

# The United Nation's Cooperation to Transboundary River Basins and Island States in Case of Natural Disaster

Fátima Moreno Merlo

Center for Development Studies, Central University of Venezuela, Caracas, Venezuela

**Email address:**

morenomerlo@gmail.com

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**Abstract:** The United Nation's cooperation in case of natural disasters could be stronger and therefore effectiveness if it is organized according to the resilience levels develop by the countries around the world. Moreover governments should include in their development plans actions to become more resilient their territories to those frequently strong natural events [1], trying through international treaties under United Nations support make an integral management of their boundary river basin, including all the actors and their social and economical characteristics [2], in case of riparian countries. While to those island states which are located in specifics parts of one sea or ocean they could work together in order to be protected from common natural disasters.

**Keywords:** Cooperation, Natural Disaster, Planning, Vulnerability, Resilience

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## 1. Introduction

The United Nations has showed concern about the increasing number of casualties caused by natural disasters worldwide. In its different documents has recommended to the governments to include in their national development plans special programs to address how to deal with frequent strong natural phenomena.

Which was highlighted at the World Conference on Disaster Reduction held in Japan in 2006, whose second goal was to: Identify specific activities aimed at ensuring compliance with the relevant provisions of the Plan of Implementation of the World Summit on Sustainable Development on vulnerability, risk assessment and management of disaster activities. [3]

The work of the United Nations in case of natural disasters can be more effective if it identifies vulnerable nations frequently affected with natural phenomena and provides assistance for the development and implementation of effective response plans to increase their resilience to disasters.

This paper is based on the Guidelines for Natural Disaster Prevention, Preparedness and Disaster Mitigation, presented at the World Conference on Disaster Reduction, 1994, specially these recommendations:

*K. Enhancing the activities of the organizations and programs of the United Nations,..., related to disaster reduction and cooperation between them, (...). [4]*

*M. Give wider support mechanisms for disaster management and reduction of the United Nations system to enhance its capacity to provide advice and practical assistance, as needed, to countries facing natural disasters (...). [4]*

At the same Conference the "Strategy for 2000 and Beyond" was formulated setting out the need to promote regional cooperation between countries exposed to the same risk through joint activities for disaster reduction, strengthening the capacity of the United Nation system and thus helping to reduce the loss of lives. [4]

According to studies by the World Meteorological Organization (WMO), approximately 90 % of the disasters caused by natural events, between 1995 and 2004, were related to climate and water. Places such as island nations are frequently affected by natural events, which was one reason why island nations were part of the 1994 Global Conference on the Sustainable Development of Small Island States in Development, signed the Declaration of Barbados. [5]

The document entitled Mapping WOM and NMHSs' Roles

and Mandates on Hyogo Framework for Action 2005 – 2015 Key Activities, prepared by WMO in 2006, highlighted the need to strengthen disaster prevention and early warning systems in the island nations and in transboundary river basins. [6]

Between 1950 and 2005 more than 6 million people died in natural disasters registered in transboundary river basins and island nations, according to the Center for Research on the Epidemiology of Disaster (CRED) database. [7]

Based on the WMO's recommendation [6] and because of the reality exhibited by CRED [7], it was considered relevant to identify vulnerable areas to disasters caused by natural events, using as a spatial reference frame transboundary river basins and island nations.

In that way, there could be select measures to reduce the incidence of certain events, through management plans for transboundary river basins, and mitigate the effects if it occurs.

According to the 1994 Yokohama World Conference on Disaster Reduction the United Nations system is called to help developing countries in their special plans for disaster prevention as a part of strategies for the XXI Century through regional promotion cooperation among riparian countries of river basins and island states exposed to the same natural hazards. [4]

In order to make those nations more resilient as Yokohama documents said, the author has develop some guidelines which can be follow by United Nations to improve its cooperation where natural disasters have no political borders, through joint countries with regional cooperation to advance disaster prevention and mitigation.

Amount the activities, in a global scale that were done through this investigation have been to identify some guideline to be suggested to the United Nation's to help to make their work easier and could became countries more resilient to natural disaster, through two methodologies.

The first one was development to identify those human characteristics that could become hard to make an international treaty, because the differences among riparian population are many. [8]

The other methodology was used to organized the transboundary river basin and island stated by continent according to the frequency of the natural events occurs and number of fatality to determinate the vulnerability of the countries using just number of victims to be easier comparison and not event's magnitude or economical lost. [8]

The guideline are based in the follow principles

1. The identification of nations vulnerable to natural events, which could cause disasters, is an essential requirement to facilitate the cooperation of United Nations. [8, 9]
2. The management plans for transboundary river basins are necessary to identify measures to mitigate the impact of natural events. [8, 9]
3. Popular participation in disaster prevention and mitigations could help achieve greater resilience on

human settlements. [8, 9]

4. Human beings need to be educated to face the natural event they are exposed to, having real-time information to take those necessary decisions. [8, 9]
5. The respect and recognition of cultural differences is the essential rule for effective cooperation. [8, 9]
6. The preservation of human beings must overcome differences between people interacting in transboundary river basins. [8, 9]
7. It's necessary international cooperation to help make places become more resilient to natural disasters, through the performance of multilateral mechanisms. [8, 9]

## 2. Methodology to Measure the Difficulty of Implementing International Cooperation

The degree of difficulty faced through an international treaty supported by United Nation or any other multilateral mechanism that involved people from different countries riparian of the transboundary river basin, could be measured taking into account their political differences, religious belief, rights culture, development index, and other, all of them will be described in the following paragraphs. [8]

### 2.1. Variables

In order to estimate the level of difficulty to provide help, it was taken into consideration the number of countries that share each transboundary river basin and the island territories as coastal areas of the ocean basin were their discharge their water, number of inhabitants, number of majority religious practices, number of languages used by the inhabitants of the basin to communicate, the estimate average political stability of the countries riparian of the bordering river basin using the Marshall and Cole index, the average Human Development Index (HDI) of the costal countries of the basin, and the average related Gender Development Index (GDI). [8]

Each transboundary river basin and island state were considered as a unit in a fraction while the denominator were formed for the selected variables that characterize those human groups and could be hard to be part of an international treaty. The selected variables that helped to measure the level of the difficulty are mentioned right after. [8]

#### 2.1.1. Number of Countries Sharing the Basin

The number of riparian countries connected through the basin, according to the base data of Oregon University [9], will influence the ability of the United Nation or other multilateral mechanics achieve and maintain the cooperation needed.

#### 2.1.2. Population Within the Basin

The number of people living in the river basin, according to waterwiki.net [10] or island state was used to determinate the priority degree to develop an international cooperation

treaty, according to their vulnerability estimated with the other methodology.

### 2.1.3. Languages and Dialects

The number of languages and dialects, consulted in the Ullmann Geographic Atlas [11] is presented as another factor of difficulty to provide cooperation needed to select the language used by the majority of the population in the catchment area and the island nation and to facilitate their participation in the implementation of plans. To estimate this parameter was set as the denominator the number of languages and dialects used by the inhabitants of the basin to communicate, the numerator being the unit referred to as in the previous cases the hydrological unit.

### 2.1.4. Political Stability, Bases on the Index of Global Report on Conflict, Governance and State Fragility 2008<sup>1</sup>

Political stability, based on the results of the Global Report on Conflict of Governance of the year 2008, by Monty G. Marshall and Benjamin R. Cole from the George Mason University [12], let to know which political situations can facilitate the implementation of aid or limit the possibilities of providing cooperation to the nations with internal conflicts or with other nations. This index was employed to estimate the average across the values presented by Marshall and Cole, being that the average used as the denominator to each transboundary river basin, according to the index reach for their riparian countries.

### 2.1.5. Human Development Index (HDI)

The different levels of development present in every nation could be a difficult for some international treaty which main issue is an integrated management of a transboundary river basin, specially is countries located in the higher place of the basin have plans to develop any structure linked with water use. To know how the differences in the levels of development could became a difficult for the cooperation was calculated the HDI [13] average for each transboundary river basin and at the same time this indicator tells us how much the citizen of each country have their basic needs satisfied.

### 2.1.6. Gender Related Development Index (GRDI)

The GRDI as an indicator of participation of women [13] in all areas of development have a significant interest, considering the limitation of engagement by cultural and religious reason, among others, in some social groups. However, aware of the influence of women in shaping the behavior of human beings, in the first year of life and participation in society, it was considered appropriated to work with GRDI, using the average of this index among the riparian countries of the transbounday river basin and island states.

### 2.1.7. Religious Practices

The incompatibility of the religions practiced by the inhabitants of the watershed may also hinder the implementation of a management plan aimed at reducing the impacts of natural events, given the low participation of women in some cultures attending religious dogmas and specific dietary requirements, dress requirements, among others. That is why we measured the number of religions [11] practiced by the riparian countries of the transboundary river basin.

## 2.2. Qualification of the Difficulty

The level of difficulty to develop one way of cooperation in case of natural disaster to the riparian countries of the transboundary river basins and island states was determined through results obtained from the variables mentioned [8]. A sample its show in the table 1, to be clear with this methodology, taken to do it the transboundary river Parana basin:

**Table 1.** Level of difficult for the international cooperation in the transboundary Parana River.

Population	Riparian Countries	Kind of government	Religions
22.000.000	Argentina	Federal Republic with 2 legislative body	Catholics, Protestants and Jewish
	Brazil	Federal Republic with 2 legislative body	Catholics and Protestants
	Paraguay	Republic with 2 legislative body	Catholics and Protestants

**Table 1. Continued.**

Population	Riparian Countries	Languages	Political Stability	HDI	GRDI
22.000.000	Argentina	Spanish, English, France, German, Italian	2	0,863	0,854
	Brazil	Portuguese, Indian languages	5	0,792	0,786
	Paraguay	Spanish, Guarani	8	0,755	0,742

Source: Moreno Merlo F. 2012

Number of countries riparian the basin	1/3 = 0,33
Languages and dialects	1/8 = 0,125
Political Stability	$2+5+8 / 3 = 5$
HDI	$0,863+0,792+0,755 / 3 = 0,803$
GRDI	$0,854+0,786+0,742 / 3 = 0,794$
Religious practices	$1 / 3 = 0,33$
Level of difficult	$0,33+0,125+0,2+0,803+0,794+0,33 = 2,582$

In Parana river basin, use as sample to estimate the level of difficult to take cooperation, the result is: 2,582 and according to the table 2, it has a high difficult to apply a successful treaty due to differences amount language, political stability, HDI and GRDI.

<sup>1</sup> In these case was used the information *state fragility index 2007* from the table 1 state fragility index and matrix 2008 from page 14 to page 17. Available in <http://www.systemicpeace.org/Global%20Report%202008.pdf>

**Table 2.** Ranks to determinate the levels of viability of international cooperation in transboundary basin.

Rate	Qualification	Difficulty
0.00 - 1.75	Little or no chance to implement preventive measures to reduce the impact of natural events of significant magnitude, through a watershed management. Cooperation can only be carried through accompanying measures.	Very high
1.76 - 3.51	Reduced probabilities to implement measures to reduce the impact of natural extreme events.	High
3.52 - 5.27	There is a chance of implementing a watershed management with measures to reduce the impact of natural events with highly intensive.	Moderate
5.28 and more	High probability to implement a management plan for the hydrological unit, with measures to reduce the impact of natural events from catastrophic magnitude to low.	Low

Source: Moreno Merlo F. 2012

### 3. Methodology to Identify Vulnerable Areas to Natural Disasters

Most of the country are able to get a register of fatal victims number after and natural strong events, but just a few have economical information, know as much their main infrastructure were affected and other. Moreover, government asks for help to the international community if they are

unable to attend the emergence.

According to the reason mentioned, to establish one way to identify transboundary river basin and island estates more vulnerable or less resilience [8], as we want to call, matrices were organized by continent with the transboundary river basin and island states with the number of fatalities registered since 1950 to 2005 classify by natural events. Using the methodology present before a sample is showed in the table 3 with the same transboundary river basin, Paraná.

**Table 3.** Intensity on natural disasters adds up to the number of fatalities in the transboundary basin of Parana River.

Date	Country	Earthquake	Tsunami	Volcanic eruption	Dry mass movement	Flood	Storm	Wet mass movement	Drought	Extreme temperature	Fatalities
1966 Feb	Argentina					1,5					62
1967 Oct						1,5					56
1972 Jan										1	1000
1975 Jul										1	70
1979 Jun	Brazil					2					300
1983 Jun						1,5					68
1983 May						1,5					75
1984 Dec						2					200
1987 Jun						1,5					95
1983 Feb						1,5					76
1998 Apr						1,5					55

Source: Moreno Merlo F 2012. Made with data from the Centre for Research on the Epidemiology of Disasters (CRED) and Munich Reinsurance Company (Munich Re) (2009).

#### 3.1. Natural Events Intensity

The intensity of the natural events that caused disaster was established according to some scale systems as are described in the next paragraphs.

##### 3.1.1. Drought and Flood

A scale was developed to measure the intensity of drought and flood through quantity and qualify, according to the table 4. [8]

**Table 4.** Intensity of the drought and flood measured according to the number of fatalities.

Qualification	Fatalities	Weight
Low	50	1
Low to moderate	51 – 150	1,5
Moderate	151 – 300	2
Moderate to medium	301 – 600	2,5
Medium	601 – 1.200	3
Medium to intense	1.201 – 2000	3,5
Intense	2.001 – 5.000	4
Severe	More than 5.000	5

Source: Moreno Merlo F. 2012

The vulnerability to those events was estimates divide the addition the number of time that the events appear during the study period and these results were multiply by the intensity

average [8]. The vulnerability qualification was done according to the parameter showing in the table 5.

**Table 5.** Vulnerability to the drought and flood according to the intensity measured with the number of fatalities.

Qualification	Intensity
No vulnerable	0
Low	0,01 - 0,1
Medium	0,2 - 0,9
High	1,0 - 2,0 y
To high	2,1 - ≤

Source: Moreno Merlo F. 2012

**3.1.2. Vulnerability to the Seismic Movements**

The vulnerability to the seismic movements was estimated divide the frequency of seismic with fatalities equal or more than 50 in 55 year and multiply the result by the average of the intensity in the Richter scale [8]. The result was organized according to the table 6.

**Table 6.** Vulnerability to the seismic movements according to the intensity measured with the number of fatalities.

Qualification	Intensity
No vulnerable	0
Low	0,1 - 0,7
Medium	0,8 - 1,4
High	1,5 - 2,1
To high	2,2 - ≤

Source: Moreno Merlo F. 2012

**3.1.3. Vulnerability to the Tsunami, Volcanic Eruption, Mass Movements and Extreme Temperatures**

The tsunami vulnerability and the volcanic eruption were estimated depending to the frequency of those events during the study period where at least 50 people die [8]. The level of vulnerability was qualified according to the table 7.

**Table 7.** Vulnerability to the tsunami, volcanic eruption, mass movements and extreme temperature measured according to the number of fatalities.

Qualification	Frequency in 55 year
No vulnerable	0
Low	1
Media	2
High	3
To high	4 y more

Source: Moreno Merlo F. 2012

**3.1.4. Vulnerability to the Storm**

The vulnerability to the storm was calculated quantifying the number of times that these events are registered with at least 50 fatalities. The qualification was made according to the table 8 [8].

**Table 8.** Vulnerability to the storm according to the intensity measured with the number of fatalities.

Qualification	Frequency in 55 year
No vulnerable	0
Low	1 - 5
Medium	6 - 11
High	12 - 20
To high	21 - ≤

Source: Moreno Merlo F. 2012

**3.2. Code Suggested**

The code comprises capital letters to refer natural event, followed by a lower case letter, which indicates the degree of vulnerability of that event. Using a vulnerability apostrophe separates the degree of difficulty to implement cooperation identified in Roman numerals, followed by an anagram number, which indicates the variables that cause more difficulty to implement cooperation mechanisms. The identification of acronyms used in this code is described below. [8]

Natural events are identified with the following capital letters:

Geophysical events: Seismic movements -----(SM)  
 Tsunami -----(TS)  
 Volcanic eruption -----(VE)  
 Movements of dry mass -----(MDM)  
 Hydro meteorological Flood -----(F)  
 Storm -----(S)  
 Wet movements mass -----(WMM)  
 Drought -----(D)  
 Extreme temperatures -----(ET)  
 Vulnerability to natural event

Vulnerability to the natural event is identified with the following letters:

Not vulnerable ----- o  
 Low vulnerability ----- l  
 Moderate vulnerability ----- m  
 High vulnerability ----- h  
 Very high vulnerability ----- vh  
 Level of difficulty for the cooperation

The level of difficulty for establishing a cooperation mechanism was coded with the numbers listed below:

Low ----- I  
 Moderate ----- II  
 High ----- III  
 Very high ----- IV

The codes to identify the variables of difficulty attributed to cooperation is related to

Number of riparian countries ----- 1  
 System of Government ----- 2  
 Number of Languages ----- 3  
 Religion ----- 4  
 Political Stability ----- 5  
 Human Development Index ----- 6  
 Index of Development Gender Related ---- 7

The application of this coding system facilitates the simultaneous identification of the event, which is vulnerable to a particular geographical area, the degree of difficulty in implementing the required cooperation mechanism and to which human variable should have a greater attention.

Figure 1 shows the degree of difficulty in the implementation of a mechanism for cooperation within a multilateral and global framework. As well as, priority order to be provided to the United Nation for its cooperation plan in case of natural disaster, as illustrated in figure 2. [8]

## 4. Results of the Methodologies

The results from the methodology used to establish an

order of priorities for implementing cooperation mechanisms of the United Nations to transboundary river basins and islands are summarized in the following table 9. [8]

**Table 9.** Natural disaster vulnerability of transboundary river basin and island states in order of priority to be attended.

CONTINENT	RIVER BASIN / ISLAND NATION <sup>(1)</sup>	POPULATION <sup>(2)</sup>	CODE <sup>(3)</sup>	ORDER OF PRIORITY
Asia	Ganges – Brahmaputra - Meghna	581.000.000	SMm Fvh SvH WMMvh ETvh ' IV 1234567	1
Asia	Indonesia	242.000.000	SMh TSvh VEvh Fm SI WMMvh ' II 3567	2
America	American Pacific Coast		SMvh TSh VEI ' Fm SvH WMMvh ETI	3
America	Mississippi	70.500.000	FI SvH WMMvh ETvh ' II 4	4
America	Amazon	21.900.000	SMI Fm SI WMMvh ' III 1234567	5
Asia	Sea of China		SMI Fh SvH WMMvh ' III 345	6
Asia	Philippines	87.857.000	SMm VEm MDMI Fm SvH WMMvh ' II 5	7
Asia	Japan	127.417.000	SMI TSm Fm SvH WMMmavh ' I	8
Asia	Indo	219.000.000	SMI MDMI Fmvh WMMI ETvh ' III 1234567	9
Asia	Arab Sea		SMh Fh Sh WMMI ETvh ' III 34567	10
Asia	Mekong		SMI TSm Fh Sm WMMvh ' III 1234567	11
Europe	Danubio	78.800.000	SMI Fm WMMm ETmvh ' II 345	12
Europe	Rin	53.900.000	FI WMMI ETvh ' III 135	13
America	American Atlantic Coast		WMMvh	14
Europe	Volga / Mar Caspio	58.900.000	FI SI WMMm ' III 357	15
Asia	Tigris-Éufrates/Shatt al Arab	43.647.294	SMm WMMh ' III 12345	16
Asia	Aral Sea	43.300.000	SMI ' III 124567	17
Asia	Taipei	22.894.000	SMI Sh ' III	18
Europe	Vistula / Wista	21.900.000	SI ETH ' III 1357	19
Africa	Madagascar Island	18.040.00	Sh DI ' II 567	20
Europe	Oder / Odra	17.200.000	FI ETH ' II 35	21
Oceania	Papua New Guinea	5.887.000	SMI WMMh DI ' IV 567	22
Europe	Mediterranean Sea		SMI Fm WMMh	23
America	Continental Caribbean Sea Coast		SMI Fm Sm WMMm	24
Africa	Nilo	160.000.000	SMI Fm Dm ' IV 1234567	25
Africa	Congo/Zaire	63.200.000	VEm FI WMMm DI ' IV 134567	26
America	Parana	22.000.000	Fm ETm ' III 35	27
America	Haiti	8.122.000	Fm Sm MHMb ' II 567	28
Africa	Dra	1.390.000	SMm Fm ' III 367	29
Asia	Amur Daria	63.900.000	Fm ' III 345	30
Africa	Zambezi	18.040.000	Fm SI WMMI DI ' IV 13567	31
Africa	Awash	1.920.000	VEI FI Sm ' III 3567	32
Europe	European Atlantic Coast		SMI SI WMMm	33
Africa	Juba-Shibeli	11.800.000	SMI TSI FI DI ' 34567	34
Asia	Bei Jiang/Hai	83.400.000	MDMI FI SI ' III 345	35
Africa	Turkana Lake	15.200.000	FI SI DI ' IV 34567	36
America	Orinoco	10.200.000	SMI FI SI ' III 5	37
America	Titicacas Lake – Poopo System	2.180.000	FI SI WMMI ' II 567	38
Africa	Chad Lake	37.300.000	FI ETI ' IV 1234567	39
Europe	Elbe	22.400.000	SI ETI ' II 3	40
Oceania	Australia	20.090.000	FI SI DI ' II	41
Europe	Po	17.700.000	FI ETI ' II 35	42
Africa	Basin of Orange River	13.100.000	FI SI ' III 3567	43
Europe	Tagua / Tejo	9.440.000	FI ETI ' I 3	44
America	Dominican Republic	8.950.000	FI SI ' II 567	45
America	Colorado	8.270.000	FI SI ' III 4	46
Oceania	New Zeland	4.028.000	VEI SI ' III	47
Africa	Ruvuma	3.220.000	FI DI ' III 3567	48
America	San Juan	2.750.000	SMI FI ' II 567	49
America	Jamaica	2.732.000	FI SI ' II 4567	50
Europe	Drin	1.830.000	SI WMMI ' II 67	51
Africa	River Basin of Senegal	442.000	SMI SI ' III 3567	52
Oceania	Vanuatu	206	TSI SI ' IV 567	53
America	San Lawrence	45.700.000	SI ' II 4	54
Asia	Ob	25.800.000	FI ' III 345	55
Africa	River Basin of Volta	20.100.000	FI ' III 3567	56
Europe	Seine	16.300.000	ETI ' II 3	57
America	Cuba	11.347.000	SI ' II 5	58
Europe	Ron	9.860.000	WMMI II 35	59
Europe	Schekle	7.820.000	ETI ' II 3	60

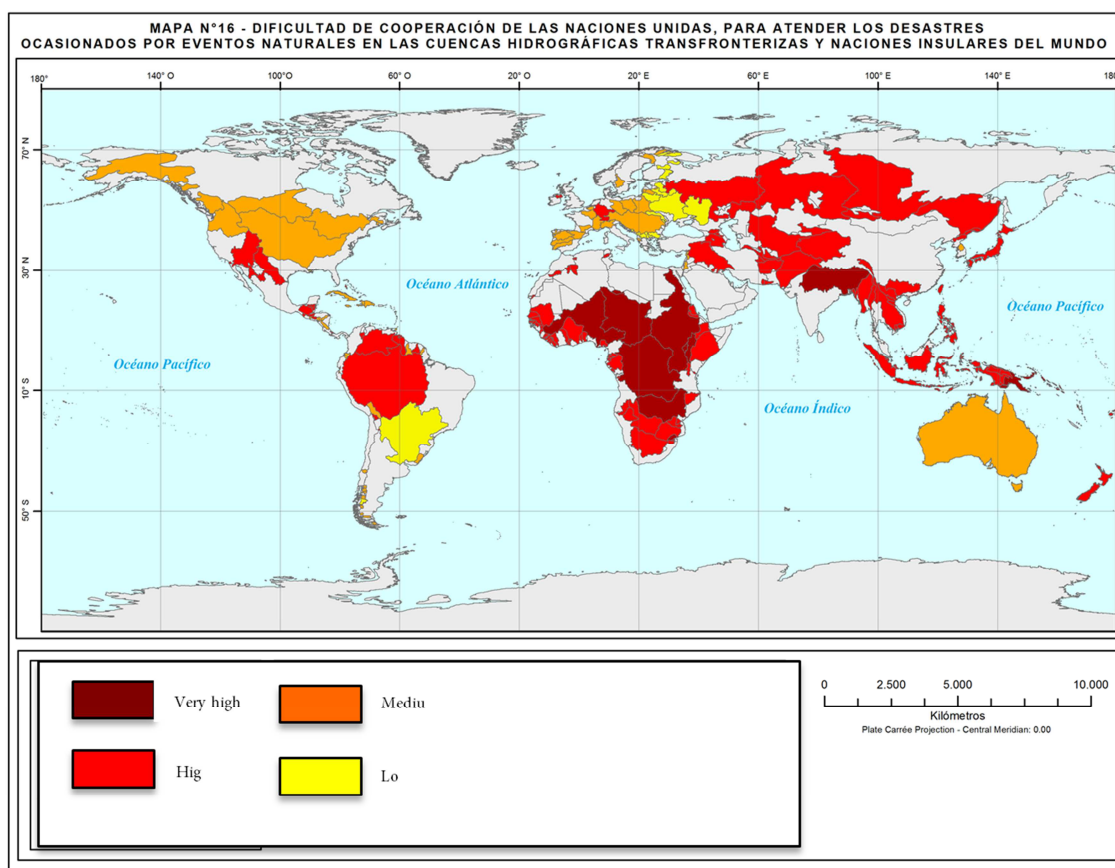
CONTINENT	RIVER BASIN / ISLAND NATION <sup>(1)</sup>	POPULATION <sup>(2)</sup>	CODE <sup>(3)</sup>	ORDER OF PRIORITY
Asia	Helmand/Sistan Lake	7.800.000	FI ' III 34567	61
Europe	Schekle	7.820.000	ETI ' II 3	62
Asia	Helmand/Lago Sistan	7.800.000	FI ' III 34567	63
Africa	River Basin of the Oueme	5.110.111	FI ' III 3567	64
Europe	Garonne	3.520.000	SI ' II 35	65
Europe	Ebro	2.760.000	FI ' II 3	66
Africa	River Basin of Merdjerda	2.440.000	FI ' III 3567	67
Africa	Maputo	1.830.000	SI ' IV 34567	68
Africa	Natron Lake	1.350.000	DI ' III 34567	69
Africa	River Basin of Little Scarcie	869.000	SI ' III 3567	70
Africa	Comoras Island	671.200	SI ' II 567	71
America	Barbados	279.300	SI ' II 4	72
Africa	Limpopo	218.000	FI ' III 34567	73
Africa	St. Tome & Prince	187.000	VEI ' II 567	74
Oceania	Samoa	178.000	SI ' III 567	75
America	ST. Kitts & the Grenadines	117.500	SI ' II 6	76
America	Yukon	96.200	SMI ' II 4	77
Africa	River Basin of Gambia	68.695	FI ' III 3567	78
Europe	Dneiper		MDMI ' I 345	79

Source: own elaboration

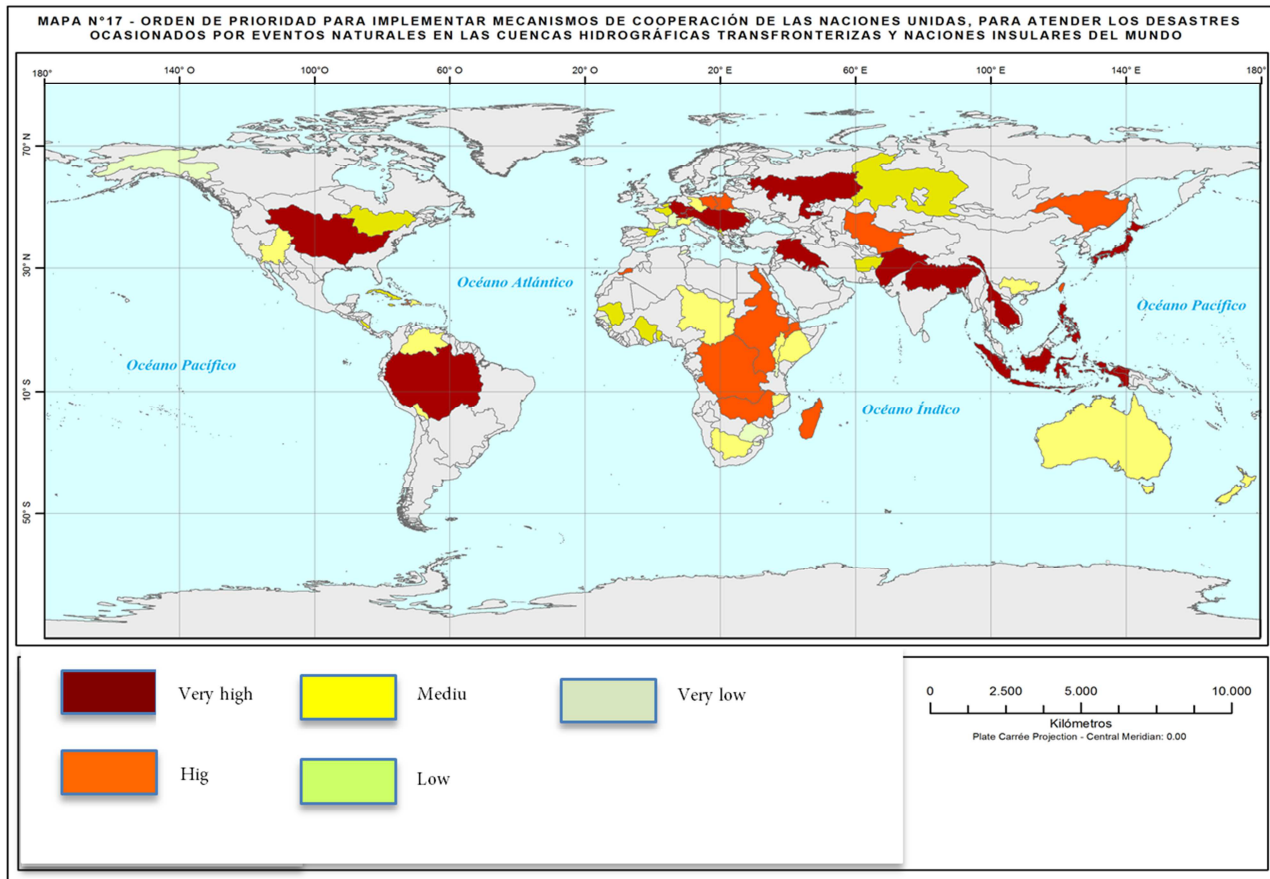
(1) According to the web site <http://www.transboundarywater.orst.edu>

(2) Data from the web site <http://waterwiki.net>

(3) Taken from the site [http://saber.ucv.ve/jspui/bitstream/123456789/9427/1/T026800010858-0-Tesis\\_de\\_Fatma\\_Moreno-000.pdf](http://saber.ucv.ve/jspui/bitstream/123456789/9427/1/T026800010858-0-Tesis_de_Fatma_Moreno-000.pdf), pages 432 - 435



**Figure 1.** Difficulty for cooperation of the United Nations to attempt the natural disasters occurred by natural events in the hydrographic transboundary river basin and insular nations of the world.



**Figure 2.** Order of priorities to implement cooperation mechanisms of the United Nations to attempt the natural disasters occurred by natural events in the hydrographic transboundary river basin and insular nations of the world.

## 5. Guidelines to Improve the Cooperation of the UN in Case of Natural Disaster

The United Nations, in order to make easier the cooperation in case of natural disaster, seek the development and implementation of plans according to the following guidelines:

1. Technical cooperation by nations of large technological development in the study of natural events, equipment and methods of prevention and early warning systems.
2. Non refundable grant aid aimed at implementation in regions of high and very high vulnerability to natural events, development of meteorological facilities centers in strategic locations to capture and send information at regional level.
3. Environmental management plans for transboundary river basins and island nations. It should be taken into consideration the development of infrastructure for flood control, as for the storage water resources in those areas regularly affected by flood and drought.
4. Humanitarian aid and emergency must be scheduled in advance for those regions with greater vulnerability.
5. Food aid must meet the traditional diet of the group

people affected.

6. The United Nation through the Office of the Humanitarian Affairs Coordinator carrying out the task of coordination between its bodies (regional economic commissions, Food and Agriculture Organization, World Meteorological Organization, United Nations Program for Development, United Nations Environment Program, United Nations Fund for Children, World Food Program, World Health Program, United Nations Educational, Scientific and Cultural Organization, United Nations University and Environmental Convention Secretariats), trying to bond with aid groups and local civil defense organizations.

To meet the objectives of this guideline it is recommended to:

1. Subscribe agreements between the riparian countries of transboundary river basin, led to development of management plans for the reduction of natural disasters.
2. Engage the States Parties of the United Nation to adjust their national development plans according to management plans of transboundary watersheds, aimed at reducing the effects of natural disasters.
3. Ensure the participation of the actors responsible for decision-making and community leaders living in the area.
4. Include in the management plans of transboundary



watersheds programs aimed at reducing the effects of natural disasters, scientific and technical basis in order to avoid possible difficulties due to political differences of government systems.

5. Ensure the participation of women in the development and implementation management plans.
6. Engage the most vulnerable states to establish their participation in the programs that will provide them with education on disaster prevention and mitigation, with real-time access to information.
7. Plans for prevention of natural disaster must be published in the official language of the riparian countries of the basin river transboundary, and signatory States are obliged to disseminate to their communities in their own language and dialects.

## 6. Conclusions

The natural events that could become disasters can be organized according to their origin: hydrometeorological ones which are produced by alteration of the atmosphere and hydrosphere; and the geological ones due to process registered in the geosphere and its interaction with the hydrosphere. However, only the events in which fatal victims are registered are qualified as disasters and when the situation exceeds the capacity of the states to address the problem, they can request international assistance.

The United Nations cooperation can be technical, scientific – technical, financial, humanitarian, debt swap, cultural, internships and training through treaties, that are the legal framework on which the international cooperation in case of natural disaster, under conventions, agreements, protocols and exchanges of letters or notes that govern international law, is based.

The United Nations' system has the direct responsibility to organize the actions to help any country that requests aid, through the Office of the Coordinator for Humanitarian Affairs and the International Strategy for Disaster Reduction; and indirect through the Economical Commissions, Food and Agriculture Organization, United Nations Program Development, United Nations Program for the Environment, World Health Organization, World Meteorology Organization, Environments Conventions, and its others instances.

The continents, which are seat of transboundary river basins and island states, have differences in their dimensions, geology, geomorphology and weather, as well as their vulnerability to natural events. In addition, the different forms of organization of human groups in the same region could hinder the implementation of the cooperation mechanisms.

There are distinctive features between the physical characteristics of the continents and the lack of data of the intensity of some natural events that have caused disasters. For these reasons the information was homogenized to determinate the vulnerability level in the transboundary river basin and island states through a methodology to measure the

intensity of natural events using as a reference the number of fatalities, giving as result five categories: no vulnerable, low vulnerable, medium vulnerable, high vulnerable and to high vulnerable.

The United Nations has had some difficulty to implement mechanisms of cooperation due to differences among human groups reflected in their political systems, language, religions, level of human development, development index in relation to gender, as well as political stability according to the Marshall and Cole index; giving as result difficulty levels from high, medium and low.

When this investigation began, two events happened that caught the attention of the international community for their significant magnitude: an earthquake in China and a group of storms accompanied by flood in Myanmar. The Office for the Coordinator of Humanitarian Affairs (OCHA) of the United Nations attended both countries. But, there was resistance from governmental authorities to allow the representative of the OCHA to work in the affected areas, while they permitted representation from other specialized agencies of the United Nations such as the Food and Agriculture Organization and World Health Organization. These cases are samples about the one of the difficulties that the United Nations face when they try to help people affected by natural disasters.

The qualification given to each transboundary river basin and island states about vulnerability to natural disasters and their intensity as well as the degree of difficulty to implement mechanisms of cooperation, was expressed by alphanumeric code, with it is possible to know immediately the studied areas features.

According to the investigation the United Nations' cooperation in case of natural disasters can be improved taking into consideration the problems for the development of vulnerable nations to those kinds of problems through a holistic vision having in mind the following facts:

1. The intensity and duration time of each event, let know why the effect of droughts and their long duration that produce more victims, don't cause the same impact in the news than those short duration events that have infrastructure destruction such as earthquakes, tsunamis, storms and hurricanes. Nevertheless, through a comprehensive management plan those transboundary basins affected by drought and flood can mitigate it.
2. The list of countries with records of victims caused by natural events. Most of them are nations located in Africa and Asia, where drought stands out for having caused the greatest number of victims.
3. The nations affected by some kind of natural event can receive the United Nations' cooperation just if the government of the affected country declares the emergency because it exceeds its capacity to handle the procedures and resources required to address the emergency and consequently requests the support of international community. Given this condition, the implementation of the proposal is justified in order to provide assistance to nations with fewer resources,

through the development and implementation of the required measures according to the type of event to which it is vulnerable.

4. The cooperation of the United Nations in case of natural disasters has proved to be insufficient, because there is no manual or guidelines that facilitate the channeling of actions to be undertaken to reduce their effects.
5. The United Nations does not have a methodology to measure vulnerability to natural events that cause disasters based on the number of victims; nor one to determine the degree of difficulty in the implementation of its treaties.
6. Being aware of the content of Resolution 46/182 of the United Nations General Assembly, of December 19, 1991, in whose main guidelines establishes in its numeral 3: *The sovereignty, territorial integrity and national unity of States must be respected in their entirety in accordance with the Letter of the United Nations. In this context, humanitarian assistance must be provided with the consensus of the affected country and, in principle, on the basis of an appeal from the affected country.* It is considered pertinent that the Executive Committee for Humanitarian Affairs, based on the different political systems of the countries Parties of the United Nations Organization, develops strategies to facilitate compliance with the tasks entrusted to OCHA, in case of natural disasters, without facing obstacles, to assess the feasibility of granting international visas for humanitarian activities to OCHA officials.
7. The continuous evolution of the planet is more clearly perceived in recent times by the evidence of climate change and geophysical events of great magnitude such as the earthquake and tsunami that affected riparian countries of the Indigo ocean at the end of December 2004. That situation must motivate the international community to take the necessary measures to reduce the impact of natural events.
8. The methodology presented to measure vulnerability to natural events and the difficulty in proving cooperation, applied to transboundary river basins and islands nations, can be used for national hydrographic units, in order to have a guide in which those spaces with the greatest need of attention can be identified and establish an order of priorities in the administration of budget. In addition, the proposal can be adjusted if it needs to expand the level of detail and the area of study is smaller, In those cases, natural events would be selected where less than 50 fatal victims are registered.
9. Among 258 transboundary river basins, at work scale 1:10,000,000, eighty-two hydrographic units were identified vulnerable to natural disasters, representing 26,7% of the total. Africa proved to be the continent with the largest number of transboundary river basins and island nations vulnerable to the natural disasters. However, the degree of vulnerability in any of these hydrographic units was very high. The Ganges river basin – Brahmaputra – Meghna, turned out to be of very high vulnerability to hydro-meteorological and climatic events, while the seismic movements are of medium vulnerability. Based on this result and taking into account what is related to climate change, the risk situation in this basin could increase. Consequently, it is a priority area due to its physical condition and the number of population living in this hydrographic unit.
10. The exposed methods to estimate the natural disaster vulnerability and the index to determine the degree of difficulty for the implementation of a multilayered cooperation mechanism can be used to work on a more detailed scale, obtaining more precise results. It would also work with a smaller number of victims if it were desired to expand the scale of work. On the other hand, it is worth mentioning the flexibility of the developed methods, which can be applied in different geographical areas to the transboundary river basins, which was evidenced by the case of island nations.
11. The use of a code to express the results of research using the proposed methodology, allows knowing the natural disasters to which transboundary watersheds and island nations are vulnerable, the degree of vulnerability, the level of difficulty of multilateral organizations to implement some cooperation mechanisms and human variables to be considered in order to implement cooperation. The use of the code facilitated the illustration of the results in cartographic documents and presented the results summarized in tables.
12. By using transboundary river basins and island nations as a spatial reference frame, in the face of imminent climate change, a management plan would facilitate the decision making of building infrastructure made for a better use of water resources, which would guarantee the water supply during periods of drought, try to control floods and identify areas of watersheds, which could help mobilize the population if necessary to safeguard their physical integrity.
13. Riparian nations of the Pacific and Indian Oceans need to develop and implement an early warning system for tsunami, develop evacuation plans for the areas susceptible to be affected by these types of event and carry out practices with the inhabitants of these places in order to facilitate the mobilization of people at the right time.
14. The intensity of events based on the number of fatalities estimate, such as the method used in this investigation; make it easier to identify those nations less resilient to natural disasters. Taking into consideration that events of the same magnitude leave fewer deaths in nations that have developed resilience.

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