

Assessment of the Socio-Economic and Environmental Impact of Hurricane Wilma on Jamaica



**Planning Institute of Jamaica
October, 2005**

1. INTRODUCTION

Description of the Meteorological Event

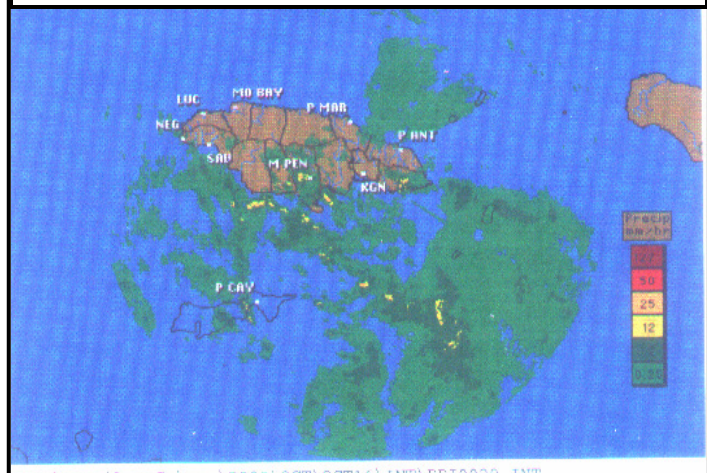
Hurricane Wilma of 2005 has gone down in the record books as the most intense hurricane to have developed in any Atlantic Hurricane Season, having generated sustained wind speeds of 280 km/h. The tropical cyclone traced a very slow path while developing over the western Caribbean Sea from a non-descript area of low-pressure. During this time, bands of rainfall associated with the system persisted over the island of Jamaica and produced serious flooding in various regions of the country for a period of almost eight days from October 13 to 20.

Wilma approached Jamaica as a cluster of disturbed weather early in October, and was defined as an area of low-pressure near Jamaica by the end of the second week of the month. Upper-level conditions had become more conducive for tropical cyclone development at this time, and the local Doppler radar was beginning to detect an increase in showers over sections of the island, starting with north-central and north-eastern parishes.

A Severe Weather Alert was issued for all parishes at 7:00 a.m. on October 14, 2005, and upgraded to a Flash Flood Watch by noon that day. By then, a broad area of moderate to heavy showers were observed to be scattered over offshore areas of the island's southern coast, and appeared to be moving towards the west-northwest. All parishes throughout the island were also experiencing shower

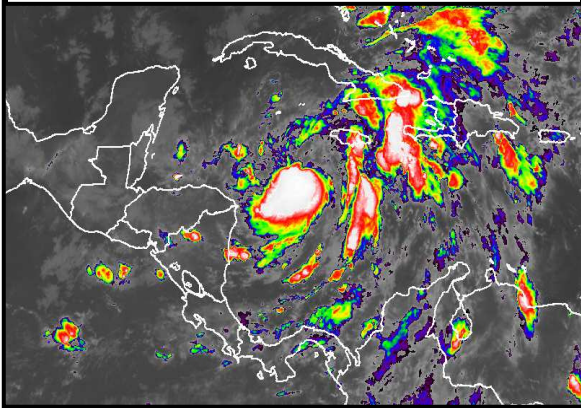
activity, which was concentrated over the western two-thirds of the country. A Flash Flood Warning was issued at 5:00 a.m. on the following day.

Figure 1: Radar image of rainfall associated with Wilma on October 15 at 10:00 a.m.



By 5:00 p.m. on October 15, the low-pressure system was classified as the season's 24th Tropical Depression with wind speeds reaching over 45 km/h. The centre was located about 140 km southwest of Montego Bay, or 90 km southwest of Negril Point, Jamaica. The slow movement of the system, combined with the extent of its outer bands, maintained a blanket of rainfall over the island for the next two days. Heaviest activity remained in the south.

Figure 2: Satellite image of rain-bands associated with Hurricane Wilma on October 17 at 3:45 a.m.



During this time, there was an erratic southward movement of the system as it developed into a Tropical Storm on the morning of October 17, and into a Category 1 hurricane on the morning of October 18. The intensity of showers, although showing a slight decrease over eastern and some northern parishes, persisted across the island. Rapid intensification of Wilma took place during the twelve hours between 5:00 p.m. on October 18 to 5:00 a.m. on October 19 as the hurricane exploded into Category 5 status with maximum sustained winds of an unprecedented 280 km/h.

A tightening of the rain-bands associated with Wilma, and its resumption of a westward and then north-westward forward motion, resulted in fewer showers over Jamaica and the discontinuation of the Flash Flood Warning for the island at 5:00 p.m. on October 20.

Rainfall Analysis

A preliminary analysis of selected rainfall stations from the parishes with highest rainfall values reveals the following:

1. The maximum 24-hour rainfall for a return period of two-years was reported in sections of the parishes of Kingston & St. Andrew, St. Thomas, and Westmoreland.

2. The maximum 24-hour rainfall for the return periods of five and ten years was reported in sections of the parish of St. Catherine.
3. The maximum 24-hour rainfall for return periods of 25 and 50 years was reported in sections of the parish of Clarendon.

The island was severely impacted by the heavy and persistent rainfall that occurred over the period of October 13-20, 2005. An elevated ground water table, the result of rainfall of the days preceding these events, exacerbated the widespread damage.

TABLE 1: CUMULATIVE POINT RAINFALL (OCTOBER 13-20,2005) WITH CLIMATOLOGICAL MEAN

Parish/Station	Wilma Rainfall (mm)									30-year Mean	% of Mean
		14	15	16	17	18	19	20	Tot.		
Kingston/St. Andrew											
Norman Manley International Airport		17	44	80	79	51	70		341	167	204
Norbrook		14	89	160	85	35	21		403	N/A	N/A
Waterloo Road		244				53	119		416	213	195
St. Thomas											
Norris		14	88	152		155	130		539	N/A	N/A
Cedar Valley		57	137	175	110	188	74		741	518	143
Ramble		51	171	107	68	139	81		616	386	160
Portland											
Swift River		155				85			240	232	103
Comfort Castle		-	71	101	71	72	-		316	N/A	N/A
St. Mary											
Hampstead		63				26	-		89	301	29
Richmond		60	49	79	30	33	2		255	214	119
St. James											
Sangster’s International Airport		77	3	1	12	39	12		144	166	86
Mount Horeb		51	25	30	27	29	24		186	277	67
Westmoreland											
Frome (Climo)		12	9	11	26	54	23		135	273	49
Negril Lighthouse		42	6	105	36	106	24		319	186	172
Non-Pariel		50	206				60		316	203	156
Retreat		-	109				33		142	206	69
St.Elizabeth											
Accompong		138			79		57		274	574	48
Appleton		5	20		44	89	27		185	323	57
Barton Isle		4	10	22	38	82	25		180	305	59
Manchester											
Old England		82					80		162	315	51
J.J. Gagnon		10	18	61	138	140	108		475	N/A	N/A
Evergreen		5	7	20	73	108	73		286	302	95
Clarendon											
Beckford Kraal		13	39	78	278	78	53		537	356	151
Crofts Hill		40	50	84	270	106	28		578	317	182
St. Catherine											
Bois Content		34	75	154	255	N/A	N/A		518	318	163
Tulloch Estates		36	41	145	160				381	292	130
Bybrook		42	33	120	155	62	48		460	234	197
Worthy Park Estate		48	33	98	94	165	18		456	261	175

Source: Meteorological Division

Emergency Actions

The National Emergency Operation Centre was activated on October 16 at 8:00am while the weather system was a tropical storm. The system remained a tropical storm until 6:00 a.m. on October 18 and was later upgraded to Hurricane Wilma by 6:00 p.m. on the same day. Evacuation notices were served on all flood prone communities. Seven emergency shelters housing 187 evacuees were opened to accommodate residents from flood prone communities in St. Catherine and Kingston & St. Andrew. Welfare and relief supplies were issued accordingly. Trucks from the National Works Agency were dispatched very early during the event to assist residents in communities in St. Catherine *viz.* Hill Run and Frazers Content.

Emergency shelters remained opened from October 16 - 21 with a maximum of 378 evacuees recorded on October 18. The numbers of persons in shelters subsequently declined as persons were able to return to their homes. The total cost for emergency and relief services rendered by the Office of Disaster Preparedness and Emergency was J\$2.6 Million as set out in Table 2.

TABLE 2 COSTS FOR EMERGENCY AND RELIEF SERVICES – HURRICANE WILMA OCTOBER 2005

Heading	Amounts	
<u>Fuel Cost</u>		
Fuel - Motor Vehicle Transportation of Staff and Supplies	150,000.00	
Evacuation and Rescue	70,000.00	
	220,000.00	220,000.00
<u>Relief Supplies</u>		
Foam Pads for shelters (500@\$2000 ea)	1,000,000.00	
Food Supplies Relief Donation food items	250,000.00	
	1,250,000.00	1,250,000.00
<u>Staff Cost</u>		
Support Staff \$1000 per day for 8 persons for 15 days	120,000.00	
Overtime Average of 18 hours work by staff members	500,000.00	
	620,000.00	620,000.00
<u>Administration Cost</u>		
Food (NEOC, Casual Labour)	150,000.00	
Motor Vehicle Maintenance	130,000.00	
Communication (Telephone Fax etc.)	100,000.00	
Transportation Cost Transporting of persons to shelter	70,000.00	
Stationary and Office Supplies	60,000.00	
Miscellaneous	25,000.00	
	535,000.00	535,000.00
Grand Total		2,625,000.00

Affected Population

Doppler radar report indicated that moderate to heavy and sometimes very heavy showers and thunderstorms affected all parishes resulting in landslides; flooding and damage to the agriculture sector, housing and other buildings, roads, bridges and other physical infrastructure. The worst affected parishes were Kingston and St. Andrew, St. Catherine, and Clarendon (See Figure 2). A total of 106 communities island-wide were affected by Hurricane Wilma. Table 3 shows the number of communities affected by parish.

FIGURE 2: LOCATION OF AFFECTED COMMUNITIES

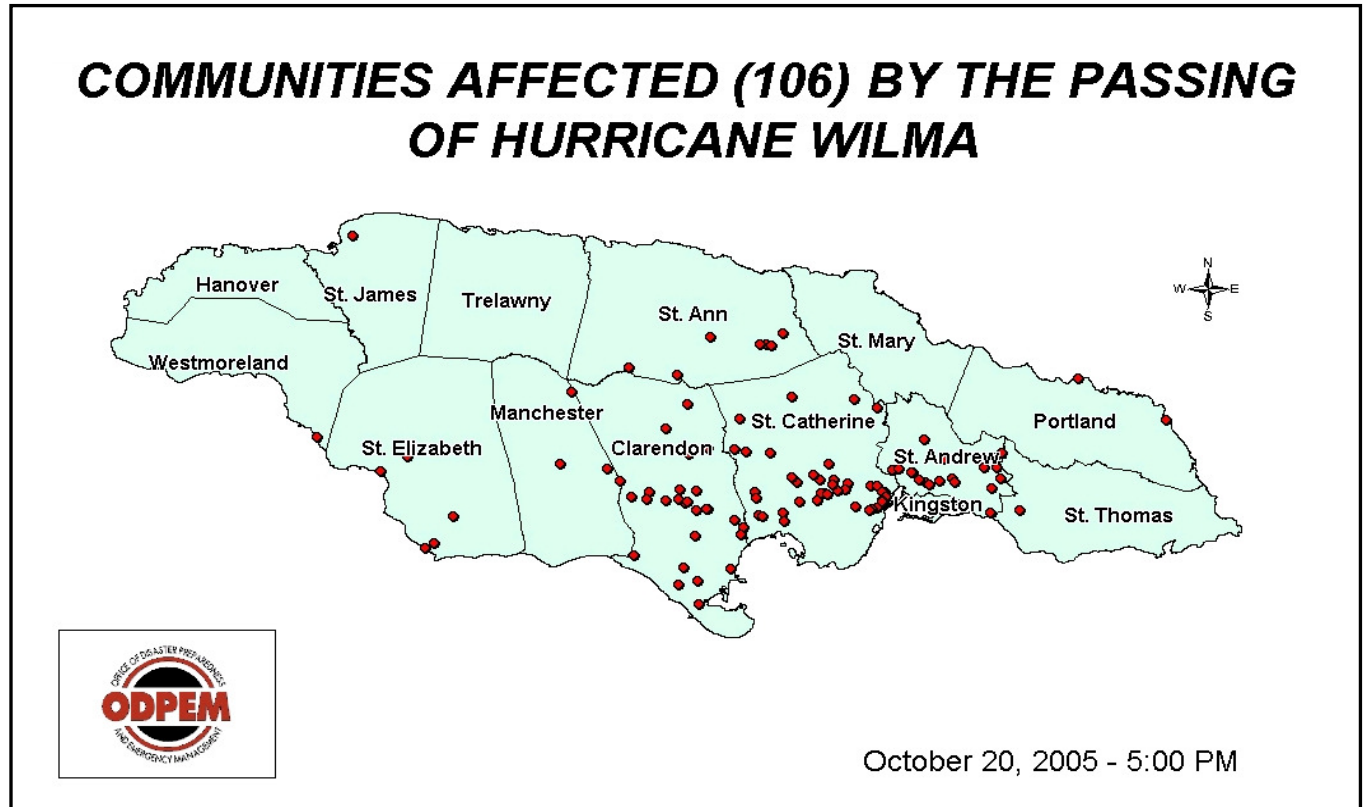


TABLE 3: NUMBER OF AFFECTED COMMUNITIES BY PARISH

PARISHES	NUMBER OF AFFECTED COMMUNITIES
St. Catherine	40
Clarendon	27
Kingston & St. Andrew	19
St. Ann	7
St. Elizabeth	5
Manchester	3
Portland	2
St. James	1
St. Thomas	1
Westmoreland	1
Total	106

Source: ODPEM (October 2005)

Many road users were seriously affected as a result of damaged and inaccessible roadways and bridges. The Bog Walk Gorge and the Yallahs fording were inaccessible to commuters for several days. A number of road ways were inundated with flood waters. These included the westbound lane of the Mandela Highway/Ferry Road. To facilitate access the eastbound lane was used to accommodate movement in both directions. The Portmore Causeway was also inundated with flood waters. The inundation of both the Mandela Highway and the Portmore Causeway, the main portals in and out of the capital city resulted in significant traffic congestion sometimes for over three hours in the mornings and evenings thus causing frustration to commuters and other users of the road.

The National Water Commission operates 460 potable water systems island-wide. Of this number approximately 95 systems were affected by Hurricane Wilma and the damage was not estimated to be substantial compared with that for Hurricanes Dennis and Emily. Domestic water supply to several customers in parishes including Kingston & St. Andrew, St. Catherine and St. Thomas was interrupted. Citizens served by minor water supply systems and parochial roads operated by the Ministry of Local Government and Community Development were affected as a result of damage. Although no significant damage was reported by Cable & Wireless at any of its locations, equipment at some of the company's operating plants was affected which resulted in disruptions in service to both land line and internet customers.

The Rural Agricultural Development Agency (RADA) reported that 18,179 food farmers were affected by Hurricane Wilma of which vegetable farmers were hardest hit. The worst affected parishes were St. Catherine and Clarendon which reported loss to over 5,000 farmers respectively. With regard to loss in the livestock sub-sector, 1,626 livestock farmers suffered loss, with the greatest losses being recorded among chicken and fish farmers.

Casualties

During the passage of the hurricane there was one fatality, a male who died by drowning when he was washed away in the Birds Hill area of Clarendon, while attempting to assist his goat. Two other cases of drowning involving two young boys were indirectly linked to the passage of the hurricane. The incident occurred days after the hurricane and was related to rising water in the Moneague area of St. Ann.

The Ministry of Labour and Social Security estimated that approximately 2 454 families or 9 335 individuals island-wide were directly impacted. The value of damage to infrastructure and facilities was estimated at J\$68 million. However, in light of the fact that the event was experienced island-wide it can be estimated that approximately 83 741 persons were directly or indirectly affected (see Table 4).

TABLE 4: JAMAICA: ESTIMATED POPULATION AFFECTED BY HURRICANE WILMA

ESTIMATED AFFECTED POPULATION - HURRICANE WILMA										
	Population Census 2001	%	End of Year Population 2002	%	End of Year Population 2003	%	End of Year Population 2004	%	Projected Population At the time of Hurricane Wilma (October 13-20, 2005)	Estimated Population Affected during Hurricane Wilma
Jamaica	2,607,633	100.0	2,622,465	100.0	2,638,275	100.0	2,650,933	100.0	2,663,842	362,002
Kingston and St. Andrew	651,879	25.0	653,811	24.9	656,406	24.9	660,623	24.9	663,245	79,528
St. Thomas	91,604	3.5	91,919	3.5	92,485	3.5	92,608	3.5	93,256	21,958
Portland	80,205	3.1	79,980	3.0	80,396	3.0	80,211	3.0	80,672	4,744
St. Mary	111,467	4.3	111,593	4.3	112,592	4.3	112,797	4.3	113,275	8,482
St. Ann	166,762	6.4	168,970	6.4	171,098	6.5	172,652	6.5	173,942	7,894
Trelawny	73,066	2.8	72,903	2.8	73,183	2.8	73,023	2.8	73,249	5,184
St. James	175,126	6.7	178,370	6.8	180,138	6.8	181,682	6.8	183,023	11,726
Hanover	67,037	2.6	66,658	2.6	66,696	2.5	66,341	2.5	66,466	5,837
Westmoreland	138,947	5.3	140,266	5.3	141,383	5.4	142,478	5.4	143,346	5,800
St. Elizabeth	146,404	5.6	145,754	5.6	146,163	5.5	145,858	5.5	146,274	18,323
Manchester	185,801	7.1	189,485	7.2	191,863	7.3	194,744	7.3	196,283	22,423
Clarendon	237,025	9.1	237,865	9.1	240,088	9.1	241,096	9.1	242,773	86,362
St. Catherine	482,308	18.5	484,892	18.5	485,785	18.4	486,819	18.4	488,038	83,741

Source: Population Unit, Planning Institute of Jamaica, October 2005

Note: Estimated Population affected is determined by communities reported to be affected in each parish.

2. IMPACT ON THE SOCIAL SECTOR

Education

Reports from the Ministry of Education, Youth and Culture indicated minimal damage to educational facilities. Serious damage resulting from land slippages was reported at St. Mary's High, St. Mary Technical and Martin's Primary Schools all in the parish of St. Mary. A number of schools were used as emergency shelters but not for any protracted period of time. In the wake of the hurricane the Ministry took the decision to close all schools for one week to facilitate restorative activities as well as to ensure the safety of students and school personnel. There were no reports of damage to cultural facilities.

Housing

Widespread flooding and landslides associated with Hurricane Wilma resulted in damage to the housing sector. The National Housing Development Corporation reported that approximately 31 housing schemes in all three counties were affected. These included: Port Royal, Callaloo Mews and Riverton Meadows (Surrey); Mt. Edgecombe Phase IV; Portmore Villa and Shaw Park Glades (Middlesex); and Norwood, Barrett Hall and Whitehouse (Cornwall). Thirty-six of the 187 housing units in the Kennedy Grove housing scheme in Clarendon were affected. Four of the houses were almost completely submerged by flood water.

Solid Waste Disposal

The National Solid Waste Management Authority (NSWMA) reported that seven of their disposal sites across the island were affected by the heavy rains from Hurricane Wilma. These damages include inaccessibility due to damaged roads, onsite flooding, clogged drainage and eroded cells and cover material.

Health

As at October 24, the total estimate of loss and damage to the health sector resulting from Hurricane Wilma amounted to \$45.2 million. Approximately \$28.6 million was attributed to direct damage with indirect damage accounting for an estimated \$16.5 million. The highest level (per cent) of damage was done to health infrastructure accounting for approximately \$26.2 million.

TABLE 5: SUMMARY OF DAMAGE TO THE HEALTH SECTOR (J\$)

Type	Estimated Cost		
	Total (J\$)	Direct (J\$)	Indirect (J\$)
Partial or total destruction of infrastructure	26,278,435.00	26,278,435.00	0.00
Loss of equipment and furniture	0.00	0.00	0.00
Loss of vaccines	40,454.82	40,454.82	0.00
Vector Control	8,828,831.00	0.00	8,828,831.00
Water Quality Monitoring	1,011,869.58	0.00	1,011,869.58
Environmental Health Sanitation	275,000.00	0.00	275,000.00
Latrine Replacement	2,330,500.00	2,330,500.00	
Health Education Programme	785,000.00	0.00	785,000.00
Epidemiological/Shelter Surveillance	245,000.00	0.00	245,000.00
Vehicles	5,000,000.00	0.00	5,000,000.00
MOH Emergency Operations Centre	434,000.00	0.00	434,000.00
Total	45,229,090.40	28,649,389.82	16,579,700.58

Source: MOH National Emergency Operations Centre

Morbidity - Injuries

Twelve injuries were reported resulting from the weather event as set out in Table 6.

TABLE 6: NUMBER OF INJURIES REPORTED BY INSTITUTIONS

INSTITUTION	TYPE OF INJURY	NO.
University Hospital of the West Indies	Fractures from falls	4
Bustamante Hospital for Children	Nail Stick	1
St. Josephs Hospital	Lacerations	3
	Fall	1
Nuttall Hospital	Injury to eye	1
Hope Institute	Injury	1
Alpha Boys' Home	Child fell from roof	1
TOTAL		12

3. IMPACT ON THE PRODUCTIVE SECTORS

Performance of the Jamaican Economy during Calendar Year 2005 – The Effects of Hurricane Wilma

During calendar year 2005, the Jamaican economy recorded GDP growth of 1.4 per cent when compared with 2004. For the first six months of 2005 the economy achieved an equal level of output as was reached during the corresponding six months of the previous year. At the end of June, growth forecasts was for 2.6 per cent for the second half of the year with positive projections for all sectors except agriculture¹ for which a decline of approximately 3.4 per cent was expected. The projections for the latter half of the year were predicated on: 1. Substantial recovery of production losses which had resulted from the passage of Hurricane Ivan in September 2004; and 2. Full resumption of petroleum refining activities following disruptions in production beginning in October 2004.

Subsequently, the resilience of the productive sector was tested by Hurricanes Dennis and Emily which affected the island during July. Approximately \$5 012.0 million in direct losses and \$610.3 million in indirect costs were incurred by the productive sector because of these two events. However, the economy remained relatively buoyant during the post - hurricane period. Actual GDP growth for July – September 2005 was 3.4 per cent, surpassing earlier projections for 1.9 per cent growth. All sectors grew including Agriculture which increased by approximately 1.6 per cent.

Hurricane Wilma which occurred in October 2005 caused direct damage to the Agriculture and the Transport, Storage & Telecommunications sectors estimated at approximately \$248.8 million, mainly in agriculture.

Economic Performance – January to September

Due to the relatively strong growth performance during the third quarter of 2005², estimates of real growth in Gross Domestic Product (GDP) for the calendar year to

¹ The Agriculture sector, particularly the export sub- sector, which is comprised mainly of bananas and coffee, recover from Hurricane damage at a slower pace than other sectors of the economy.

² July – September, 2005

September, was 1.1 per cent when compared with the corresponding nine months of 2004 (see Table 1). The Goods Producing Sector grew by 0.9 per cent while the Services Sectors grew overall by 1.0 per cent. Other indicators of the economy's performance during the nine month period included:

- inflation of 11.8 per cent compared with 6.9 per cent for the similar period of 2004;
- reduction in interest rates with the average lending rate at 22.0 per cent at the end of September 2005 down from 24.89 per cent at the end of December 2004;
- relative stability in the foreign exchange rate ending September 2005 at J\$62.56 to US\$1.00 from \$61.97 at end of September 2004;
- high levels of Net International Reserves (NIR) at US\$2 118.97 million at the end of September 2005.

These achievements also occurred within the context of weather and non-weather related external and domestic shocks, which affected the economy. Increases in oil prices were the main external shocks. Domestic influences included drought during the first three months of the year followed by hurricanes in July which resulted in heavy rains and flooding (devastating flood rains) in many parts of the island. These had a dampening effect on output growth, particularly on Tourism, Agriculture and Road Infrastructure. The fiscal balance was also negatively affected with a slow-down in revenue growth and an increase in expenditure particularly for infrastructure rehabilitation.

Although there was a slowing in the rate of growth overall, the economy continued to exhibit strong growth performance in specific areas of production. The strongest growth areas were: Construction & Installation, Mining and Quarrying, Electricity & Water, and Distributive Trade. Growth in the Construction & Installation sector reflected increased activities in non-residential construction. This was mainly related to public sector activities for hurricane reconstruction and the Northern Coastal Highway, and increased

private investment expenditure for hotel construction. The improvement in performance from the Mining and Quarrying sector reflected increased production of both crude bauxite (2.6 per cent) and alumina (5.7 per cent) and was facilitated by plant expansion and high levels of capacity utilization.

Table 1 YEAR ON YEAR CHANGE IN GROSS DOMESTIC PRODUCT IN PRODUCERS' VALUES, AT CONSTANT 1996 PRICES (PER CENT)							
	Jan- Mar 2005	Apr- Jun 2005	Jan- Jun 2005	Jul- Sept 2005	Jan- Sept 2005	Oct- Dec 2005	Jan- Dec 2005
GOODS PRODUCING SECTORS	-3.2	-0.7	-2.0	7.4	0.9	1.1	1.0
Agriculture, Forestry & Fishing	-25.7	-17.5	-21.9	1.6	-15.6	28.0	-7.2
Mining & Quarrying	1.3	0.8	1.1	16.6	5.7	-3.3	3.4
Manufacturing	-4.3	-0.1	-2.2	3.8	-0.3	-4.4	-1.3
<i>of which: Food, Beverages & Tobacco</i>	-2.7	0.7	-1.0	-1.3	-1.1	-10.4	-3.1
<i>Other Manufacturing</i>	-6.3	-1.1	-3.8	9.6	0.6	2.0	1.0
Construction & Installation	12.1	8.5	10.4	10.2	10.3	-0.6	7.3
SERVICES SECTORS	1.8	0.2	1.0	0.9	1.0	2.7	1.4
Electricity & Water	0.4	1.7	1.1	10.2	4.0	4.5	4.1
Transport, Storage & Communication	2.5	-0.6	0.9	0.4	0.7	2.7	1.2
Distributive Trade	1.8	1.2	1.5	0.7	1.2	0.9	1.1
Finance & Insurance Services	-0.4	-0.7	-0.5	0.2	-0.3	2.5	0.4
Real Estate & Business Services	1.6	2.3	2.0	2.1	2.0	1.8	1.9
Producers of Government Services	-0.2	-0.7	-0.5	1.0	0.0	1.1	0.3
Miscellaneous Services (incl. Household & Private Non-Profit Institutions)	5.6	-0.7	2.5	-2.3	0.9	9.7	3.0
of which: Hotels, Restaurants & Clubs	6.5	-1.7	2.4	-4.3	0.3	12.8	3.1
Less Imputed Bank Service Charge	2.0	-0.8	0.6	-3.3	-0.7	-2.7	-1.2
TOTAL GDP AT CONSTANT PRICES	0.0	0.0	0.0	3.4	1.1	2.6	1.4
Source: Statistical Institute of Jamaica							

Economic Performance – January to December 2005

For Calendar year 2005, the Jamaican economy recorded GDP growth of 1.4 per cent when compared with 2004 (Table 1). Growth in real GDP for the **Mining and Quarrying** Sector was estimated at 3.4 per cent, reflecting larger output of both Alumina (1.6 per cent) and Crude Bauxite (21.4 per cent). The sector's output was flat (up 0.5 per cent) during the first six months of the year compared with the corresponding period of 2004. This was due to the adverse effects of heavy rainfall and labour disputes on crude bauxite production which offset increases in alumina production.

For the second half of the year, growth was estimated at approximately 5.9 per cent. The improved performance was more as a result the 16.6 per cent increase in real GDP during July – September following normalization of production activities to pre - Hurricane Ivan state. During October – December output fell by 3.3 per cent mainly because of heavy rains during the passage of Hurricane Wilma in October and technical problems at the JAMALCO refinery. At the end of 2005, production capacity in the alumina industry increased to 4 397.8 kilo tonnes from 4199.08 kilo tonnes at the end of 2004.

During calendar year 2005 the **Manufacturing** sector declined by an estimated 1.3 per cent. Within the Food, Beverages & Tobacco sub-category, lower production levels were recorded for Sugar, Molasses, Alcohol, Carbonated Beverages and Cigarettes. Other Manufacturing grew by 1.0 per cent.

In the **Construction & Installation** industry, real GDP grew by 7.3 per cent. This level of growth was driven mainly by: 1) new residential construction; 2) non – residential construction particularly new hotels and road works; and 3) post – hurricane rehabilitation efforts such as emergency repairs to buildings, road clearing and reconstruction.

In the area of services, the **Hotels Restaurants and Clubs** GDP grew by 3.1 per cent. Visitor arrivals increased by 4.0 per cent to 2 614 506 owing to increases in both stopover

arrivals (4.5 per cent) and cruise passenger arrivals (3.3 per cent). Consistent with the growth in passenger arrivals, visitor expenditure increased by 12.3 per cent to US\$1 587.0 million.

Services provided by the **Electricity and Water sub-sector** increased by 4.1 per cent, relative to 2004. Electricity generation was 4.3 per cent higher, while water production rose by 4.2 per cent. GDP for the **Transport, Storage & Communication** sub-sector increased by approximately 1.2 per cent, owing to, higher volumes of cargo and passenger movements at the sea and air ports. During the first half of the year, the sector grew marginally by 0.9 per cent. For July – December, growth was estimated at 1.5 per cent and was influenced by tourism activity and the volume of Total Bauxite exported which were particularly strong in the last three months of the year.

GDP growth for the **Finance and Insurance Services** sector grew marginally by 0.9 per cent as performance was tempered by a reduction in income earnings by financial institutions. The performance was influenced by relatively lower interest rates on fixed income securities and higher operational costs. **Distribution** services also grew by 1.4 per cent reflecting mainly construction and tourism activities.

Direct Effect of Hurricane Wilma on the Productive Sector

Hurricane Wilma which occurred during October 2005 by itself did not have a strong negative impact on the economic performance of the Jamaican economy. For October – December, the economy grew by 2.6 per cent³ compared with the corresponding period of 2004⁴. Agriculture grew by 28.0 per cent exhibiting recovery of the domestic crop sub - sector from the losses caused by the earlier hurricanes. Electricity generation and Water production were also returned to pre - Ivan levels during this period. However, output from the Mining & Quarrying, Manufacturing and Construction & Installation sectors declined by 3.3 per cent, 4.4 per cent and 0.6 per cent, respectively.

³ STATIN, 2005

⁴ Production during October – December 2004 was negatively affected by Hurricane Ivan which occurred in September

Agriculture and infrastructure were the two areas for which damage specific to Hurricane Wilma could be isolated and costed by public ministries and agencies and private sector companies. Direct damage to infrastructure such as damaged drains and gullies blocked by debris which contributed to flooding constituted the damage incurred. The costs estimates are based on costs to undertake reconstruction and repairs to retaining walls, restoration of water supply systems, repairs to drains and gullies and the restoration of roads.

Agriculture and Fisheries

The Agriculture, Forestry & Fisheries sector was one of the few productive sectors for which direct damage was assessed after the passage of Hurricane Wilma, primarily flood and wind damage. Approximately 19 973 farmers were affected.

Cost estimates of damage to the sector totalled approximately \$248 755.0 million. Losses to the Domestic Crop sub-sector were \$206 401 million, encompassing 1 655 hectares comprised mainly of vegetables, condiments, fruits, ground provision, and pulses (Table 2).

Table 2 Estimates of Direct Losses to the Domestic Crops Sub-sector caused by Hurricane Wilma		
Crops	Hectare	Value \$
Pulses	224	14 336 000
Vegetables	784	96 774 000
Condiments	292	40 822 000
Cereals	29	2 810 000
Fruits	129	20 630 000
Ground Provisions	141	23 724 000
Plantain	24	3 135 000
Banana	9	805 000
Others	23	3 365 000
Total	1 655	206 401 000
Farmers	18 179	

Source: Rural Agriculture Development Authority, December 2005

All parishes except Kingston were impacted. St Elizabeth (\$54.1 million), Clarendon (\$42.8 million), Manchester (\$23.6 million), St. Catherine (\$20.5 million) and St. Ann (\$14.2 million) were the worst affected.

In the Livestock sub-sector, farmers incurred approximately \$42.4 million in losses to animal stock (Table 3). Farmers in Clarendon (\$26.7 million), St. Catherine (\$7.3 million) and Hanover (\$3.0 million) experienced the highest level of losses.

Table 3 Estimates of Direct Losses to the Livestock Sub-Sector caused by Hurricane Wilma		
Type of Livestock	Number of Animals	Value \$
Broilers	164 200	25 236 000
Layers	1 500	390 000
Goats	1 761	8 278 000
Cattle	134	1 810 000
Pigs	805	2 780 000
Fish	55 000	1 650 000
Sheep	60	180 000
Others		2 030 000
Total		42 354 000
Number of Farmers	1 794	

Source: Rural Agriculture Development Authority, December 2005

Mining and Quarrying

During October – December output from the Mining and Quarrying sector declined by 4.2 per cent. This was mainly because of heavy rains during the passage of Hurricane Wilma in October and associated technical problems at the JAMALCO refinery.

Telecommunications

Cable and Wireless Jamaica, Limited reported that approximately \$30.0 million in direct damage was incurred during the passage of Hurricane Wilma, mainly occurring in the parishes of St. Andrew (\$13.0 million), Kingston (\$10.6 million), St. Thomas (\$2.7 million), St. Catherine (\$1.5 million) and St. James (\$839 000). Roughly \$1.3 million was incurred by the company in locations across St Elizabeth, Portland and Westmoreland. No direct damage was incurred by the other telecommunications companies.

Other Infrastructure

Direct damage to infrastructure (excluding telecommunications) estimated at \$3.34 billion was caused by Hurricane Wilma. Of this amount, the Ministry of Local Government, Community Development and Sport reported approximately \$3.2 billion in direct damage to Parochial roads and bridges infrastructure across all parishes. Road damage included the erosion of critical roads, collapsed retaining walls, blocked drains and landslides which resulted in major disruptions to important transportation links in all parishes. Approximately \$112.1 million⁵ (Table 4) was for damage to other infrastructure including water (\$47.4 million) and housing (\$36.0 million).

Table 4 Estimates of Damage to Infrastructure	
Company/Organization	Value \$ Million
Cable and Wireless	30.0
National Water Commission	47.4
National Irrigation Commission Limited	17.4
National Housing Development Corporation	36.0
National Solid Waste Management	11.3
Ministry of Local Government, Community Development and Sport	3 199.0
Total	3 341.1

Source: PIOJ Survey

⁵ This figure excludes damage estimates for telecommunications

4. IMPACT ON THE ENVIRONMENT

Overview

Hurricanes release heat energy at a rate of 50 trillion to 200 trillion, which is equivalent to energy exploding 10 megaton bombs every 20 minutes. With this strength these natural events have large disruptive impacts on the environment. Vulnerability and risks associated with hurricanes are related to three broad factors: vulnerable locations and population pressures; poverty and affluence; and environmental degradation. Large numbers of people live in the areas that are increasingly vulnerable. However, generally, the poor live in the most marginal locations in disaster prone areas such as riverbanks, unstable hillsides, deforested lands, or fragile water catchments.

Hurricane Wilma passed slowly south of Jamaica as a strong tropical wave and then transformed into a tropical depression south west of Negril, Westmoreland. The huge outer rain bands of the storm resulted in intense rainfall over the entire island but especially in parishes on the south coast.

The Integrated Watersheds & Coastal Zone Management Branch (IWCMB) of the National Environment and Planning Agency (NEPA) reported that based on the environmental assessment the major effects of Hurricane Wilma on the environment were:

- Landslides in several upland areas due to over-saturation of the soil and continued deforestation on hillside areas.
- Flooding of many coastal communities on the southern coast. Communities in valleys and near waterways were also deluged with water, debris and silt.
- Significant siltation of rivers and streams and as a consequence, the coastal zone. It was likely that the rivers would return to normal without any major damage to the riverine ecosystems. The greatest effects of siltation are usually felt within the coastal zone and included significant beach erosion in some sections of the south coast; extensive solid waste pollution of coastal areas and increased algal plumes and sunken roadways restricting the commuting of several communities.

Pre-Existing Environmental Conditions

The environmental impacts of Hurricane Wilma must be understood in the context of the pre-existing environmental conditions. Beginning in May, 2005 the island was experiencing above normal and intense rainfall. This resulted in saturation of the soil and aquifers and served to exacerbate the impact of the hurricane and the associated hazards of flooding, landslides, and debris flows. The island's geology, topography and drainage patterns have also influenced the effects of Hurricane Wilma. In addition, the following characteristics should be noted:

- Jamaica's population is largely concentrated in the coastal areas that are vulnerable to storm surges and flooding. Many persons occupy highly vulnerable locations such as riverbanks, unstable hillsides, deforested lands, or fragile water catchments.

- Jamaica's continental shelf is most extensive on the south coast and the floor (bathymetry) of coastal waters is characterized by shoals, "fishing banks", cays, patch reefs, and seagrass beds. Several large rivers drain sediment-laden runoff to the coastal waters along the eastern, central and western sections of the coast, and extensive floodplains coalesce from Kingston through St Catherine and Clarendon. Distinctive coastal landforms and ecosystems in the coastal areas include the Palisadoes peninsula, the Portland Bight peninsula, embayments, and sandy and shingle beaches.
- Much of Jamaica's agricultural production takes place upon steep hillsides in the interior of the island. These areas are characterized by steep well-weathered slopes, highly fractured geological formations and well-developed networks of rivers and gullies draining north and south from a central east-west trending rugged mountainous axis. As such, erosion and landslides are serious problems affecting the agricultural sector.
- Solution depressions are characteristic of Jamaica's limestone topography; they accommodate extensive farming activities and interior settlements. They are drained through sinkholes and become inundated when floodwaters exceed the capacity for drainage.
- In Jamaica, poor watershed management leads to soil erosion and increases flooding. Surface, ground and coastal water are degraded by poor waste water management and agricultural run-off.

Impact of the Hurricane

Estimates of damage and losses to the environment are still being calculated. Damages were mainly flooding, landslides, beach erosion, sedimentation of waterways and coastal areas, solid waste pollution and sectional destruction of roads.

a) Coastal Areas:

While significant flooding had been reported at Nine & Ten Miles in St. Thomas it was not as intense as during Hurricane Dennis based on preliminary assessments. Hurricane Dennis destroyed a huge section of the gabion structures that reduce the impacts of flooding on these communities. These gabion structures were repaired after the hurricane and this contributed to the reduced flooding experienced during Hurricane Wilma. Also the build up of debris and silt was reduced due primarily to the clearing of proximal gullies and rivers by the relevant authorities. Heavy siltation was characteristic of the main drainage within these areas as seen in Figures 1 and 2 below.



Figure 1: Cane River (view upstream)



Figure 2: Ten Miles (view upstream)

The Yallahs Fording was washed away by the heavy rains and the high velocity flow of the water deposited significant amounts of silt in the marine environment. Prior scientific dive assessments conducted in this area revealed that coral cover was poor due to extensive algal growth and sedimentation. A huge deposition of solid waste was also observed.



Figure 3: Ten Miles (view down stream of the Bridontom Gully)

The Bridontom Gully channel (Figure 3) was visibly being widened and the subsequent rise in the water velocity forced the flow to the west bank of the gully. The widening of the gully could potentially expose the adjacent community to increased risk of flooding. The increased surface area and velocity of the water produced a noticeable wider area of reddish-brown algal plume at the exit point in the immediate coastal area. The algal plume is not only unsightly but is also detrimental to marine life including coral reefs, seagrass beds and fishes. An increase in algal growth correlates to the presence of excess nutrients in the water. The diverted water flow could increase the potential for erosion of sand banks as the water body tries to reclaim its natural course.

Flooding in Portland Cottage and Rocky Point in Clarendon were not as intense and devastating as during Hurricane Ivan in 2004. Flooding in St. Elizabeth was also significant. The Great Bay community was isolated for several days as a result of the access roads being deluged with debris and water. Boats had to be used to take people across the flooded roadways.

The effect of Hurricane Wilma was particularly devastating for the tourist resort area of Negril, Westmoreland. Strong waves pounded the seven miles beach causing significant beach erosion (Figure 4). Prior to Wilma, Negril was already suffering from massive beach erosion



Figure 4: Beach erosion in Negril.

The beach area was also flooded with copious quantities of sea weed (Figure 5). This is a common occurrence after a storm surge or high wave action. To add to the problem, tourist property owners usually use bull dozers to remove the sea weed and as a consequence usually take away significant amounts of sand. This leads to further beach erosion or recession. There was also heavy sedimentation of the coastal zone as a result of runoffs from upland areas.



Figure 5: Deposition of seaweed on Long Bay Beach, Negril

Inland Areas:

The inland areas of St. Andrew and St. Catherine were significantly affected by Hurricane Wilma. It was apparent that geographical areas affected during Hurricane Dennis were not addressed which worsened the situation as a result of Wilma. The main road which connects the Mount Industry community to the Hyde Mountain area suffered massive damages (Figure 6); which made it impossible for the passage of motor vehicles. As a result of the sunken road the residents are now experiencing great difficulties in commuting. They now have to use the alternative route through the hillside which is dangerous and long.



Figure 6: Road cut along the access road from Mt. Industry to Hyde Mountain

Considerable damages to roads and land slippage was common in the Glengoffe region, in St. Catherine (Figure 7).

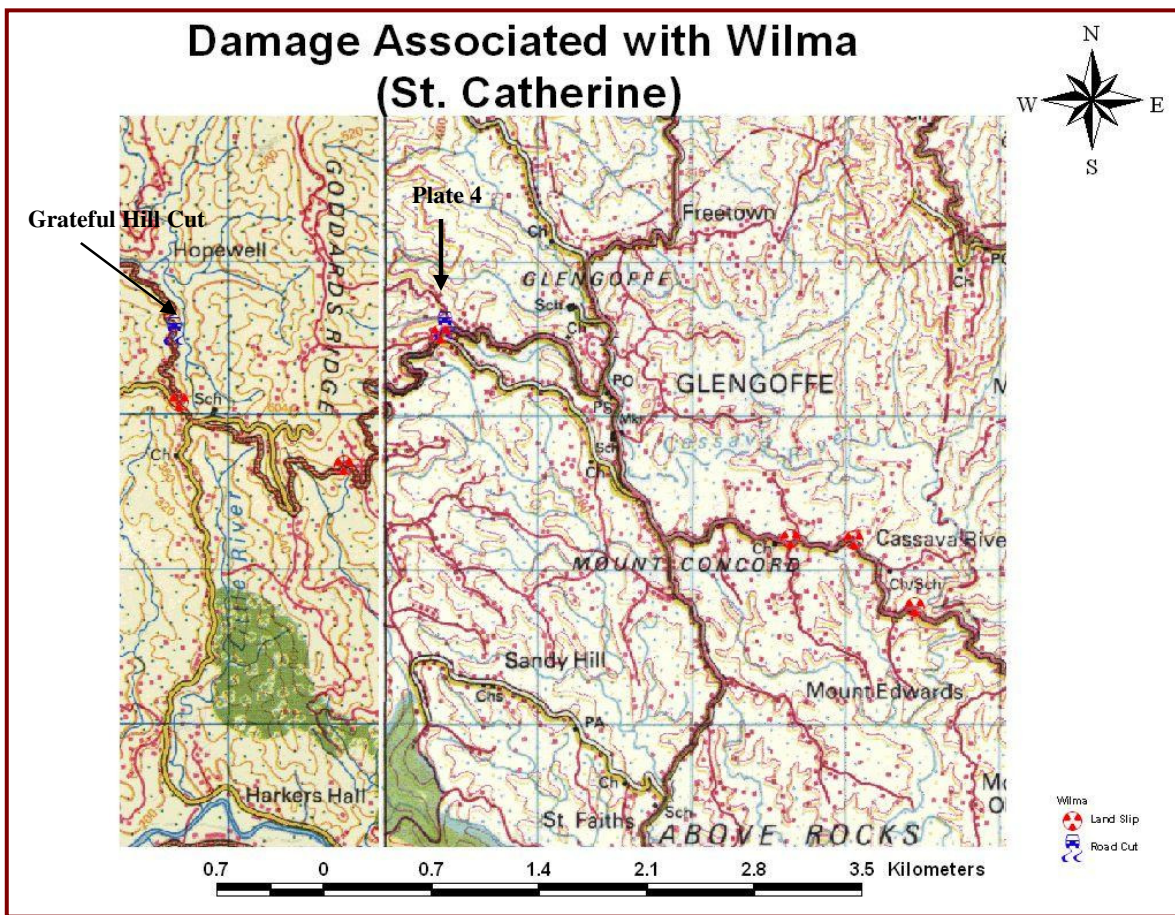


Figure 7: Location of Damage in the Glengoffe Region

The roadway at Grateful Hill in the Hopewell area of St. Catherine suffered extensive damage caused by an overflowing gully which eroded the fill around the culvert (Figure 8). This resulted in the collapse of the road. The fill seemed to lack compaction and the predominant material was soil, which meant that once the water started to flow around the pipe which may have been blocked with debris, erosion was inevitable. Only motor bikes and pedestrians can now use this road.

Other sections of St. Catherine were also inundated. Several sections of Old Harbour were immersed in water, especially the Church Pen and Nightingale Grove communities. Communities in the Big Pond area were also marooned and threatened by the overflow of the Big Pond. This pond consistently overflows after persistent heavy rainfall. Boats were utilized in transporting people across the pond. The Free Town main road leading from Old Harbour to Mineral Heights, Clarendon was also impassable due to flooding.

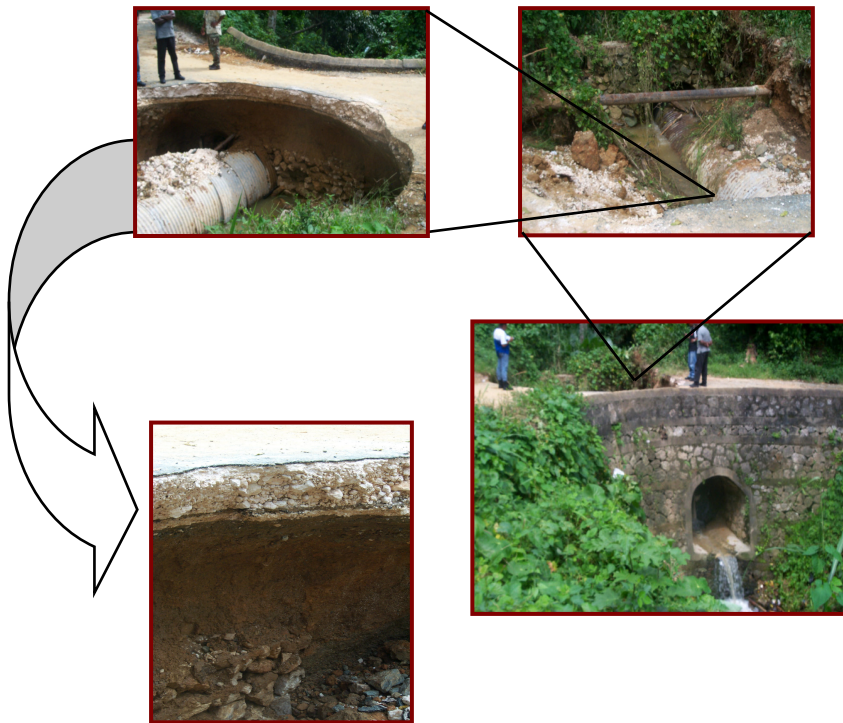


Figure 8: Extensive damage to road at Grateful Hill

Several communities in Clarendon also suffered extensive flooding. The Kennedy Grove community, in particular, which was badly flooded as a result of Hurricanes Dennis and Emily, was swamped by heavy rains from Hurricane Wilma. Several roads were also significantly damaged. Surface run off was notably slow due to the over-saturation of the aquifers. In some areas along the main road leading to Williamsfield water could still be seen gushing from upland areas. In Trelawny many areas within the Rio Bueno/ White River Watershed Management Unit were also affected by the hurricane. Figure 9 captures the degree of flooding in the Rio Bueno area.



Figure 9: Flooded area in Rio Bueno

Sections of the Swamp/Riverhead community and the main Road from this area to Moneague were flooded (Figure 10).



Figure 10: Flooded main road in the Riverhead community

Residents used rafts to cross the flooded roadways (Figure 11)



Figure 11: Residents making raft to cross flooded area in Riverhead

Other areas within the parishes were also badly flooded. Many communities in Trelawny were marooned.

Forestry:

The Forestry Department of the Ministry of Agriculture reported that damage to forests were minimal. Some trees were lost as a result of landslides.

Conclusion:

The main impacts of Hurricane Wilma on the environment were landslides, excessive flooding, significant siltation of water ways and consequently, the coastal zone, nutrient and solid waste pollution and massive beach erosion in several sections of the island. The continued denudation of hillsides increases the risk of landslides and siltation of waterways which subsequently. This has resulted in extensive sedimentation in the marine environment which stifles and eventually kills marine life. Excessive nutrient pollution (eutrophication) in the marine environment rapidly increases algal growth which stifles and kills coral reefs and seagrass beds. Coral reefs are important in protecting coastlines by reducing wave action, supplying material to make sand and providing habitats and food for many marine organisms including fish. Significant beach erosion and decline in fish species have resulted due to the degradation of this ecosystem. Effective environmental management, therefore, must be a national priority in light of the forecasted increase in natural disasters.