be taken into consideration by the macroeconomics specialist in the external-sector analysis. The same applies to any loss of individual or family income due to production shortfalls, which should be added to the corresponding figures for other sectors describing the effect of the disaster on employment and income at the national level.

Table 4 below offers an example of the total cost of direct damage and indirect losses, as well as their impact on the external sector in terms of lower exports and greater imports.

Table 4

HONDURAS: LOSSES IN AGRICULTURE, LIVESTOCK, FORESTRY AND FISHERIES
ARISING FROM THE EFFECTS OF HURRICANE MITCH IN 1998
(Millions of lempiras)

Sector and subsector	Total damage	Direct damage	Indirect losses	Impact on the external sector	
				Increase in imports	Decrease in exports
Total	27,424.5	16,554.2	10,870.3	561.2	5,864.2
Agriculture (1+2)	23,256.3	14,105.3	9,151.1	561.2	5,492.9
1. Assets (A)	11,535.2	11,535.2			
Soil	5,214.4	5,214.4			
Plantations, facilities	6,320.8	6,320.8			
2. Production: Crops	11,721.2	2,570.1	9,151.1		
Domestic consumption (B)	901.5	772.8	128.4		
Rice	128.4	30.9	30.9	19.3	
Beans	156.5	66.8	89.7	104.2	
Maize	611.6	609.1	2.5	383.5	
Sorghum	97.0	66.1	30.9	54.3	
Exports and Industry (C)	10,819.7	1,797.3	9,022.4		
Bananas	6,548.9	466.5	6,082.4		4,276.8
Coffee	854.9	629.2	225.7		600.3
Sugarcane	747.2	387.0	360.2		85.5
Citrus	440.2	30.0	410.2		25.0
Melon	473.6	31.7	441.9		530.2
African palm	862.9	143.8	719.1		
Pineapple	177.0	11.0	166.0	...	
Other	715.0	98.0	617.0		
Livestock (1+2) (D)	3,492.5	1,886.0	1,606.5		0.0
1. Assets	2,755.4	1,763.1	992.3		
Cattle	1,217.3	225.0	992.3		
Poultry	738.1	738.1			
Physical facilities	500.0	500.0			
Pasture	300.0	300.0			
2. Production	737.1	122.9	614.3		
Milk	737.1	122.9	614.3		
Forestry (E)	46.0	27.0	19.0		
Fisheries (1+2)	629.7	536.0	93.7		371.3
1. Assets	119.0	119.0			
Fishing	14.4	14.4			
Reservoirs	104.6	104.6			
2. Production	510.7	417.0	93.7		
Fishing (F)	139.4	120.0			
Shrimp in reservoirs	371.3	297.0	74.3		371.3

Source: ECLAC estimates, based on information from official sources and productive sectors.

C. OTHER ASPECTS

The agricultural specialist must take into account several additional items when assessing the impact of a disaster on his/her sector to determine the impact on other links in the production chain –trade and industry– as well as the macroeconomic impact of the disaster. These include the effects on employment and income mentioned earlier; the impact of production losses on the food and exports national balance, which has effects on the external sector; the prices of agricultural products at different points or levels in the production, transformation and commercialization chains; the differential impact of the disaster on women; and effects on the environment.

1. Employment and income

Losses of employment and income after disasters are another trans-sectoral issue because they occur in most, if not all, affected sectors. The relationship between the production of different goods and the labor required to produce them is normally used to estimate said losses; these figures are generally available from labor ministries.

How to arrive at the estimate in all the affected sectors is described in detail in the chapter on employment and income in Volume Four; what is described here is solely related to the agricultural sector. In any case, the agricultural specialist must cooperate very closely with the employment specialist to conduct these estimates.

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After a disaster occurs, employment is affected for various reasons. When disasters destroy crops, field workers' income is compromised. We include under this heading losses to crops yet to be harvested, damages to major plantations, decreases in production due to floods or hurricane winds, destruction of or damage to farm roads that prevent the extraction of harvests and the like. In all these cases, the demand for labor decreases, so field workers' income drops. These costs are to be taken into account at the macroeconomic level after the corresponding totals with other sectors have been indirectly inferred.

The average amount of labor used on each crop under normal conditions serves as the basis for calculations. For example, 120 days of labor are required for the complete production of a hectare of coffee, including the harvest. If this production does not take place, around 80 workers will lose their income. The averages used in the estimates should be those for the affected area or country.

Milk and egg production will decrease, as will fish catches. In both cases the use of labor will be affected, and the workforce's income will be reduced accordingly.

An earthquake that produces widespread damage to agricultural workers' homes may impede such workers from attending to their normal duties in the fields because they have to deal with the emergency and the immediate rehabilitation of their houses, again with a corresponding drop in income.

This loss of employment and income in the agricultural sector, as in other sectors, must be broken down by sex so that the gender specialist can estimate the differential impact of the disaster on women.

Information on the loss of employment and income makes it possible to ascertain the decrease in the population's well-being and provides inputs for the design of rehabilitation and reconstruction strategies, programmes and projects employing otherwise idle labor.

2. Food and export balances

These items are included here because they have macroeconomic effects that must be quantified. A decrease in the sector's production may affect products intended for export and lead to a lack of sufficient food to meet the population's needs.

An assessment of the national food balance is essential for identifying total food requirements during the production rehabilitation period whenever the disaster has compromised domestic capacity to fulfill the food needs of the population over a relatively long period. This assessment can be of enormous value, especially in small economies, because it identifies the future need for food imports along with the subsequent macroeconomic effect on the balance of trade and payments.

Information must be collected on the availability of food before the disaster, as well as on the food assistance that is expected to arrive from countries or institutions after the disaster has occurred. In other words, the total volume of available food must be determined, regardless of its source. Later, an estimate of total demand is prepared based on the number of affected people, the estimated per capita consumption of each type of food and the expected duration of a domestic shortfall in the production of each foodstuff. The deficit for each of the food items affected by the disaster can be calculated as the difference between expected supply and demand.

The following table shows how analysts estimated the food balance in Honduras following hurricane Mitch in late 1999.

Table 5
FOOD BALANCE IN HONDURAS AFTER HURRICANE MITCH

Product	Per capita consumption, kgs	Total consumption, tons ¹⁰	Total production after the disaster, tons	Donations received from abroad, tons	Imports required, tons
Maiz	125	875.000	670.000	200.000 ¹⁰	5.000
Frijol	30	210.000	200.000	---	10.000
Sorgo	---	---	---	---	---
Arroz	---	---	---	---	---
Trigo	---	---	---	---	---

10 Estimated based on a population of seven million inhabitants.

11 Donation received by means of Act PL480 of the United States of America.

12 Several donations from friendly countries.

13 Cash donation made by the government of the Federal Republic of Germany for the purchase of rice.

14 Donation made by the World Food Program (WFP).

To anticipate possible decreases in exports resulting from disaster-induced production losses, the specialist must examine statistics for recent years and as forecasts for the year of the disaster. Once the volumes that can be effectively produced after the disaster are ascertained and compared with projected exports, it is possible to determine the volumes that will not be sent abroad as a result of the event. That procedure must be followed for each of the export products while estimating lost volumes in tons. The macroeconomics specialist will be responsible for determining the impact of those lost exports on the country's external sector.

3. Sectoral output

The agricultural specialist must develop a table describing the production for each product under both normal and post-disaster conditions as his/her contribution to the analysis of the effect on macroeconomic variables. All products, or at least those accounting for 85% of the sector's gross output, must be included in the analysis.

The table must include information on production volumes and on prices at the various stages of production, transformation and commercialization, as indicated above. This will allow the macroeconomics specialist to estimate the effect of production losses in the sector on national GDP, and it will provide a basis for the trade and industry specialists to undertake their respective loss estimates.

A description of the type of prices that the agricultural specialist must obtain for his/her assessment is included below.

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a) Producer prices

The estimation of production losses must be based on the prices paid to the producer for each item. These unit prices can be obtained in countries' statistics offices or in the agricultural economics offices of the respective ministries, especially when a government agency guarantees the prices of certain products to farmers. International prices for a product should only be used in the case of items that are exported abroad.

b) Wholesale prices

These are prices at which industries generally sell already processed products to wholesalers. Comparing them to the prices paid to producers can provide a first estimate of the costs of transforming or processing agricultural products. Information on these costs is also usually available in national statistics offices or ministries of trade or economy.

c) Retail prices

These are the final prices paid by consumers for products acquired at shops. The difference between retail prices and wholesale prices provides a measure of the cost of commercialization. Once again, this information may be found in statistics offices and in ministries of economy and trade.

d) Government guaranteed prices

Governments sometimes guarantee prices to producers, primarily for articles deemed to be of strategic interest to the national economy. Guaranteed prices ensure farmers a minimum income at harvests. National sectoral offices and ministries of trade and economy can provide relevant information.

e) Import prices

Imports may be needed to make up for food shortages resulting from actual or foreseen production losses caused by a disaster. To estimate the value of such imports, use the food balance to ascertain the required volume, and then determine import prices –including insurance, freight and corresponding commercialization margins– with the help of representatives of commercial enterprises responsible for the imports.

Table 6 shows typical prices of certain agricultural inputs for one of the countries in the region, which might be useful for the agricultural specialist.

Table 6
PRICES OF SELECTED AGRICULTURAL INPUTS

Item and characteristics	Price in dollars a/
Tractors	21 000
Ford 6600 77 HP	26 500
Ford 6610 84 HP (Imported)	
Ford 6610 103 HP (Imported)	
TW-25 164 HP	
Certified seed (per ton) b/	
Maize	860
Beans	710
Forage sorghum	280
Grain sorghum	415
Rice	190
Soy bean	410
Wheat	325
Fertilizers (per ton)	
Urea (loose)	88
(in bags)	102
Ammonium nitrate (loose)	70
(in bags)	81
Ammonium phosphate (loose)	197
(in bags)	224
Ammonium sulphate (loose)	46
(in bags)	56
Phosphoric acid (loose)	166
Anhydrous ammonia (loose)	91
Triple phosphate (loose)	109
(in bags)	123
Simple superphosphate (loose)	46
(in bags)	54
Potassium chloride (loose)	110
(in bags)	125
Potassium sulphate (loose)	199
(in bags)	213
Potassium nitrate (loose)	241
(in bags)	254

a/ At market prices in Mexico, 9.50 pesos per dollar.

b/ Price of certified seed in the 2000 spring - summer cycle.

f) Export prices

As indicated above, the value of lost production must be expressed in terms of prices paid to producers, while that of export products should be determined by applying international prices for the lost or unproduced items. These prices are normally available in FAO Yearbooks and other publications of international organizations related to trade in agricultural products, as well as in local ministries of agriculture and foreign trade.

4. The differential impact on women

Section Five contains a thorough description of the uneven effects of disasters on men and women and how to estimate this differential impact. This is done because specific programmes and projects can, and must, be designed for implementation by women as part of rehabilitation and reconstruction programmes. The methodology required to carry out this assessment is set out in the aforementioned section, along with the requirement that each sectoral specialist work in close cooperation with the gender specialist. It is difficult to make estimates in this regard because the backyard economy is not yet included in national accounts, which is the basis for the assessments presented in this Handbook. This oversight notwithstanding, it is possible to estimate losses in this all-important productive heading.

18 In other productive sectors, women operate micro and small enterprises from their homes to supplement family food and income. The corresponding activities in the agricultural sector are known as the backyard economy. The agricultural specialist must carry out special estimates of losses of stock and production associated with such activities, which tend to be more heavily affected in the rural sector.

Losses of chickens, pigs and other small animals represent losses of stock in the backyard economy. Their quantification is difficult and is usually estimated indirectly for each affected area as a percentage of the family's total assets (housing, household goods and furniture). Values ranging between 10% and 40% of those assets are used, depending on whether the family belongs to subsistence or more developed agriculture. The agricultural specialist must make this estimate based on on-site interviews or on data obtained through quick surveys or samplings. The methodology must be developed in close cooperation with the gender specialist to ensure that there are no omissions or duplications. Asset losses in the backyard economy are over and above asset losses estimated for the agricultural sector.

Any decrease in backyard-economy production also represents indirect damage that must be estimated. In the absence of detailed and reliable information on this heading, the agricultural specialist –in close cooperation with the gender specialist– must estimate this loss as a percentage of household income, taking into consideration the direct loss of stock in this same heading. In other words, indirect damage may be estimated at between 20% and 40% of the household's formal income, depending on the corresponding income level. Field visits must be made in order to directly interview the men and women affected, and surveys or samplings must be made to decide on the value to be adopted. As in the case of asset losses, these production losses are over and above those estimated by the agricultural specialist for his/her sector.

Women's employment and income in agricultural activities is another area usually affected by a disaster. The impact can be estimated based on cooperation and interaction among the agricultural, gender and labor specialists. An example of such analysis is included in the appropriate chapter in Volume Four of this Handbook.

The resulting estimates of the effects on women's assets and contribution to the backyard economy –as well as figures for damages to the environment– must not be added to the total losses for the sector because their components are not as yet included in the national accounts. Total damage figures are used to analyze the effect on macroeconomic variables, which are estimated based precisely on the use of national accounts.

Below is a list of information that the agricultural specialist must obtain, with close cooperation and support from the gender specialist, to estimate losses caused by the disaster in the agricultural sector.

In connection with direct damages, the following data or information must be estimated or determined by means of quick surveys or sampling:

- Losses of productive lands, by sex;
- Losses of subsistence agricultural production already harvested or about to be harvested, by sex;
- Losses of export agricultural production already harvested or about to be harvested, by sex;
- Losses of assets in agricultural cooperatives, by sex;
- Losses of major or minor animal stocks, by sex and producer level; and
- Losses of fishing assets (vessels, engines, nets and tackle) by sex.

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In regard to indirect losses, the following information must be obtained, either through estimates or field samplings:

- Future losses of agricultural production, by sex;
- Future losses of livestock production, by sex;
- Losses of livestock production in cooperatives, by sex;
- Future losses of fish catches, by sex; and
- Losses of employment and income by women wage earners in the sector.

5. Impact on the environment

The methodology for assessing damages caused by disasters to environmental assets and flows of environmental goods and services is presented in the respective chapter in Volume Four of this Handbook. Agriculture, livestock and fishery are sectors based on the country's natural resource endowment. Production factors such as physical infrastructure, labor and business management, and technology are incorporated in the natural capital for obtaining environmental goods such as agricultural, forest and fish products. Agriculture and fishery sectors, in turn, are related to environmental services provided by specific ecosystems. Used in a sustainable way, forests, in addition to timber and non-timber forest products, provide environmental services such as carbon sequestration, biodiversity conservation and water flow regulation.

The same happens with agro-forestry systems such as shadow coffee production. Genetic diversity is one of the most important assets for agriculture; some production systems, mainly traditional ones, contribute to biodiversity conservation. Similarly, the productivity of fisheries in some regions is related to the health of ecosystems such as mangrove forests, coral reefs and sea-grass beds.

Therefore, a close relationship exists between damage assessment in the agriculture and fishery sectors and environmental damage assessment. In terms of quantification and valuation of damage, two situations should be distinguished (for details, please refer to the chapter on the environment):

a) Environmental damages included in the assessment of the agriculture sector

These are direct and indirect damages (loss of natural capital and changes in the flows of environmental goods and services) that are already accounted for in the agricultural sector. Examples include losses of agricultural land and timber forests, as well as decreases in agricultural and fishery production during the recovery period after the disaster. The environmental assessment seeks to identify the share of these damages that refer to the contribution of natural capital, isolated from contributions of human capital and other assets such as infrastructure, machinery and equipment. This contribution is estimated using the economic rent concept (the difference between market prices and production/extraction costs). To avoid double accounting, these estimations should not be included in the damage overview.

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b) Separate quantification and valuation

This refers mainly to the valuation of assets and environmental services related to productive activities that are not accounted for in the agricultural sector assessment. Examples include changes in environmental services such as carbon sequestration, water flow regulation and fishery habitat that result from losses of forests, mangroves and agro-forestry systems. These damages should be included in the damage overview as they have not been considered in the agriculture damage assessment.

APPENDIX X

AGRICULTURAL LOSSES IN HONDURAS FOLLOWING HURRICANE MITCH

The following concepts were applied to estimate agricultural losses:

- A) **Loss of assets.** One of the most significant effects of the hurricane, in terms of both its short - and long-term repercussions, was the loss of assets, including physical facilities, investment in plantations and the production capacity of soils that lost their top layer. Floodwaters ruined agricultural land, covering it with a diverse range of materials.

Pending a detailed survey, it was estimated that soil loss was total on approximately 10 000 hectares, located mainly on floodplains. Stone deposits were the predominant factor in these areas. In one area of roughly 750 hectares, it was decided that the high cost of eliminating sand sediment might be justified by crop profitability. However, before land covered by sand and materials can be used productively, considerable expense must be incurred in cleaning and leveling works.

Mud deposits can be beneficial because they improve soil quality, but several agricultural seasons must pass before the site can be used. Soil losses due to mudslides were detected on approximately 7 000 hectares of mountain slopes used for growing coffee; recovery will take many years.

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Estimated total soil losses amounted to 5 200 million lempiras in lost net income (see Table 4). Losses in plantations and ancillary facilities amounted to 6 300 million lempiras. As a whole, they accounted for 50% of the total damage in the agricultural sector. In the case of some crops and regions, new seeds would be needed for planting.

Since agriculture in the valleys was significantly damaged, proper management of hillside agriculture became more important, not only as a source of supply and income for a sizable sector of the rural population, but also as an integral part of sustainable development for the forestry and agriculture sector.

- B) **Crops for domestic consumption.** The hurricane coincided with the end of the harvest of certain crops and the planting of others, so availability of those products would drop the following year. The deficit would be smaller if soil humidity conditions allowed for a second crop. The magnitude of production losses is shown in Table 4.

In the case of maize, data shows that approximately one - third of the first (and most important) harvest for the 1998-1999 farming year had already been collected, whereas in the area still to be harvested production would be reduced by 250 000 tons, worth 609 million lempiras (see Table A below). Excess water generated by the hurricane resulted in extraordinary costs by preventing the use of machinery for the harvest, which had to be done manually. That value is recorded as indirect damage. At the same time, the poor state of roads hindered transportation of the crop to collection and grain-drying centers, thereby undercutting quality.

The first harvest in the bean cycle had also been collected at the time of the disaster and the second crop, which provides 75% of national production, had already been sown. In the area planted, losses were estimated at 30%, which entails approximately 9,000 fewer tons of beans than were available in 1999. This shortfall would have to be compensated through additional imports. Replanting was possible, but not over the entire affected area. The direct damage of 67 million lempiras includes lost production in the first harvest, as well as investment in the planting of the damaged areas. Indirect damage represents the harvest that was not collected.

Table A

HONDURAS: ESTIMATE OF PRODUCTION LOSSES IN MAIN AGRICULTURAL CROPS
AS A RESULT OF HURRICANE MITCH
(Thousands of tons)

Source:

Product	Production forecast before the hurricane	Production estimated after the hurricane	Lost production	Loss over expected production (%)
Basic grains				
Uncleaned rice	64.8	56.1	8.8	14
Beans	95.1	89.9	5.2	6
Maize	607.1	252.2	354.9	58
Sorghum	94.2	71.8	22.4	24
Industrial and export crops				
Bananas	872	766 a/	739 b/	85
Sugarcane	3,397	1,360	2,037	60
Coffee	153	126	27	18
Melon	203	144	59	29
African palm	576	415	161	28

ECLAC estimates, based on information from official sources and productive sectors.

a/ In 1998.

b/ The last months of 1998 and the 1999 harvest.

A similar situation occurred in the case of rice, as adverse weather led to a production shortfall of 8 800 tons. Moreover, excess water hindered growth on around 700 hectares already planted that were to be harvested the following year. Direct damage of 30 million lempiras reflects lost production and investment. Indirect losses of 5.5 million lempiras represent future production that will not be obtained.

The volume of sorghum lost was greater than that of rice and beans, since barely a tenth of the harvest had been collected and almost a quarter of annual production was lost. Because a part of the planted area ready for the next cycle was damaged, supply was expected likely to fall by an estimated 10 000 tons.

Expectations of a considerable drop in the supply of basic grains led to uncertainty and a scarcity in markets that was aggravated by difficulties in the transportation of goods as a result of the deterioration of highways and access roads in production areas. To prevent price increases, the government reached an agreement with producers and wholesalers for a temporary price freeze. To meet the demands of industry and direct consumption, officials considered a zero tariff on the import of certain basic grains that are sold within a price range and with a variable tariff of approximately 35%. However, once communications were stabilized to some degree, it became obvious that available short-term stocks were sufficient and that imports (a total of 560 million lempiras) could be deferred until the following year.

Support programmes would have to be designed in line with producers' socioeconomic conditions to mitigate the harm they sustained. The priorities of a rehabilitation and reconstruction program for the whole sector should include the rehabilitation of damaged agricultural areas, the recovery and distribution of genetic material, plant and animal health surveillance, access to financial resources through preferential credits to facilitate reactivation and, more generally, the introduction of river basin management practices and infrastructure reconstruction.

Table B
HONDURAS: AREAS OF MAIN EXPORT CROPS
AFFECTED BY HURRICANE MITCH
(Hectares)

Export crops	Production area before the hurricane	Area affected by the hurricane	Percentages
Total	292,000	83,760	29
Bananas	22,000	16,000	73
Coffee	194,000	38,800	20
Sugarcane	44,300	22,000	50
African palm	32,000	8,960	28

Source: ECLAC estimates, based on information from official sources and productive.

- C) **Industrial and export crops.** As in the rest of agriculture, industrial and export crops sustained major direct damages, which were estimated at approximately 1 800 million lempiras. Moreover, since most losses refer to permanent crops that would have to be replanted in many areas, losses not only affected production during the current cycle, but would continue throughout the time required for new plantations to reach maturity (between two and seven years, depending on the crop). Total losses thus amounted to 6 000 million lempiras, including damage to assets and indirect losses of production over several years.

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Significant losses were reported for bananas, since almost all plantations are located in two of the areas most severely affected by floods. Large producers lost all or part of their plantations, as did many independent producers, particularly cooperatives. The Tela Railroad Company (Chiquita Brands) reported that between 50% and 60% of its plantations were damaged, while Standard Fruit Company (which normally hires about 10,000 workers) lost 80%. Independent producers had very high losses on some 6 000 hectares, of which only a small fraction can now be harvested to meet domestic demand and the needs of farmhands and cooperative members.

Floods affected current and future crops as many plants were destroyed. Although new plants could begin producing in one year, the time required to clean up and level fields should be taken into consideration. That year's crop losses (466 million lempiras) correspond to the November-December harvests, whereas indirect damage refers to production lost until the plantations would recover in two years' time. Infrastructure and plantation losses, totaling 3 500 million lempiras on approximately 16 000 hectares, are listed under the heading of assets.

Losses in coffee —the country's main export— amounted to 500 000 quintals, while a further 105 000 quintals of reserves were ruined when warehouses were flooded. Another 7 000 hectares were affected by landslides, as were many access roads to plantations. Over 100 coffee-processing facilities were either swept away by swollen rivers or rendered useless by flooding, which also caused significant damage to access roads and many bridges. Crop production losses were estimated at 629 million lempiras, while future production will be decreased due to the number of lost coffee plants. That loss is recorded under the heading of soils. The decrease in the next harvest and exports during the present and future cycles must also be taken into account, as the normal development of plantations was curtailed.

Sugar cane losses were high in areas rendered useless by flooding, silting, mud, sand and stones. Although sugar cane is relatively resistant to excess water, it is difficult or impossible to harvest, either mechanically or by hand, when it is covered by mud. Furthermore, the inevitable postponement of the harvest decreased sugar yield. If delays were prolonged, it would no longer be economically feasible to harvest the crop. Damage to some mills and industrial facilities (the machinery in one of them was covered by water and mud) made the delay even greater and the situation more critical. It was therefore estimated that 50 percent of the planted area had been lost and that the value of the crop that could not be harvested during the present cycle was 387 million lempiras. Extensive areas would have to be replanted to ensure the recovery of sugar cane plantations, which is why the investment lost in plantations was also taken into account. The following year the sugar cane harvest would also be lower, and foreign exchange earnings from sugar exports in the next two years would decrease by some 85 million lempiras.

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African palm losses have affected the cooperatives established following the agrarian reform, as well as independent producers and large enterprises. The most recently planted area sustained significant damage, since two to three year-old plants, which are the most vulnerable, were partially covered by mud. This affected the heart of the plants, which died as a result; adult plantations were better able to withstand the effects of the hurricane. Nurseries and other plantation-related facilities were also significantly affected. Damages sustained by plantations provide the basis to estimate present year production losses (143 million lempiras). This situation will continue over the next few years until the damaged plantations recover.

In melon production, which is concentrated in the department of Choluteca, 12 000 hectares had been set aside for planting to take advantage of market demand in the winter months. When the hurricane struck, 3 600 hectares had just been sown or were being prepared for sowing, and 80 percent were lost; the direct damage led to the loss of 32 million lempiras in investment. In contrast, indirect losses refer to the area that was not sown, resulting in lower exports in 1998 and 1999. Action was rapidly taken to recover the market, but only 7 000 hectares were set aside due to the total loss of fertile soil on farms that were covered with large amounts of sand and stones deposited by the river. These farms are included in the loss of agricultural assets, as are the substantial investments that would have to be made to recover some of the affected areas. Infrastructure was also significantly damaged, with more than 50 refrigerated transport containers destroyed; this item, however, is included in the transport section.

Citrus crops on the Atlantic coast were also seriously affected. Fortunately, grapefruit exports to Europe had concluded on October 15, so direct damage affected mainly the oranges and grapefruit for the domestic market. Production in the coming cycles would be lower because of the damage sustained by fruit trees; indirect losses were therefore estimated at 400 million lempiras. The greatest losses in assets occurred in the region of the Aguan valley, where an estimated 1 750 hectares of grapefruit were covered by sand and debris and were completely lost, and approximately 7 000 hectares of young orange groves were waterlogged for several days and would have to be replanted.

- D) **Livestock.** The beef and dairy herd was reduced by approximately 50 000 head, valued at some 225 million lempiras. Information on livestock-raising areas was incomplete, owing to difficulties in gaining access to such areas. Although livestock raising is carried out in the highlands, losses occurred among cattle grazing in the lowlands. Adverse weather conditions resulted in animal weight decrease, causing an estimated loss of 900 million lempiras.

On the Atlantic coast, where dairy production is concentrated, the supply of raw materials to industry dropped during the first week as a result of flooding on farms and adverse transport conditions. The losses sustained on those days would cause lower milk production for several months. Direct damage was estimated at 120 million lempiras, while the subsequent impact of lower production was expected to result in higher indirect losses in view of the time required for recovery.

Damage to poultry production amounted to approximately 740 million lempiras from the loss of 60% of poultry stocks. The damage to dairy farm facilities and fences, calculated at 500 million lempiras, would have to be repaired. Flooded grasslands would eventually recover, but investments would be required to improve pasturelands. According to information provided by the unions, 70 000 hectares were affected at a loss of 300 million lempiras.

The public sector lost animal health control facilities and laboratories that produce and record genetic material. Under the prevailing conditions, the sector's response and international support in preventing diseases were very timely. Reconstruction would have to include recovery of the lost installed capacity.

- E) **Forestry.** Timber production is an important activity in Honduras, generating export earnings of 20 million dollars. Sawmills suffered no major damage from the hurricane, although some machines were affected by water. Damage to roads was more of a problem, since it hindered access to logging camps. Lumber, however, was available for reconstruction purposes.

One of the most significant losses in the sector was timber from trees blown down by the hurricane, amounting to 100 000 cubic meters of pine. The most seriously affected areas were in the Sierra de Agalta of the eastern and western parts of Olancho and in Yoro. Losses, based on the average price per cubic meter, amounted to 27 million lempiras. If the sales price offset the cost of extraction, which was hindered by road conditions and remote locations, part of the losses could be recovered. Collecting this timber would have other benefits, such as eliminating potential sources of fire in the dry season and forest pollution.

In Atlantida, 25 000 additional cubic meters of timber from latifoliated trees were reportedly lost, and forestry plantations throughout the country were also damaged.

- F) **Fisheries.** Fishing on the Atlantic coast and shrimp production in ponds in the Gulf of Fonseca are very profitable in Honduras. The hurricane affected these two zones, causing damage to both artisan and industrial fishing fleets. Owing to the type of shrimp-farm investments in the south, it would seem that the economic impact was more significant in that area. A total of 13,700 hectares were flooded in Choluteca and Valle, and during the first few days after the hurricane, estimates indicated an almost total destruction of infrastructure and the loss of at least two of the 2.5 annual shrimp harvests. Once the water level dropped, it became apparent that damage was considerable but clearly not as great as originally feared. Pond and packaging facilities, as well as investment in larvae for the restocking of ponds, sustained damages amounting to 100 million lempiras. In production, direct damage was estimated at 300 million lempiras—a harvest of 3,200 tons of shrimp— plus indirect costs from the partial loss of the first 1999 harvest.

Coastal fishing sustained losses of 140 million lempiras, although information on losses in the 365-vessel fish, lobster and conch fishing fleet could not be confirmed.

II. TRADE AND INDUSTRY

A. INTRODUCTION

1. General considerations

This chapter has four sections. The first describes conceptual aspects that are common to trade and industry and that must be taken into account when assessing damage due to natural phenomena. The next two sections refer to each of these productive sectors. The presentation includes an overview both of the characteristics of the natural phenomenon and of the magnitude of damage in the sector; a description of the methodology and information sources that must be used to quantify direct damage and estimate indirect effects or losses; an estimation of the impact of the phenomenon on macroeconomic indicators or the manner in which damage and losses affect the performance of the main economic variables of the affected country; and recommendations on the definition of priorities that the responsible authorities must establish to meet the needs arising in both sectors from disaster effects. Finally, the fourth section contains a methodological appendix with formats of basic tables that the sectoral specialist can use as a guide, to be filled out with the information obtained from different sources as mentioned throughout the text.

To illustrate the methodology proposed for the assessment of direct damages, indirect losses and the corresponding macroeconomic effects on a national economy, the text draws on information from field research and various sources used to assess the impact of the 1999 floods in Venezuela.¹

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For each of the sectors, references are made both to the sources of statistical information most often available in Latin America and the Caribbean, and to complementary information that should be obtained from official sources, chambers of trade and industry and field work.

2. Characteristics that are common to both sectors

When assessing damage caused by a natural phenomenon, specialists will find certain similar features that run through the trade and industry sectors. In both economic sectors, value - added is generated in establishments that are well defined by their physical extension and facilities into large, medium-sized, and small enterprise categories. The peculiarities of each of these sectors differentiate them from other areas of the economy in terms of specific disaster effects and the actions needed for both the rehabilitation and reconstruction of productive units and risk reduction.

¹ ECLAC, *The Socioeconomic Effects of the Floods and Landslides in Venezuela in 1999*, Mexico City, 2000.

In both trade and industry, large establishments contribute the lion's share of production and are normally more modern than medium-sized and small businesses. Therefore, they proportionally concentrate more of the capital stock in both sectors. They also generally have more solid installations and frequently have insurance covering the risks of damage caused by disasters.

According to Latin American and Caribbean censuses, there has been a structural trend towards a decrease in the relative importance of small establishments in terms of numbers and value - added; however, they still account for a large share of employment in both trade and industry, a fact that has even tended to increase in recent decades. This has been due mainly to the low absorption of labor by the most highly productive units –which constantly incorporate technological advances– and the subsequent increase in informal activities, especially in trade in large urban agglomerations.

These small establishments operate under precarious conditions, which undoubtedly make them more vulnerable to natural phenomena. Their recovery tends to be quick, however, since their functioning is more directly related to the subsistence of the persons engaged in each enterprise and because proportionally less physical capital is prone to destruction than in larger establishments.

28 Both trade and industry concentrate most of their activity in big cities (although trade –especially the small and informal kind– is less polarized and can be found in medium-sized and small cities as well as in remote tourism centers). Therefore, they are relatively less affected by disasters occurring primarily in the countryside (droughts, floods, etc.), with the exception of agribusiness and those branches of manufacturing that have broad production chains extending all the way to mining, fishing, forestry, food processing and so forth.

Nevertheless, hurricane winds that strike coastal areas can have a significant impact on commercial and manufacturing activities when they are located in major cities on the coast or very near to it and when secondary and tertiary activities linked to tourism are significant.

These features, which are common to trade and industry, have an obvious influence not only on the type and magnitude of the damage a natural phenomenon can cause, but also on the support they might need for rehabilitation and reconstruction and for disaster mitigation.

There are other characteristics worth noting. Because of the large financial capital they handle and the scale of their investments in machinery, equipment, buildings, warehouses and stock, large establishments often have insurance against such types of risks, and their asset losses can be proportionally lower than those of small and medium-sized industrial and commercial establishments. On the other hand, micro-enterprises –which in many cases operate in their owners' homes and basically use domestic inputs– may react more flexibly and quickly to the effects of a natural phenomenon in order to safeguard their stocks of inputs and partially completed or finished goods, which are the bulk of their assets. In addition, as mentioned earlier, the urgent need to recover their only source of income requires small businessmen and artisans to quickly get their premises and workshops operating again, undoing the damage on their own.

The above reasons explain why accumulated assessment experience in the region shows that medium-sized industrial and commercial establishments require proportionally greater recovery assistance than small or large ones.

Breakingdown the impact on these sectors by sex is equally important. Although the aim is to determine the monetary value of the damage, both the impact and the required rehabilitation and reconstruction tasks take on different characteristics depending on the sex of the affected owners. The trade and industry specialist must work in close cooperation with the gender specialist for assessment purposes.

Finally, it is necessary to estimate the employment and personal income losses registered because of direct damage and production decreases in the trade and industry sectors. Such a calculation should be made in cooperation with the employment specialist, making use of known ratios of labor required for specific production volumes.

B. MANUFACTURING SECTOR

1. General considerations

The assessment of damages caused by a natural disaster in the industrial sector can be undertaken following a procedure of successive approximations, as described below. The starting point is the collection of basic information that will provide the specialist with an overview of the sector in the disaster area. Next comes the most accurate calculation possible of the specific damages sustained. Finally, a precise diagnosis of the situation must be made. This process will enable one to set priorities for the recovery of productive activities by defining reconstruction projects and programmes. It is recommended that the steps described below be followed.

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a) Collection and sources of information

One of the sector specialist's first tasks is the collection of basic information. In this activity he/she must proceed selectively because of the limited time usually available for such work.

The main domestic sources of information that should be used include the following:

- The most recent industrial census;
- Information and time series on production available in statistics bureaus, central banks or sectoral planning offices;
- Periodic surveys carried out by trade and industry ministries or by central banks;
- Information in periodic bulletins published by industry associations;
- Economic and statistical information published or made available by industrial or manufacturers' groups, such as the chambers of the textile, clothing, food, electrical appliance and construction materials industries;

- Information prepared by other groups on micro and small enterprises or businesses, which are sometimes available from development banks, manufacturing workers' unions or social security institutions;
- Information available in patent and trademark offices; and
- Information available from industry promotion offices or in municipal records.

In addition to local and national sources, the trade and industry specialist should consult the information available in the Latin American Demography Center's Redatam, which should provide a very precise view of pre-disaster conditions. Such data are useful for making damage estimates, identifying those affected and defining the bases for reconstruction programmes and projects. The Redatam network brings together census or household survey information in a coherent and compatible way, and presents it broken down by state, province and even municipality. For example, Redatam provided analysts with remote access to a highly useful body of information on the state of Vargas in Venezuela (economically active and employed population, productive activities, number of establishments by size, etc.).

Likewise, Internet searches before and during the assessment may reveal information on special characteristics of the most important manufacturing enterprises, which that might not be available through other sources.

30 The sector specialist should promptly trace all available sources in order to obtain as much quantitative information as possible on the sector both nationally and in the disaster area. This set of background information should then be complemented with the most important specific information obtained in the field. All of the above will be used for the assessment of direct damage, indirect losses and macroeconomic effects.

b) Description of the affected area and of general damages

Immediately after a disaster occurs, the national authorities responsible for the post-disaster emergency stage usually act very quickly and provide general information on the nature of the phenomenon, the affected area and the magnitude of damage. Sometimes they also carry out quick surveys that help the specialist obtain an overview of the number of industrial establishments damaged or completely destroyed.

Based on a knowledge of the characteristics of the affected geographical area and the availability of primary information either provided by local authorities or collected from other domestic sources, the sectoral specialist –taking into consideration information from the most recent industrial census available and information collected from the sources mentioned above– must ascertain the approximate number of establishments affected; the industries to which they belong; their size, grouped into small, medium, and large, in terms of personnel employed; the employment and value - added each one generates; and the degree of interdependence on the productive activities located within and outside the area. This information will help one perceive any domino effects that might arise owing to the destruction of a given subsector's productive structure.

The sector specialist must then use this information, complemented with periodic assessments usually carried out by ministries and planning offices, to arrive at a quantitative and qualitative estimate of the situation of industrial activity in the immediate aftermath of the disaster. This will be very important for the subsequent estimation of the effects on changes in given macroeconomic variables.

The sectoral specialist, either individually or in cooperation with national authorities, must also conduct an informal survey among owners or managers both of the main industrial establishments and of a representative sampling of small and medium-sized companies, so as to obtain a clearer idea of the magnitude and nature of damage, as well as of the sector's most urgent rehabilitation and reconstruction needs. The survey may include information on companies' production chains that is unlikely to be found in the sources mentioned earlier, as well as the source of inputs and the destination of intermediate or final goods processed by the affected companies.

2. Direct damages

As soon as the sector specialist has a general idea of the effects of the disaster on the manufacturing sector in the affected area, he/she must estimate the damage more accurately, beginning with the value of direct damages.

The assessment's final purpose is to define reconstruction programmes containing specific projects and profiles. To that end, the following three types of direct damage must be determined to the fullest possible extent :

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- The value of the assets lost by manufacturing establishments, in their pre-disaster condition (in other words, measured in terms of their depreciated value);
- The replacement cost of lost assets, with the same characteristics as their original design; and
- The cost of reconstruction, including vulnerability-reduction components. The concept of vulnerability refers to the probability that a set of manufacturing establishments exposed to a natural hazard will sustain damage, depending on how fragile their installations are. The magnitude of this damage is directly related to their degree of vulnerability.

The assets considered in this calculation should be grouped by the sector specialist under the headings of buildings and facilities; machinery and equipment; transportation equipment; furniture; stocks of goods under processing; finished goods; raw materials; and spare parts.

The sector specialist must make these estimates in close cooperation with government offices responsible for the sector, as well as with trade groups and producers' associations. The specialist should verify all available official estimates during his/her field visits.

To obtain updated replacement costs for valuing losses of assets, the specialist could adopt internationally valid unit costs, at unit import prices, as well as costs used in development projects that the country's development banks might have in their portfolios and that, whenever possible, are in similar industrial branches and on a similar scale.

When calculating direct damage, the sector specialist should distinguish among establishments of differing sizes. Large establishments are those that employ 200 workers or more; medium - sized establishment employ between 199 and 40 workers; and small establishments employ 39 or fewer workers. Large establishments usually have more accurate accounting records; in this case, estimates should be based to a greater degree on interviews with the executives of such establishments. In the case of small establishments, the weight of fixed assets among total assets is very small, which, together with the precarious nature of the accounting information these establishments have, requires that the specialist carry out rougher, less accurate estimates.

32 Special attention should be paid to those manufacturing enterprises involved in productive processes making goods for re-export, known as in-bond (maquila) enterprises. Some characteristics of such enterprises –such as the fact that they are normally subsidiaries of, or dependent on, international enterprises, that they are normally backed by insurance against damage, that they are labor intensive and that their assets are possibly prone to rapid depreciation– should be taken into consideration for the assessment of disaster-related damages. In any case, the sector specialist should collect as much information as possible on these companies (when affected), ideally obtaining it directly from their executives and defining their corresponding incentives with local authorities.

The main categories into which destroyed or affected assets should be grouped for the purposes of assessing direct damages are presented below.

a) Buildings and facilities

Losses under this heading are to be valued at their pre-disaster condition cost (that is, at their depreciated value); at replacement costs with the same characteristics as their original design; and at reconstruction costs including vulnerability-reduction components. This will entail determining the destroyed or damaged surface area, the age of the facility and the current value of a square meter of construction in industrial-type buildings. This last factor generally varies as a function of the enterprise's size, because large enterprises require facilities and constructions of higher quality and complexity than medium-sized and small enterprises because of the machinery and equipment they use and associated technologies.

In each case, a definition must be reached in cooperation with national authorities on the vulnerability-reduction components that should be introduced in the reconstruction process, which will likely increase their cost. Alternatively, such mitigation components might encompass works that are external to and independent of facilities, such as ditches, river protection works, retaining reservoirs and channels. In the first case, there are important elements to be considered in construction-design and land-use regulation. Reconstruction should only be carried out on the basis of a significant qualitative improvement over the previous situation as regards vulnerability to future phenomena.

b) Machinery and equipment

Under this heading, it is necessary to determine the corresponding replacement prices for assessing total or partial damage to machinery and equipment. The value of these items as they appear in industrial censuses refers to the value registered in enterprises' accounting records and does not take into consideration accumulated depreciation as a function of the number of years of useful life since acquisition. They also show acquisition prices, except in certain countries with high inflation where a periodic restatement of physical assets is advisable. Such limitations are especially significant in the case of machinery and equipment, where rapid technical change governs the replacement value.

As in the case of buildings and facilities, losses of machinery and equipment in large industrial enterprises must be estimated directly by their executives, in consultation with national authorities. These figures must then be examined and adjusted by the sector specialist to obtain the current value of destroyed equipment, using as a basis the unit values of recent imports.

When assessing direct damage sustained by medium-sized and small establishments, the varied nature of potentially affected industries and the inconsistencies typical of data obtained through direct surveys may require analysts to rely more on census parameters, which must be assessed and updated.

c) Furniture and vehicles

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Larger enterprises usually have a proportionally higher stock of these goods, both because their personnel work under better conditions and because they more frequently have such equipment as forklifts and a fleet of vehicles for the transportation of raw materials, intermediate products or finished goods. Intermediate and small enterprises usually outsource these services. For valuating widespread damages sustained under these headings, the analyst may need to obtain updated market values for furniture and vehicles similar to those destroyed or damaged.

If the disaster is deemed to have had a relatively minor impact on this type of fixed assets, indirect estimates should suffice. For example, investments in furniture and equipment are, to a certain extent, proportional to the value of buildings and facilities, although the validity of this relationship depends directly on the size of establishments. It is also necessary to make distinctions between specific industries; for example, the relative importance of vehicle fleets among total assets is greater in the soft drinks and cement industries.

d) Stocks or inventories

This heading includes finished goods produced by the company in question; goods being processed; raw materials; and other goods such as spare parts that are not directly related to production. This is one of the headings experiencing the most damage during a disaster because space limitations often mean that warehousing facilities are less protected than those that house machinery and equipment.

The specialist must consider that a portion of stocks might have been imported. Relevant information on large enterprises can be obtained from official sources and from the enterprises themselves. In the case of medium-sized and small enterprises, estimates can be based on the application of the ratio of stock to total fixed assets, which is normally slightly higher for medium-sized companies.

Total losses of fixed assets can be obtained by adding the four previous headings. The imported component of direct losses must be estimated by calculating the foreign currency that would be required to replace the fixed assets and destroyed or damaged stocks. Various sources can be used for this, such as the domestic and imported cost structure of investment projects that might be available from development banks, as well as macroeconomics statistics listing the imported content of gross investment. Finally, a breakdown of damage among private and public enterprises must be made, because different patterns may be followed in reconstruction.

3. Indirect losses or effects

34 Damage sustained by industrial establishments located in a disaster area will obviously have a negative effect on production flows because of both the temporary suspension of activities –for as long as the rehabilitation lasts and until the pre-disaster production level is recovered– and relative shortages of inputs caused by the temporary interruption of communications and sales channels.

The increased costs involved in choosing and using alternative (longer) transportation routes must also be added to indirect losses. These and can be especially important for certain sectors where the transportation of goods is a major cost factor, as in the case of the sugar and cement industries.

Losses due to an interruption of exports must be taken into account for the same reason, along with taxes the government stops receiving as a result of the interruption in production and sales. To complete the picture of indirect effects, emergency expenditures made by enterprises must be ascertained, as well.

Local associations of industrial entrepreneurs often carry out surveys aimed at estimating losses due to the suspension of production, whose results must be verified by the specialist by means of interviews with businessmen in the disaster area. In the case of small establishments, and whenever necessary, the specialist can even make calculations of production losses based on worker productivity coefficients obtained from census information or industrial surveys.

Trade associations also have information regarding which enterprises have been affected and which are mainly involved in export activities. The sector specialist must also take into account seasonal factors when calculating this type of damage because the impact on production flows rarely lasts for more than a year, judging by past experience in Latin America and the Caribbean.

For example, estimates of direct damage and indirect losses caused by the floods and mudslides that occurred in the Venezuelan states of Vargas and Miranda in 1999 were based on information provided by EDEINDUSTRIA for small and medium-sized activities and by CONINDUSTRIA for larger ones (Tables 7 and 8).

Table 7

DIRECT AND INDIRECT DAMAGE AND LOSSES SUSTAINED BY THE
MANUFACTURING AND NON - RETAIL ENTERPRISES IN THE
STATE VARGAS, VENEZUELA
(Millions of bolivars)

Type of establishment (units)	Direct damage	Indirect losses	Total damage
Drugstores (57)	1,130	830	1,420
Medical equipment factories	300	300	600
Pasta factories	125	125	250
Ironworks (315)	2,700	1,880	4,580
Bakeries (40)	1,600	1,600	3,200
Clothing workshops (337)	405	400	805
Footwear workshops	625	625	1,250
Mechanical workshops (17)	595	600	1,195
Radio stations and concessionaires (2 and 25, respectively)	395	350	745
Others	725	690	1,415
TOTAL	8,600	7,400	16,000

Source: ECLAC, based on official sources and those available from chambers of commerce.

The volume of non-commercial industrial activities in Vargas, the state most affected by the phenomenon, is rather small, consisting of a less than 800 enterprises. These are small establishments such as ironworks, garment and footwear factories and mechanical workshops. The vast majority of these establishments sustained total losses.

The state of Miranda, on the other hand, incurred significant losses because of the presence of the Guarenas/Guatire industrial complex – which includes such manufactures as plastics, batteries, laboratories, textiles and clothing, and food. Direct damages and indirect losses to the manufacturing sector in the state of Miranda were estimated at 9.360 billion bolivars.

Table 8

ESTIMATED DAMAGE AND LOSSES IN THE MANUFACTURING SECTOR
(Millions of bolivars)

State	Direct damage	Indirect losses	Total
VARGAS (includes drugstores)	8,600	7,400	16,000
MIRANDA and other affected States:	4,110	1,920	6,030
Car parts	960	400	1,360
Food	830	360	1,190
Metalworking	1,240	560	1,800
Plastics	380	200	580
Laboratories	200	100	300
Other industries	500	300	800
TOTAL	12,710	9,320	22,030

Source: ECLAC, based on official figures and those available from chambers of commerce

4. Macroeconomic effects

This section of the assessment should include background information and quantifications that will enable the macroeconomics specialist to determine the future overall effects of the disaster on the performance of the main macroeconomic variables, such as gross domestic product, balance of payments and public finances.

The industrial sector specialist must try to obtain an overview of the conditions prevailing in the sector before the disaster and of its prospects. These reference points are essential for properly weighing the future consequences of the disaster.

The information directly obtained from the affected productive units will normally be in terms of the gross value of production. This must be converted into value - added units so that the total output for the sector may be estimated. The sectoral specialist must carry out this conversion using coefficients linking one item to the other, which can be obtained from industrial censuses, some statistics and the national accounts themselves.

5. Priorities for recovery and rehabilitation

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The industrial sector assessment should include a list of priority actions that affected business owners want the government to undertake to facilitate recovery. When conducting surveys of affected industrialists, industrial chambers and associations, ask for opinions on the immediate support that the sector needs for rehabilitation, both from the public sector and from abroad. Ideally, these proposals should be presented in the form of project ideas or proposals.

C. THE COMMERCIAL SECTOR

1. General considerations

Only a brief methodological description for the assessment of the effects of a disaster on commercial activities will be presented in view of the considerable overlap with the industrial sector. However, some features of the sector are different from those of the industrial sector. Whereas commercial establishments are relatively smaller than industrial concerns on the level of personnel employed and the relative weight of machinery and equipment to personnel and to total physical assets, the opposite is true on the level of inventories.

The trend in the industrial sector toward an expansion of larger establishments to the detriment of smaller ones is even more evident in the commercial sector because of the special proliferation of supermarkets. Their rise has affected medium-sized businesses more than small ones, which have a greater chance of survival because they normally serve remote urban or rural areas.

On the other hand, information on the commerce sector is generally scarcer and less reliable than that available for industry, so the sector specialist must rely comparatively more on the opinion and judgment of the trade and professional associations of the country or region under study. For example, practically no country in Latin America has time series on the level of commercial activities, except in the case of GDP estimates, which are very broad and indirect.

In this subsection of the manual, we only make detailed references to the methodology and sources of information used when they differ from those previously described for the industrial sector.

2. Description of the affected area

Rough estimates must be obtained for the number of commercial establishments destroyed or damaged, grouped by size and type (such as supermarkets, grocery stores, fresh produce stands, footwear shops, general stores, gas stations and spare parts stores). These estimates should be based on information collected by national authorities in order to identify the area affected by the disaster.

Use of pre- and post-disaster digital aerial photographs can be extremely useful for defining the affected area and to obtaining an overview of damages sustained.

3. Direct damages

The information available on commerce is usually so limited that detailed estimates cannot be made of the various headings under which one might otherwise list enterprises' fixed assets. Therefore, direct damage should only be broken down into three categories: buildings and facilities; furniture and office machinery; and stocks.

a) Buildings and facilities

To calculate this component, it is necessary to determine the affected surface area, whether the damage is total or partial and the replacement value as a function of the cost per square meter of construction. The latter should be adjusted to include the cost of demolition and of vulnerability-reduction components.

According to past experience, the surface area of small stores normally ranges between 50 and 500 square meters and averages around 100. These figures vary in the case of fruit stores or stalls in public markets, for example, which require approximately 12 square meters. Service stations and spare parts stores have an average of 500 and supermarkets require 1 500. The cost per square meter of the most solid constructions, such as service stations and spare parts stores, can be seven times greater than those of food stores or public markets.

b) Furniture and equipment

This component usually has relatively less weight within total fixed commercial assets than in the industrial sector, so there is no reason for the sectoral specialist to conduct an exhaustive valuation study. In past assessments, estimates stated the value of furniture and equipment as a percentage of that of buildings and facilities; the best figure seems to be 20% for small businesses and 40% for all others.

c) Stocks

The inventories of commercial establishments have a higher relative weight in total assets because these businesses are intermediaries between producers and consumers. Surveys have shown that for this specific case, stocks are usually equivalent to a maximum of two months' sales in the small-scale commercial sector. The sector specialist should compare this information to local conditions.

Furthermore, a more or less stable relationship of one to two has been observed between the value of buildings and facilities and that of stocks. This may be a function of the physical storage capacity of the facilities, although it does vary somewhat depending on the branch of commerce. Once again, the sector specialist must corroborate the local applicability of such average figures.

4. Indirect losses or effects

38 Since commerce is an activity whose main function is the provision of services, production losses incurred during the interruption of activities should be estimated not on the basis of the amount of sales not made (it is not a question of goods that could not be produced, as in the case of industry), but on the basis of profits not made. In turn, these effects should be given as value - added. Therefore, an estimate should be made of the income (or product) generated on average by each worker (vendor or owner), broken down into small, medium-sized, or large commercial establishments. Based on annual sales, an estimate may be made of losses for one or several months' of interrupted activities.

Experience shows that with proper official support, small commercial establishments can restart activities in a month, while other establishments can do so in a period that rarely exceeds six months after a disaster has occurred.

Even when the trade sector of a country is not directly affected by the disaster, its activities may be affected to varying degrees if other productive activities with which they have intermediation ties or chains have experienced damage.

Summarized information on direct damage and indirect losses caused by the floods and mudflows that affected several states in Venezuela in 1999 is provided in Table 9. The trade sector in the country had considerably diminished its output in 1999 (by around 18%), a situation exacerbated by the disaster.² Losses were estimated for the affected coastal area (mainly for the states of Vargas, Miranda and Falcón), and attention was paid to what happened in the capital and other states, where the effects were less severe. Effects in the first of the states mentioned, however, accounted for most of the damage. The coastal area's high dependence on tourism-related commerce meant that its recovery was almost completely dependent on tourism's recovery. This explains the high weight of indirect losses in the estimation of total damages.

² Consecomercio, *Basic Economic Policies to Stimulate Internal Demand*, Venezuela, 1999.

Most of the data came from the National Commerce and Services Council (Consejo Nacional de Comercio y Servicios – Consecomercio), the La Guaira Chamber of Commerce and the specialist's own estimates carried out in the field.

It was estimated that slightly over 6 000 establishments operating in the area were affected, including large and medium-sized supermarkets, formal and informal commercial establishments covering a wide range of commercial and services activities, and over 500 customs brokers. The effects on the restaurant and recreational club facilities were dealt with separately because of their large impact in the area analyzed. In most of the cases included, damage was severe and often implied total loss of stock and facilities.

Table 9

ESTIMATED DAMAGE AND LOSSES TO THE TRADE AND SERVICES SECTOR
(Millions of bolivars)

Area and type of trade	Direct damage	Indirect losses	Total damages
State of Vargas			
Supermarkets and similar	53,950	10,790	64,740
Caraballeda (7)	4,550	910	5,460
Carayaca (5)	3,250	650	3,900
Catia la Mar (27)	17,550	3,510	21,060
Macuto (5)	3,250	650	3,900
Naiguata (2)	1,300	260	3,900
La Guaira (19)	12,350	2,470	14,820
Maiquetia (18)	11,700	2,340	14,040
Other medium-sized commercial establishments (a)	132,000	33,000	164,000
Micro commerce (b)	15,000	3,000	18,000
Bank branches (44)	6,600	2,200	8,800
State of Miranda			
2 Supermarkets and 55 goods and services businesses	3,050	1,340	4,390
State of Falcon (c)	3,000	1,500	4,500
States of Sucre, Táchira, Yaracuy, and Zulia (d)	5,100	2,400	7,500
GRAND TOTAL	218,800	54,280	265,580

Source: ECLAC, based on official figures and those available from chambers of commerce.
(a) Approximately 3,000 formal commercial establishments with direct losses of 48 million bolivars each.
(b) Estimated at 3,000 premises or "Small stores" with average stocks of five million bolivars each.
(c) Simply estimated.
(d) Estimated losses based on the data for states of Miranda and Falcon, considering half the losses per inhabitant for damage to commercial establishments, coefficients applied to the population of the four states mentioned in the table.

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5. Macroeconomic effects

Under this heading, the sector specialist must estimate the effects of damage and losses sustained by affected commercial establishments on local (if this information is available) and national GDP.

Disasters affect a countries' development because of their economic ramifications, which are inversely proportional to the country's economic diversification and disaster vulnerability.

As noted in the example of the assessment of direct damage and indirect losses in Venezuela, the central coastal area had a huge number of restaurants, recreational clubs, hotels, condominiums and homes, in addition to well-developed commercial and service infrastructure, all of which were destroyed to a sizable degree. A summary of all damages to non-agricultural productive sectors is presented below (Table 10).

Table 10
SUMMARY OF DIRECT DAMAGE AND INDIRECT LOSSES SUSTAINED BY
NON-AGRICULTURAL PRODUCTIVE SECTORS

Activity	Direct damage	Indirect losses	Total damages	Imported component (mill. of dollars)
	(Millions of bolivars)			
Trade and services	218,800	54,280	273,080	426.7
Manufacturing industry	12,710	9,320	273,080	34.4
Construction enterprises	640	640	1,280	2.0
Tourism	124,150	66,120	190,270	297.3
TOTAL	356,300	66,120	486,660	760.4

Source: ECLAC, based on official figures and those available from chambers of commerce

D. OTHER RELATED SUBJECTS

1. Employment and income

The cross-sectoral nature of loss of employment and income by workers and their families due to the temporary paralysis of productive activities after a disaster has been previously noted. The trade and industry sectors are no exception to this rule; indeed, some of their subsectors or activities can have a heavy negative impact on employment and family income.

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The existing relation between the output of different goods and the associated labor requirements may be determined and then applied to estimate losses of employment and income. The figures required for such estimates are normally available from labor, industry and trade ministries.

The chapter on employment and income in Volume Four of this Handbook provides details on the methodology to be used in all sectors that might be affected by a disaster. To that effect, the trade and industry specialist must work in close coordination with the specialist on employment when making such estimates. Likewise, the same type of cooperation must exist with the gender specialist when breaking down employment and income lost by women.

2. The differential impact on women

A description of how women are affected differently by disasters and the methodology for estimating this differential impact are included in the appropriate chapter of Section Five of this handbook. Each sectoral specialist is reminded to work in close cooperation with the gender specialist in this regard. Both direct and indirect damage must be estimated for women in the trade and industry sectors.

A breakdown is needed of women's private - sector assets that were damaged or destroyed by the disaster in question. Information on women's share in the ownership of industrial and commercial establishments is usually available in public statistics. Information derived from any surveys or samplings carried out to ascertain the effects on women can also be used. Once again, estimates should be broken down into large, medium-sized, small, and micro industrial and commercial enterprises. Women generally own a large share of micro and small enterprises, both in the industrial and commercial sectors.

Women often operate micro and small enterprises out of their homes to increase and supplement family income. These production activities are not always duly considered in the system of national accounts, nor can they be identified in quick surveys carried out by the trade and industry specialist because these women-run enterprises are not necessarily members of trade associations. Therefore, it is necessary to estimate damage to women-owned assets and production as a percentage of the total for formal micro and small enterprises. These damages will be over and above those estimated by the trade and industry specialist.

The gender specialist will normally carry out a quick survey among affected women to obtain figures on losses of assets and production in these types of home-based micro and small enterprises. The results of this survey must be compared with the rough estimates described in the paragraph above.

Information that must be obtained by the trade and industry specialist in close cooperation and support with the gender specialist for estimating losses caused by the disaster, is described below.

In regard to direct damages, the following information must be estimated or determined by means of quick surveys or samplings:

- Losses of assets (infrastructure, machinery and equipment and stocks) in private industrial and commercial establishments, broken down into large; medium-sized, small and micro enterprises, that belong to women; and
- Losses of assets (machinery and equipment and stocks) of family micro enterprises run by women in their homes.

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with regard to indirect losses, the following information must be obtained through estimates or samplings:

- Losses of production in formal private enterprises –large, medium-sized, small and micro enterprises– owned by women; and
- Losses of production in informal, home-based enterprises run by women in their homes.

3. Environmental impacts

One of the very frequent effects of a disaster is the uncontrolled release of toxic substances to the environment (both to the air as toxic clouds and to the ground and bodies of water).These effects are usually related to the industry and energy sectors. They are generally caused by anthropogenic activity and are considered a disaster in themselves, although they may also be a consequence of natural phenomena such as earthquakes and floods.

The environmental consequences caused by these events are quite varied and depend on the magnitude, location and type of disaster. Sometimes it will be difficult to identify the environmental impact, especially for the short term.³ Consequences of these damages can reach, directly or through “chain-link” effects, assets and flows of goods and services in several sectors.

In general, these direct damages and indirect losses are accounted for in the respective sectors. The environmental assessment specialist should work in close coordination with other members of the assessment team to ensure that these damages are duly accounted for, especially those expenses required to restore the environment. In some cases, natural areas are affected by these events; the environmental specialist will likely estimate such damages.⁴ The preferred method to assess these damages is the restoration cost method (as described in Volume Four).

³ In some cases, the interaction of certain substances with the environment is not sufficiently known, involving effects that may only occur in the very long term. In the case of floods, for example, in spite of the fact that dilution capacity of substances in water bodies increases significantly, containers of toxic substances are carried away and their contents may be released later.

⁴ Regardless of whether the sectoral specialist estimated direct and indirect damages, restoration measures may fall under the jurisdiction of institutions not directly related to the sector. In such a case, especially when environmental authorities must decide what solutions to adopt, it is likely that these expenses will not have been accounted for in the sector.

APPENDIX XI METHODOLOGICAL APPENDIX

This brief methodological appendix contains tables with examples of the type of information that the sector specialist must collect both in field research and from government authorities, chambers of commerce and professional associations.

Table 1

BASIC CENSUS INFORMATION FOR EACH OF THE NON-AGRICULTURAL SECTORS
Year: _____

Items	National	In the affected area	Share (%)
1. Number of establishments			
Large			
Medium-sized			
Small			
2. Personnel employed			
Large			
Medium-sized			
Small			
3. Fixed assets			
Large			
Medium-sized			
Small			
4. Value added			
Large			
Medium-sized			
Small			
5. Other items of interest			

Note: Criteria used to define large, medium-sized, and small establishments must be spelled out, as they may vary from country to country.

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Table 2

ESTIMATE OF THE DIRECT DAMAGE TO BUILDINGS AND FACILITIES IN THE
MANUFACTURING SECTORS AT REPLACEMENT COST VALUES
(With the same characteristics in their original design)

Size/Type of enterprise/ number of establishments	Surface area affected in m ²	Average cost per m ² constructed	Total value
Total (230)			
Large (30)			
Sugar refineries (10)			
Shipyards (10)			
Man-made fibers (10)			
Food (10)			
Medium-sized (80)			
Severely damaged (50) (a)			
With minor damage (30) (a)			
Small (120)			
Severely damaged (90) (a)			
With minor damage (30) (a)			

As an example, it was estimated that the average surface area per establishment is 1,400 m² for medium-sized and 500 m² for small establishments.

Note: Figures between parentheses for the number of establishments and average surface areas for medium-sized and small establishments, as well as the specific breakdown by branches, are given only as examples and refer to the work carried out in Venezuela. The sector specialist must obtain actual figures for each case under consideration. This same estimate can be carried out using depreciated values for the condition buildings and installations were in when the disaster occurred or using reconstruction costs, including vulnerability mitigation components for buildings and facilities. The choice of estimate will depend on the specific purpose of the assessment.

Table 3

ESTIMATE OF DIRECT DAMAGE TO FIXED ASSETS AND STOCK IN THE MANUFACTURING SECTOR AT REPLACEMENT COSTS

Enterprises/number of establishments	Buildings and facilities	Machinery and equipment	Furniture and vehicles	Stock	Total
Total					
Large					
Sugar refineries					
Shipyards					
Petrochemicals					
Others					
Medium-sized					
Major damage					
Minor damage					
Small					
Major damage					
Minor damage					

Note: The breakdown by branch is presented only as an example; it refers to work carried out in Venezuela. The sector specialist must obtain real figures for each case. Damage to stocks should be determined at the replacement value prevailing under pre-disaster conditions. Depending on the aim or purpose of the assessment, damage to other assets can be estimated at their pre-disaster depreciated value; at replacement costs, with the same characteristics as their original design; or at replacement cost, including vulnerability-reduction components, in the case of buildings and facilities. The incorporation of technological advances should be considered in the case of machinery and equipment.

Table 4
ESTIMATE OF PRODUCTION CHAINS BY SECTOR AND ENTERPRISES LOCATED IN
THE AFFECTED AREA
(In local monetary units)

Branch/enterprises	Source of raw materials and inputs				Destination of final goods			
	(a)	(b)	(c)	Total	(a)	(b)	(c)	Total
Food								
Large								
Medium-sized								
Small								
Textiles								
Large								
Medium-sized								
Small								
Cement								
Large								
Medium-sized								
Small								
Other branches								
Enterprise 1								
Enterprise 2								

(a) Same area; (b) Rest of country; (c) Import/Export

Note: Information on production chains is collected to determine the indirect effects of a disaster on the main sectors or main enterprises located in the affected area. In other words, an interruption in the supply of raw materials and inputs will undoubtedly affect production flows of certain sectors or enterprises for a given time. Production chains or interrelationships can be estimated on the level of a branch or representative enterprises, as illustrated here.

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Table 5

LIST OF BASIC INFORMATION REQUIRED FOR THE ASSESSMENT
(Information usually provided by governments a few days after a disaster happens)

FEATURES OF THE NATURAL PHENOMENON THAT CAUSED THE DISASTER:

-
- Date of occurrence
 - Duration of the phenomenon
 - Definition of the phenomenon and degree of intensity
 - Other characteristics of the natural phenomenon

AVAILABLE SOURCES OF INFORMATION:

-
- Census
 - Redatam
 - Periodic assessments by ministries, planning offices
 - Other sources of information (including Internet)
-

Table 6

AFFECTED STATES OR PROVINCES AND DEGREE OF DAMAGE TO NON-AGRICULTURAL
PRODUCTIVE SECTOR ESTABLISHMENTS
(In the currency of the affected country)

Name of the state or province/size of establishments	Degree of damage		
	Severe damage (Total loss)	Medium damage (Partial loss)	Slight damage (Minor loss)
State or province 1			
Large			
Medium-sized			
Small			
State or province 2			
Large			
Medium-sized			
Small			

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Note: The government or the municipality of the affected country or area, in collaboration with competent authorities (chambers, professional associations, trade associations, etc.), should prepare this basic information to enable the sector specialist to make rapid progress in field research.

III. TOURISM

A. INTRODUCTION

1. General considerations

In most of the countries in the region, tourism is a sector that is not very well defined and whose activities are often included under other sectors in national accounts. However, in Mexico, Central America, and the Caribbean, which are frequently affected by disasters, tourism is a significant sector of the economy because of the foreign currency earnings and employment it generates. We have thus included a separate section on tourism in the Handbook.

Tourism activities may be grouped together under the following headings:

- Coastal tourism, typical of most of the islands and seafront areas in the Caribbean, Mexico, and Central America, although also found in South American countries;
- Tourism based on natural and historic heritage, commonly found in Mexico, America Central and South America;
- Marine tourism, including yachting, diving, touring on relatively small sail or motor-powered vessels, sport fishing and the like;
- Cruise tourism, traditionally very popular in the Caribbean but also extending to South and Central America in recent years;
- Winter tourism;
- Business travel;
- Family trips to visit friends and relatives; and
- Restaurant operations and activities.

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Impact assessment can be dealt with similarly for all tourism activities except for cruise tourism, which generally does not require installations other than port facilities for their operation.

In contrast to business travel, which takes place year round, tourism in the region is essentially seasonal as international tourists seek a break from the cold weather prevailing in their countries of origin. Therefore, typical tourism seasons are different for countries in the northern and southern hemispheres.

Another characteristic of tourism is that damage to infrastructure or operations caused by disasters has repercussions on other sectors. Services such as restaurants and taxis that cater to visitors are also affected. The tourist industry attends to the needs of visitors either in their country of origin (domestic tourism) or in other countries (international inbound/outbound tourism). In general terms, domestic and inbound tourism are normally more affected by a disaster, although residents of the affected country who are planning to travel abroad (outbound tourism) may also be affected.

In general, international inbound tourism has increased markedly in Latin America and the Caribbean in recent years in tandem with the industry's sustained growth worldwide. Caribbean economies depend to a high degree on tourism, while Central American economies have experienced tourism growth greater than 5% a year in recent years. Moreover, both the World Tourism Organization and the World Travel and Tourism Council foresee growth rates for the sector of 5% in the Caribbean and between 2% and 10% for the rest of the region.

International inbound tourism generates sizable foreign currency earnings, domestic and foreign investment, male and female employment and tax revenues. The sector is also linked to a wide variety of production chains for both local and imported goods and services, including ground, marine, and air transportation; communications and informatics; financial and business services; commerce; construction; and productive services in general. The sector can also lead to significant imports of goods and services not produced locally. In short, the impact of a disaster on the sector has ramifications for other sectors.

Tourism must be sustainable over time, meaning it needs a range of attitudes, behaviors, strategies, plans, laws and regulations in response to economic, social and environmental needs. A comprehensive tourism policy is required to enable an improvement in the country's economic opportunities, which benefit communities and enterprises, and to contribute to personal, social and economic growth for men and women.

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2. Tourism and vulnerability

Throughout the region, tourism facilities have sprung up in many destinations without proper planning for ecological and vulnerability concerns. The resulting facilities are often located in hazardous areas due to the absence of environmental management and natural resource land-use regulation, as well as a lack of adequate construction standards or regulatory compliance in hotel infrastructure and related human settlements. To a large degree, tourism depends on the preservation of the environment and of cultural, social, and historical heritage. Therefore, the effects of disasters can be aggravated if the aspects mentioned above are not strictly addressed.

It is well known that in some areas or regions –such as the Caribbean or Central America– the tourism developments most frequented by international vacationers are highly exposed to natural phenomena with significant hazard risk. The best tourism destinations in the region are frequented by tropical storms and hurricanes, as well as floods and earthquakes. Although vulnerability varies from one country to another, the fragile nature of the land and marine ecosystems in the region is obvious, as is the lack of suitable environmental management, disaster-aware land-use planning and building standards.

Other long-lasting natural phenomena, such as droughts and prolonged eruptions of volcanic ash, can indirectly affect tourism through the national supply chain –farming and agribusiness, or even access to water for human consumption– or by reducing the comfort foreign tourists experience. When supplies are stressed, the industry may suffer from resentment among a local population denied basic services while foreigners receive privileged treatment.

The sector is also exposed to another type of vulnerability related to the volatility of demand. News of a real or potential disaster can prompt immediate cancellation of reservations by foreign tourists and diminish future tourism flows and income for a long time.

3. Sources of information

The tourism sector specialist can use various domestic and international sources to obtain reliable information both on the pre-disaster situation and on the damage caused by the action of the underlying phenomenon.

Domestic information sources include the following :

- Recent censuses or surveys on tourism spending and stays;
- National statistics offices;
- Information provided by national tourism sector authorities;
- Hotel and tourism associations;
- Tour operators;
- Central banks;
- Port and airport authorities; and
- Insurance companies.

Useful international sources include, among others, the following:

- Central American Tourism Integration Secretariat;
- Caribbean Hotel Association;
- Caribbean Tourism Association;
- International reinsurance companies; and
- World Tourism Organization.

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Reviews of the information published by these international bodies and field visits to the aforementioned local institutions will allow the specialist to gather information on the situation both before and after the event.

B. ESTIMATION OF DAMAGE AND LOSSES

As in other sectors, it is necessary to estimate direct damage to assets and indirect losses in economic flows derived from tourism. Afterwards, it will be necessary to calculate the impact on the main macroeconomic variables (e.g., gross domestic product, foreign accounts and public finances), employment and the differential effect on women.

1. Direct damages

As a first step in estimating the direct damage to the sector, it is necessary to establish the baseline. This refers to tourism-specific assets that are not included in any other sector, and it requires detailed information on items such as the number and capacity characteristics of several types of establishments:

- Hotels, by category;
- Guest houses or family-run establishments;
- Cultural and historical attractions;
- Docks and jetties;
- Vessels or transportation vehicles;
- Winter tourism facilities; and
- Restaurants.

The tourism specialist may use such data as a basis for comparison when assessing direct damage to the infrastructure and equipment of the sector. The area affected by a disaster may be superimposed on this baseline as the first step in damage assessment.

Estimating direct damage for the tourism sector is essentially the same as for the housing sector, and what was indicated in that chapter will not be repeated here. In the case of tourism facilities, equipment might include water collection and purification works, wastewater collection and treatment plants, electricity generators and large-scale air conditioners. Likewise, any damage to the sector's transportation infrastructure and equipment should be included –docks, leisure vessels and other works– so the tourism specialist must work closely with the transport and communications specialist to make his/her work easier and to avoid double accounting. Moreover, the tourism specialist must make estimates –once again, in close cooperation with the environmental specialist– on the impact on natural resources that make up the tourism environment, such as erosion or silting of beaches. Undoubtedly, these estimates will be specific to the sector in some cases, whereas in other cases cooperation with other sector specialists will be essential.

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It should be noted that beach erosion is common in the case of tropical storms and hurricanes in the Caribbean and Central America. Nature tends to return the beaches to their pre-disaster condition, but the process may be a lengthy one.¹

2. Indirect losses

As in the case of direct damage, the tourism specialist must obtain basic information on the pre-disaster conditions for making comparisons against the post-disaster situation.

In this regard, the specialist should obtain the following information for each of the categories of establishments or recreation and tourism transportation equipment noted above:

- Number of rooms, listed by capacity;
- The occupancy rate of each type of room and changes over time (the demand curve);
- Number of restaurants and their capacity;
- Capacity of vessels and average occupancy during the tourism season;
- Employment –by type of job or trade and by se – needed to operate each type of establishment; and
- Volumes of inputs of all types –food, drinks, etc.– that must be imported for the operation of each type of establishment and vessel.

¹ Hurricanes Luis and Marilyn significantly damaged the beaches of Anguilla in 1995. A later visit to the island in 1996 revealed that the sand had almost returned to normal thanks to the action of the tides.

The tourism specialist must estimate, in close consultation with the owners of establishments or trade associations, the time needed for a return to pre-disaster conditions. Such a projection, in conjunction with occupancy and demand-curve data, makes it possible to estimate the loss of income the industry is likely to suffer (i.e., the main indirect losses).

The tourism specialist must also consider other types of indirect damage, including the possible cancellation of reservations from abroad and the possible cost of a promotional campaign to once more attract tourists.

The cleaning of beaches damaged by tides, floods or winds, and of paths used in ecotourism must also be counted as indirect damage.

It is necessary to calculate the extent of probable tourism occupancy reduction resulting from damage to other related sectors, such as access roads, water and sanitation systems, power availability and communications systems.

Any decrease in tourism activity also implies a diminished demand for related services such as the use of restaurants, nightclubs and taxis.

One last type of indirect damage that must be taken into account by the tourism and other sector specialists is the increase in insurance premiums that companies often charge in the wake of a disaster in anticipation of a possible recurrence of such extreme natural phenomena. The increased premiums could lower the income and operational profitability of tourism establishments.

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In the case of cruise tourism –so popular and common in the Caribbean– certain additional estimates must be carried out. Since cruise liners schedule their ports of call well in advance, it is possible to estimate the income each of those tourism sites would have been likely to post had the disaster not occurred. Any natural event that damages port infrastructure, natural resources or commerce in a tourism destination can cause immediate cancellations by cruise ships. Interviews with national authorities, businessmen in the sector and representatives of the cruise lines can allow the analyst to project how long it will be before the ships are likely to return, thereby making it possible to calculate the corresponding (indirect) loss in income.

3. Macroeconomic effects

We have already noted that officials in many countries in the region register tourism as part of accounts for other sectors; tourism satellite accounts are not yet common practice or might not be sufficiently updated or broken down by activity or region. In addition, the heterogeneous nature of tourism means that many of its components fall within the sphere of other sectors, such as infrastructure, communications, commerce and the like. Despite such potential obstacles, and in light of the economic weight of tourism in the Caribbean and increasingly in Central America, Mexico and elsewhere in the region, it is necessary to conduct a separate assessment of tourism's macroeconomic impact.

Such an analysis must include calculations of how a disaster's impact on the sector would affect economic output, external accounts, and public finances, with proper attention given to the effects on public and private investment, employment and women.

a) Effects on economic activity

Forecasts of how tourism would have performed in the year in question, had there been no interruption in activities due to the disaster, are normally available in national planning offices, central banks or sector agencies.

The tourism specialist should compare this information with estimates on decreases in income as estimated in the section on indirect losses, and then estimate a new economic output (contribution to GDP) for the tourism sector after the disaster. Special care must be exercised to ensure that these estimates do not lead to double accounting should other specialists include tourism activities in their sectors. (In the cases of small Caribbean economies in which income from tourism is high, potential duplications are unlikely).

It should also be noted that tropical storms and hurricanes that cause damage to the sector in the Caribbean usually occur during the low tourism season. Therefore, indirect losses due to drops in occupancy rates and the subsequent effect on GDP are not necessarily significant, unless the reconstruction period for damaged infrastructure is very long.

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b) Effects on the external sector

International inbound tourism has a special impact on the external sector. If the relative weight of tourism in the economic activity of the affected country is significant, any drop in tourism activities due to a disaster will imply major reductions in foreign-currency revenue (from the export of services). The tourism sector specialist should estimate such decreases in revenue from abroad.

Another heading that the tourism specialist should take into consideration is the possible availability of insurance or reinsurance policies on goods destroyed or damaged in the tourism sector since they can generate an unforeseen inflow of foreign currency. In addition, the rehabilitation and reconstruction of hotel and restaurant infrastructure, and the replacement of their equipment and machinery, might require significant imports, especially if they are not produced in the affected country. Once again, the tourism specialist must make the corresponding estimates.

These calculations should be delivered to the macroeconomics specialist so that he/she can combine them with those of other sectors and determine the overall effect of the disaster on the external sector of the affected country.

c) Effects on public finances

Although the current trend in the region is for tourism sector infrastructure to be privately owned a disaster can have major effects on the finances of an affected state.

Indeed, the natural phenomenon may directly affect transportation, port and airport infrastructure (which is normally publicly owned), further diminishing tourism income. However, such estimates of damage to infrastructure are usually taken into consideration in the respective sectors.

The main negative effects on public finances caused in the tourism sector stem from the drop in revenue from taxes and fees paid by , which the country will not collect during a certain period. This loss of state revenue can be estimated on the basis of the drop in hotel demand or occupancy previously estimated as indirect losses.

In addition, the state might be forced to make unplanned outlays to overcome problems in the tourism sector, such as beach and forest path cleaning work, special benefit payments to persons who lose their employment in the sector and so forth.

The tourism specialist must make these estimates and provide them to the macroeconomics specialist who, after ensuring that there is no duplication with the information from other sectors, will use them to obtain the total impact of the disaster on public-sector finances.

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d) Effects on investments

The impact on public or private investment may vary depending on the magnitude of total damage relative to the size of the economy of the affected country or region.

The occurrence of a disaster and the subsequent rehabilitation and reconstruction may produce several effects. First, uncertainty as to the likelihood of hazard prevention and mitigation works may discourage investment decisions and inflows. Second, public and private investment programmes may be modified and increased to meet the needs of rehabilitation and reconstruction. Third, the need to replace lost assets may take precedence over projects previously designed to overcome long-standing social shortcomings; the resulting programme postponements and cancellations imply a social cost.

Although these observations are valid for all sectors, the tourism specialist must provide the macroeconomist with all information that can be obtained in this regard, so that he/she may get a clear overview of possible changes in the behavior of the economy of the affected country.

4. Effects on employment

When tourism activities are reduced, there is a corresponding decrease in the employment and income of men and women working in the sector. A relationship exists between the income generated in the sector and the number of various types of employees with their different income levels. Therefore, it is possible to estimate job losses in the sector based on the estimates of industry activity and income during and beyond the rehabilitation and reconstruction stage. This loss can be partially compensated by the use of tourism sector workers in cleaning and infrastructure recovery tasks, since both employers and employees wish to ensure that the same labor force will be available once the emergency is behind them and normal tourism activities resume. The tourism specialist should make these estimates in close cooperation with the employment specialist.

In very small economies, the labor force available in the construction sector may be insufficient to quickly carry out the reconstruction that hotels require. In such cases, labor, machinery and equipment have been imported from abroad, and these will not necessarily return to their countries of origin after reconstruction is completed, possibly aggravating pre-existing employment problems. The tourism specialist must be aware of this type of potential dilemma and quickly report it to the macroeconomics and employment specialists.

5. The differential impact on women

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As in other sectors, women's share of tourism is affected by disasters. Tourism facilities and services affected by a disaster may be owned by women; other women might temporarily lose their employment in the industry.

In this regard, the tourism specialist must co-operate closely with the gender and employment specialists to determine three key points:

- Women's share of sector ownership;
- Women's share in the sector's labor force; and
- The possibility of including women in rehabilitation and reconstruction tasks.

The required information may be obtained from censuses, recent household surveys, chambers of tourism statistics and so on. The results of this analysis must be delivered by the tourism specialist both to the macroeconomist and to the gender specialist, who will be responsible for adding the figures from all sectors to determine the differential impact of the disaster on women at the national level.

6. Environmental impact

The methodology for assessing damage to environmental assets and flows in environmental goods and services is described in the chapter on the environment in Volume Four of this Handbook. A significant portion of the tourism industry is based on the environmental services of recreational opportunities and scenic beauty, both in the case of highly intervened environments (usually the case of sun and beach tourism) and the less intervened environment (usually the case of the tourism in protected areas, sometimes called ecotourism).

Therefore, damage assessment in the tourism sector and environmental damage assessment are closely related. In terms of quantification and valuation of damage, two different situations may occur (see the chapter on the environment).

a) Environmental damages usually included in tourism sector assessment

This heading refers to direct damages and indirect losses (loss of natural capital and changes in the flows of environmental goods and services) that are already accounted for in the tourism sector. Beach loss and degradation, lodging infrastructure damage and drops in revenues that occur during the restoration period are good examples of these losses. The environmental assessment tries to identify the share of these damages corresponding to the contribution of natural capital, isolated from contributions of human capital and other assets such as infrastructure and equipment. Estimation of this contribution can be made using the economic rent concept (the difference between market prices and production costs). However, it is not easy to estimate this contribution in the tourism sector, except in the cases of fees charged to enter protected areas and taxes used for environmental protection (e.g., additional airport or room taxes that are levied on foreign visitors in certain countries). To avoid double accounting, these estimates should be included in only one sector (either tourism or environment) in the damage overview.

b) Separate quantification and valuation

This case refers to the valuation of assets and environmental services related to tourism activities that are not accounted for in the tourism sector assessment. Examples include, the valuation of environmental changes in ecosystems relevant to the tourism sector such as forests, coral reefs or damage to emblematic species. These damages should be included in the damage overview, as they have not been considered in the damage assessment of the tourism sector.

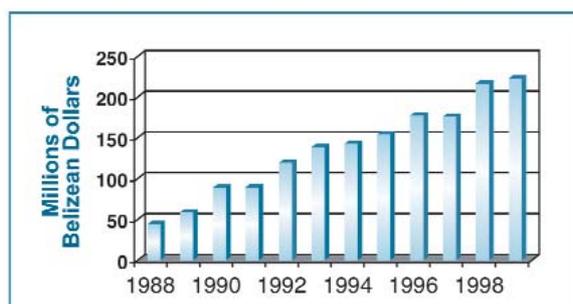
APPENDIX XII THE IMPACT OF HURRICANE KEITH ON BELIZE'S TOURISM SECTOR IN 2000

The following is ECLAC's estimate of the impact caused when Hurricane Keith passed through Belize in late 2000.²

General information

Hurricane Keith caused significant damage to tourism, which is the main sector in Belize's economic activity. According to the World Tourism Organization, in 1996 tourism accounted for 14.3% of GDP. It is also the country's leading exporter, generating income of 88 million US dollars in 1998, almost twice as much as sugar, which ranks second.

Figure 1
Tourist expenditure, 1998 - 1999



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Tourism has developed at high growth rates in the last decade (see figure 1): Tourist arrivals have almost doubled, and tourism infrastructure and activities have been expanded significantly.³ The tourism products on offer are linked to Belize's cultural and environmental heritage: tropical rain forests, biodiversity, historical buildings and marine life.⁴ Seventy percent of tourists come from the United States and Canada, and 23% are from Europe.

In terms of income per hotel room, the most important areas are Ambergris Cay (43.1% of the total), the Belize District (23.6%) and the Cayo District (10.7%).⁵ The high season for tourism runs from December to Easter.

² ECLAC, *Belize: Assessment of the Damage caused by Hurricane Keith, 2000: implications for Economic, Social and Environmental Development*, Mexico City and Port of Spain, November 2000.

³ Between 1990 and 1999, the number of hotels increased from 210 to 390, and the number of hotel rooms rose from 2,115 to 3,963.

⁴ According to a survey of visitors in 1997, marine attractions were their main reason for coming to Belize.

⁵ The Belize Tourism Board receives a 7% tax on income from each occupied hotel room.

Direct damages

The winds and high seas produced by Hurricane Keith devastated the cayes of northern Belize, especially Ambergris Caye, Caye Caulker and Caye Chapel. Most of the hotels (62 on Ambergris and 37 on Caulker) sustained differing degrees of damage to their infrastructure and equipment. Inland, however, the damage was less severe. The Mayan archaeological site in the Lamanai Nature Reserve was damaged by high winds, fallen trees and flooding, and fissures appeared in the main pyramid.

The northern cayes sustained the following damage:

- Total destruction of two hotels on Caye Caulker and one on Ambergris and structural damage to several others;
- Damaged roofs on a large number of the hotels, which led to damage to their interiors, including ceilings and furniture;
- Damage to equipment (pumps, water heaters, washing machines, air conditioners);
- Damage to the landscape caused by the loss of trees and depositing of residues;
- Damage to gift shops and restaurants;
- Damage to the Caye Chapel golf course;
- Quays completely or partially destroyed;
- Jetties destroyed in Caye Chapel and Caye Caulker;
- Land lost from beach erosion (included under the heading of environmental damage and loss); and
- Loss of boats used for the tourist trade.

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An assessment was made of the cost of replacing destroyed infrastructure and repairing that which was only damaged, as well as of replacing lost boats. It was based on official information supplied by Belizean authorities and local insurance companies.

The total amount of direct damage was estimated at 62 million US dollars. The following table contains a breakdown of estimated direct damage.

Table 1

ESTIMATE OF DIRECT DAMAGE TO THE TOURISM SECTOR CAUSED BY HURRICANE KEITH

Heading	Miles of USD
Country Total	62,047.0
Hotel buildings, including furniture, equipment, and golf course	42,000.0
Souvenir shops	5,000.0
Restaurants	5,600.0
Landscape	1,280.0
Quays and marinas	567.0
Piers and connected works	5,200.0
Tourist boats (140)	2,100.0

Source: ECLAC, based on official figures

Indirect losses

Indirect losses caused by the hurricane to Belize’s tourism sector includes the following:

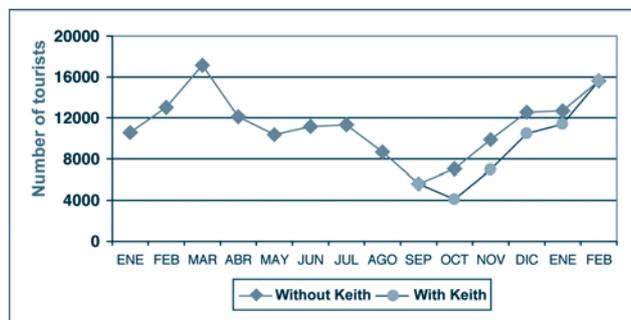
- Lower hotel occupancy (on Ambergris Caye and Caye Caulker);
- Lower tourist expenditure, including food and beverages, local transport and recreation;
- Lower revenues from country exit taxes;
- Unforeseen expenditure on promotion overseas to counteract the negative information about the effects of the hurricane published in the international press; and
- Cost incurred by some hotels to purchase emergency generators to make up for the lack of electricity after the hurricane.

Fortunately, there was no decline in cruise tourism, nor were hotel room rates lowered.

A study was made of possible tourist arrival behavior, bearing in mind both its seasonal nature and the trends detected in 1998 and 1999 in the wake of Hurricane Mitch. It was estimated that recovery would take four months, which was the projected period for the overseas promotional campaign to produce results. In other words, it was estimated that the country’s tourism would return to its forecast levels by February 2001 (see figure 2).

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Figure 2
ANALYSIS AND PROJECTION OF TOURIST ARRIVALS IN BELIZE BEFORE AND AFTER HURRICANE KEITH.



Existing data showing the relationship between the number of tourists arriving in the country and their expenditure on various related services were used to make an estimate of total indirect losses. On this basis, the total indirect damage to the sector was estimated at 18.15 million dollars (see the table 2).

Table 2
ESTIMATE OF INDIRECT DAMAGE CAUSED BY HURRICANE KEITH IN BELIZE
(Thousands of US dollars)

Heading	October	November	December	January	Total
Sector total					18,149.5
Decline in hotel occupancy	2,496.3	2,462.6	1,780.0	1,077.9	7,816.7
Decline in consumption of services					9,553.8
food	998.6	985.0	712.0	431.1	3,126.7
local transport	665.7	656.7	474.7	287.4	2,084.5
recreation	665.7	656.6	474.7	287.4	2,084.4
local purchases	443.8	437.8	316.5	191.6	389.7
other expenditure	277.3	273.6	197.8	119.8	868.5
Reduction in exit taxes					242.2
Additional energy cost					536.8

Source: ECLAC estimates based on official figures

The above estimates were made using information provided by the Belize Tourism Board, which indicates that on average a tourist remains in the country for 7.1 days and that room rates in 1999 in the damaged hotels on Ambergris Caye and Caye Caulker were 179.84 and 51.12 Belizean dollars, respectively. A survey of tourist spending made by the Tourist Board in 1997 showed that it was distributed as follows: lodging (45%), food and beverages (18%), local transport (12%), recreation (12%), purchases (8%) and other expenses (5%). With regard to exit taxes, account was taken of the fact that a tax of 20 US dollars is charged at the airport, while only 10 US dollars is charged at other points of exit. Finally, we took into account the fact that 20% of the hotels on Ambergris and Caulker invested an average of US 1 350 per room in emergency generators.

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Total damage and losses

After adding indirect and direct damages together, it was estimated that total damage and losses caused by Hurricane Keith in Belize amounted to 80.2 million US dollars. Direct damage accounted for 77% of the total (62 million dollars) and indirect losses for the remaining 23% (18.2 million dollars).

Macroeconomic effects

Damages sustained by the tourism sector also had a significant effect on Belize's macroeconomic performance. Not only did the growth rate for the sector and for the economy in general decline, but there was also a negative effect on the balance of payments.

The tourism sector was responsible for a significant part of the one-percent decline in the growth forecast for the national economy as a whole in 2000. The cost of repairing the damage caused to the tourism infrastructure, together with the decline in the sector's income, reduced the balance of payments by 57.6 million US dollars. This figure consists of imports of non-domestically produced materials and equipment used for reconstruction, as well as foreign currency lost because the expected number of visitors failed to arrive.

Effects on employment and income and on women

The worst flooding caused by the hurricane occurred in the rural areas of the Orange Walk and Cayo districts, two of the areas in the country where poverty is greatest. Damage to tourism infrastructure and services, which can be measured in monetary terms and which in any case was largely insured against, had relatively less tragic consequences than that caused in these districts.

Between 25% and 38.5% of households in Orange Walk and Cayo are headed by women. Rates of female unemployment and fertility are high, especially for women younger than twenty-five. There seems to be a correlation between poverty in these areas and the high incidence of transmissible diseases.

It is estimated that 33% of Belize's population has an annual per capita income of less than 645 US dollars and that income in the rural areas amounts to only 42.5% of this figure. The continuous flow of refugees from neighboring countries to the south of Belize is increasing the number of inhabitants living below the poverty level, and the incidence of poverty is growing in the rural districts and among the most vulnerable groups of the population. Average lost income among the population in these depressed areas was estimated to have reached the sum of 239 US dollars per capita.

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There is no doubt that the hurricane had a severe negative impact on the government's efforts to reduce poverty in the country. The strategy under execution before the disaster entailed reducing the fiscal deficit to less than 2% of GDP. Estimates show that the deficit will now reach 3%, which means that poverty reduction targets will be set back. Additionally, any attempt to keep to the targets set before the disaster would endanger the currency's exchange rate.