

Original Research Article

Knowledge on the environmental disaster occurrence in the Democratic Republic of the Congo: The case of flooding and bushfire in Businga Territory, Nord Ubangi

ABSTRACT

Aims: The aim of this research was to assess the knowledge, perceptions and attitudes of victims and stakeholders on environmental disasters occurring in Businga territory.

Study design: This research employed a descriptive study design whereby the characteristics of respondents were described.

Place and Duration of Study: The study was carried out in Bodangabo, Businga and Karawa sectors of Businga territory in Gbadolite, Democratic Republic of the Congo between January 2016 and December 2017.

Methodology: A survey was conducted on 150 respondents among the victims and stakeholders in the prevention and management of environmental disasters in three sectors of Businga territory to whom the semi-structured questionnaire was administered.

Results: The findings show that 54% of environmental disasters originate from bushfire and 46% from floods. The bushfire is more evident in the area of Bodangabo and Karawa, while the flood is noticed in the area of Businga precisely in the city, because the ¾ is largely crossed by streams (Likpolo, Lokame, Legbala, Mongala). Thus, 80% of disaster victims are not satisfied with the support. However, 96% of respondents denied the provincial government's contribution, 92% confirmed the total absence of the environmental disaster prevention policy, and 88% confirmed the inefficiency of disaster prevention mode in Businga territory. With regard to the period of onset of disasters, it is clear from this survey that the floods are sporadic and occurring every two or three years compared to the bushfire which is manifested every year. 68% of the difficulties are due to lack of awareness due to insufficient financial resources and 32% to the shortage of qualified personnel for the prevention and management of these disasters.

Conclusion: The lack of a policy of prevention and management of environmental disasters both at the provincial and local levels is at the base of this high frequency. Therefore, it is relevant that a provincial body responsible for alerting and advocating to the stakeholders involved in the prevention and management of environmental disasters, to settle in all Businga sectors. Furthermore, it is necessary to install the early warning system as tool of disaster prevention.

Keywords: Victims, Stakeholders, Environmental disaster, Businga, Nord-Ubangi, Democratic Republic of the Congo

39 **1. INTRODUCTION**

40 In accordance with the law of the Democratic Republic of the Congo (DRC), "everyone has the
41 right to a healthy environment conducive to full development and has to defend it." The State shall
42 ensure the protection of the environment and the health of its population [1-2]. In recent years,
43 several Institutions preserving archives have been victims of significant damage as a result of
44 natural or man-made disasters. A few minutes may be sufficient for the memory of a people to be
45 severely damaged or even disappeared [3].

46

47 The word disaster is derived from the Medieval French word "désastre" meaning "misfortune",
48 "calamity" and "misadventure" and also it has an Old Italian connection with the word disastro,
49 which refers to mischance and ill luck [4]. While in the ancient Greece and Rome disaster was
50 used more in either astronomical or astrological contexts referring to the destruction or
51 deconstruction of a star as a disaster [4]. According to Srivastava, a "Disaster is a sudden,
52 calamitous event, bringing great damage, loss, destruction and devastation to life and property.
53 The damage caused by disasters is immeasurable and influences the mental, socio-economic,
54 political, and cultural state of the affected area. Disasters are events that inflict great damage,
55 destruction, and human suffering. Their origin can be natural, such as earthquakes, floods, and
56 hurricanes, or of human origin: accidents, terrorist acts, deforestation, etc . [5].

57

58 On the other side, the United Nations defined a disaster as —the occurrence of sudden or major
59 misfortune which disrupts the basic fabric and normal functioning of the society or community [4].
60 Sometimes, a disaster also describes a catastrophic situation in which normal patterns of life or
61 ecosystem have been disrupted and extraordinary emergent interventions are required to save
62 and preserve human lives and his environment [4, 6-7]. Moreover, disasters can occur due to
63 some factors notably climatic changes, deforestation or unsustainable methods of practices [8].
64 So, despite achievements in public health, education, women's rights and literacy disasters are
65 having an ever-deeper impact on those least equipped to deal with them – taking away any gains
66 made - as well as impinging on the lives of those who might have felt themselves somehow safe
67 [6, 9]. It can be distinguished two types of disasters namely: sudden impact disaster or natural
68 disasters such as (floods, earthquakes, tidal waves, cyclones, volcanic irruptions and landslides),
69 and slow-onset disaster or man-made disasters (drought, famine, environmental degradation,
70 deforestation, pest infection and desertification). We also have the epidemic disaster where
71 microorganisms are spread (cholera, measles, SARS, and HIV) and today Ebola can be added to
72 this list along with many others [5-6].

73

74 The environmental catastrophe is defined as an event that endangers one or more ecosystems.
75 Some experts have defined it more scientifically as the result of the impact of a natural or
76 anthropogenic hazard on a socio-economic system with some degree of vulnerability that
77 prevents the affected society or population from coping as it is suitable for this impact [10-11].

78 Deforestation, mining and the decline of traditional irrigation and agricultural systems have caused
79 land degradation on a large scale, leading to one of the worst drought conditions. In India, the
80 1987 drought, was one of the worst of the 20th century while in 2001, more than eight states
81 suffered the impact of severe drought [6]. These natural calamities have not only have become a

82 problem for the state but also has become a threat to the sustainable development due to
83 frequent occurrences [6, 12].

84
85 The severity of these impacts associated with natural disasters is greatly affected by the
86 appropriateness of the built human environment and settlement patterns [13]. A powerful
87 earthquake, for instance, in an unpopulated area is not a disaster, while a weak earthquake which
88 hits an urban area with buildings not constructed to withstand earthquakes, can cause great
89 misery [13]. Any hazard can turn into a disaster when people living in danger zone are vulnerable
90 and are not able to absorb the shock. So a natural disaster can best be understood as a
91 combination of a natural hazard and the vulnerable condition of people [6].

92
93 Amongst several natural disasters known, flooding is the leading natural disaster in the world and
94 one of the major environmental challenges faced by many nations in the twenty-first century [14].
95 The applied sciences bridge this divide by claiming floods have both natural and anthropogenic
96 causes that result in damages being associated with a natural phenomenon. As the variety of
97 definitions across major scientific disciplines clearly illustrates, flood events are multidimensional
98 [15]. According to the natural sciences, floods occur when streamflow greatly exceeds average
99 values due to unavoidable and natural hydroclimatic phenomena. In contrast, the social sciences
100 define floods as a purely socially constructed event that occurs when water causes damages to
101 human life and property [15].

102
103 Floods are complex processes that involve physical and socio-economic factors. Accordingly,
104 flood disasters are the result of both societal and hydro-meteorological factors. It is important to
105 make a distinction between hydrologic and damaging floods [16-17] The difference is that a
106 hydrologic flood, occurring in an unpopulated area, may cause no damage and therefore, flood
107 disasters are the result of the interaction between hydrologic floods and societal systems. The
108 latter include many subsystems that determine the level of interaction, such as flood mitigation
109 policies and the numbers of people and properties exposed to the risk [17]. Moreover, floods are
110 the most costly and wide reaching of all natural hazards and are responsible for up to 50,000
111 deaths and adversely affect some 75 million people on average worldwide every year [18].

112
113 River floods are considered one of the most important natural disasters in the world and causes
114 huge damages every year, both in economic consequences and fatalities [19]. In the developed
115 countries such as Switzerland, Austria, The Czech Republic, Slovakia, Poland, Hungary, Croatia,
116 Serbia and Germany, extreme floods were characterized by huge losses in damage to economic
117 activity [20]. The focus was on the flooding occurred in parts of Germany in 2013 (overall losses
118 US\$12,500m, 25 fatalities). Meanwhile in the developing countries, where the flood protection
119 standards are the lowest, coping with floods is even harder and result besides economic damages
120 in many fatalities. Examples of this are the flooding of parts of Nigeria in 2012 (overall losses
121 US\$500m, 363 fatalities) and Pakistan in 2011 (overall losses US\$2,500m, 520 fatalities) [19].
122 Several studies reported the flooding events in different countries in Europe as described above
123 but mainly in Africa (like Algeria, Benin, Burkina Faso, Cote d'Ivoire, DRC, Ethiopia, Gambia,
124 Ghana, Guinea, Kenya, Liberia, Mali, Mauritania, Nigeria, Rwanda, Senegal, Sierra Leone, South
125 Africa, Togo, Uganda, Zambia, Zimbabwe) and Asia (India, Thailand, Cambodia, Vietnam, Laos,

126 The Philippines) as developing continents where the economy is low, this makes the situation very
127 difficult especially when the affected areas are inaccessible. This worsens the situation because it
128 would be very tough to accurately access the death toll [6, 14, 18, 21-24]. It should be noted that
129 all communities (rural or urban) is vulnerable to hazards. However, different regions will be more
130 prone to certain types of hazards than others. Natural hazards are those triggered by climatic and
131 geographical variability, which is at least partly beyond the control of human activity.

132
133 The occurrence of extreme floods is expected to increase even more in the future due to a
134 constantly changing world. Socio-economic factors and climate change are considered the main
135 drivers of the increase in flood risk [19]. Furthermore, floods had several socio-economic and
136 political implications which caused a wide range of complex issues. Some of the immediate
137 consequences included the displacement of people, the destruction of infrastructure such as
138 houses and roads, damage to farms and crops and loss of cattle and livestock. The destruction of
139 roads and other infrastructure delayed on-going development initiatives and political processes,
140 hence the under development of many African countries [18, 26-27 – Ismail, Theron]. It is clear
141 that the increasing population of our planet is leading to the increasing exposure of people and
142 property to hazards of flooding [18].

143
144 The occurrence of extreme floods is expected to increase even more in the future due to a
145 constantly changing world considering the rapid increase human population in the last century
146 [28]. The most common causes of floods are climate related, most notably rainfall. Prolonged
147 rainfall events are the most common cause of flooding worldwide. These events are usually
148 associated with several days, weeks or months of continuous rainfall. Human impacts on river
149 catchments influence flood behavior. Land use changes in particular have a direct impact on the
150 magnitude and behavior of floods [18]. However, socio-economic factors like urbanization,
151 increase in wealth, increased demography and economic development have caused that more
152 people and more valuable assets are prone to flooding [28]. On the other side, deforestation
153 results in increased run-off and often a decrease in channel capacity due to increased
154 sedimentation rates [18]. However, flooding has a wide range of health consequences such as
155 drowning, injury, outbreak of gastroenteritis, respiratory infections, poisoning, communicable
156 diseases, epidemic diseases such as cholera, diarrhoea, and dengue fever, poor mental health,
157 and , among others [14].

158
159 In DRC, DREF under the International Federation of Red Cross and Red Crescent Societies
160 reported recently the flooding disaster that occurred in Gemena in Sud Ubangi province. In 2016,
161 rain and violent winds intensified causing extensive floods in the neighbourhoods located on the
162 banks of rivers Mombonga, Sukia and Labo [29]. The National Society noted the destruction of
163 105 houses, while 173 families lost their household possessions. Four wells out of seven in this
164 town were contaminated with dirty rainwater and 200 household latrines. There is a high risk of a
165 public health disease outbreak due to the proliferation of vector and water-borne diseases [29].
166 However, heavy rains in Kinshasa seriously affected 1,500 families in 11 high risk municipalities of
167 Kinshasa in 2009. According to weather forecast, the volume of water reached 222 mm per
168 square meter, a rate never reached since 1961. The force of the water caused serious landslides
169 and erosion in many municipalities communes, killing 31 persons and causing the destruction of

170 or damage to 1,500 homes. About 11,000 people were directly affected by the effects of the
171 disaster in their localities (lack of food, clothes, and other non food items, etc.) [30]. Lately in
172 2018, Kinshasa faced the same problem of heavy rains which caused flooding with several
173 damages as observed in previous years [31]. Following the disaster occurrence, an evaluation
174 was carried out and helped draw up a plan of action with relief operation, sensitization of the
175 populations on hygiene and sanitation, and building capacities [30]. Despite these and other
176 advancements, the common recurrence of devastating floods around the world indicates there are
177 still many remaining challenges [15]. To assess and carefully handle these risks, studies are
178 needed in order to measure the risk and map them in order to give an overview of the most
179 vulnerable regions.

180

181 The utmost goal of the United Nations Programme for World Food (WFP) and the United Nations
182 Development Programme (UNDP) is to strengthen the capacity of experts and support these latter
183 who would advise the minister of solidarity and humanitarian actions. Their aim is to support
184 developing countries in the strategy of prevention and management of environmental disasters
185 [32-33].

186

187 On the other side, bushfires also constitute a real disaster in regions where deforestation is
188 practiced in an abusive way. Bushfire can be defined as the unplanned vegetation fire. It is a
189 generic term including grass fire, forest fires and scrub fires both with and without a suppression
190 objective. Bushfire mitigation are activities which are undertaken for the purpose of minimizing the
191 incidence and impact of bushfires. The chance of a bushfire occurrence which have harmful
192 consequences to human settlement, economic, environmental and cultural assets is very high
193 [34]. Bushfires can be caused either naturally or by the actions of people, either accidentally or
194 deliberately. Although lightning is a common cause of bushfires, most are started by people.
195 During extreme bushfire weather any fire has the potential to be devastating as is the case of
196 Australia [35].

197

198 In Ghana for instance, many policy makers expressed the satisfaction with the promulgation of the
199 bushfire way and the consequent establishment of the Nations Bush Fire Committees because it
200 led to a massive reduction in bushfire cases [36]. This, though, was not achieved immediately until
201 after a massive bushfire campaign that drove home the need to protect and conserve nature and
202 its resources [36].

203

204 The will of the DRC in the policy of prevention and management of environmental disasters, would
205 be to increase its capacity in anticipating the risks of environmental disasters and to improve its
206 performance in case of the occurrence of environmental hazards. Therefore, different means of
207 collection and processing have been developed by the Government including regular
208 dissemination of data of these hazards as reported by the Disaster Relief Emergency Fund DREF
209 [37-38]. These changes put increasing pressure on governments and other decision-making
210 instances for dealing with these extreme events and because extensive flooding is likely to occur
211 in multiple countries at the same time, it puts increasing pressure on trans-national risk reduction
212 [39]. Therefore, DRC plans and coordinates the interventions of all stakeholders working in this
213 field for the reduction before, during and after environmental disasters as DREF [31]. The aim of

214 the present study was to assess the knowledge, perceptions and attitudes of victims and
215 **stakeholders** on environmental disasters in Businga territory. The significance of this survey was
216 to show the importance of material, economic and human damages caused **by** environmental
217 disasters in Businga territory. Politically, the once-neglected disaster situation currently occupies a
218 prominent place on the political and social front, to accompany and alert administrators and
219 decision-makers in their disaster-prevention program in this area.

220

221 **2. MATERIAL AND METHODS**

222 **2.1 Study area**

223 The present study was carried out **between January 2016 and December 2017** in Businga territory
224 located in the north-west of DRC (3° 20' 19" North latitude and 20° 53' 09" East longitude, at 400
225 m of altitude) [6]. The climate **found in Businga territory** is of the AW₂ type according to the
226 Köppen classification **i.e. this territory is subjected to heavy rains during the year** [37-38]. The
227 study period was between January 2016 and December 2017.

228

229 **2.2 Study design**

230 **This research employed a descriptive study design whereby the characteristics of respondents**
231 **were described. The choice of this design was required by the nature of the issue being studied.**
232 **The community was selected because it has experienced floods for several consecutive rainfall**
233 **seasons. The researcher had discussions with key informants and stakeholders at the community**
234 **level i.e. randomly sampled households at sector level.**

235

236 **2.3 Sample size and target population**

237 **A purposive sampling is entirely based on the judgement of the researcher in that a sample is**
238 **composed of elements that contain the most characteristics, representative or typical attributes of**
239 **the population [18]. The questionnaire enabled structured social interaction between the**
240 **researcher and the respondents thereby providing an opportunity to obtain quantifiable and**
241 **comparable information related to the study [40]. The semi-structured questionnaires containing**
242 **open and closed questions enabled the researcher to carry out an objective probe to the sampled**
243 **population in Businga territory.**

244

245 **In Businga territory, three sectors were selected randomly namely Bodangabo, Businga and**
246 **Karawa whereby 150 respondents (i.e. 50 respondents per sector). The selected informants were**
247 **interviewed using an open-ended questionnaire. Socio-demographic characteristics (gender, age,**
248 **level of education, duties and seniority) were assessed and the evaluation on the knowledge,**
249 **perception and attitude of victims along with stakeholders involved in the prevention and**
250 **management of environmental disasters. This last aspect constitute the qualitative part of this**
251 **research. The interview was held with all the informants (disaster victims ad stakeholders) which**
252 **comprised all critical players having a role to play in the management of floods and bushfire in**
253 **Businga territory using a questionnaire where the victims and the stakeholders.**

254

255

256

257

258 **2.4. Data analysis**

259 All data collected from the questionnaires were coded and transferred to Excel 2010 where
260 findings were presented in a descriptive form through summary measures such as frequency and
261 percentage distribution in a tabular form.

262

263 **3. RESULTS AND DISCUSSION**

264 *3.1. Socio-demographic characteristics*

265 The socio-demographic characteristics of the respondents is presented in the table below.

266

267 **Table 1. Socio-demographic characteristics of respondents**

Variables	Frequency (n=150)	Percentage (%)
Sex		
Male	98	65
Female	52	35
Age (years)		
23-27	26	17
28-32	12	8
33-37	11	7
38-42	6	4
43-47	29	20
48-52	14	9
53-57	12	8
58-62	24	16
63 and above	16	11
Marital status		
Married	120	80
Single	30	20
Level of education		
Illiterate	12	8
Primary	30	20
Secondary	84	56
University	24	16
Duties		
Victims of disaster	126	84
Solidarity and humanitarian	15	10
Red Cross	10	6
Seniority in the area		
Less than 5 years	30	20
Between 5 and 10 years	78	52
Between 10 and 20 years	24	16
More than 20 years	18	12

268

269 The survey was conducted with 150 victims and stakeholders involved aged between 23 and 65
270 years. Age classes \geq 63 years, 58-62 years, 53-57 years and 48-52 years constitute 56% of
271 victims and stakeholders involved. Age classes 23-27 years, 28-32 years, 38-42 years and 43-47
272 years are the least represented.

273

274 There was a predominance of males than females. This could be justified by the fact that men are

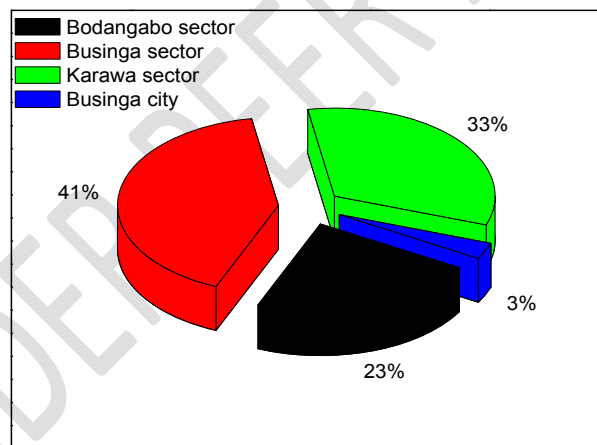
275 used to going early to the bush to set traps to capture the games and came back home while
276 females stayed to arrange the house before going to the farm. As shown above, there is a
277 predominance of married people in the three sectors aforementioned than bachelors, though the
278 high percentage of single is found in Bodangabo. Mwape [18] reported similar findings in his study
279 carried out in Kazungula district, Zambia. The author found a predominance of males over
280 females and married than other groups. In terms of ages, the author found that most of
281 respondents were aged between 30 and 34 years.

282

283 Regarding the education level, most of respondents have a secondary level (56%), followed by
284 20% of respondents having a primary level (20%), the respondents having a university level (16%)
285 while 8% are illiterate. Seeing this situation, it is obvious that most of respondents have a needed
286 level to comprehend explicitly the questionnaire administered to them. Furthermore, 84% of
287 respondents are victims of disasters while 16% are stakeholders in disaster management and
288 prevention. This shows that the number of casualties is greater within Businga territory. Most of
289 the respondents (80%) live in this area for more than 5 years. This confirms the fact that the
290 respondents possess sufficient knowledge of their environment and of the disasters which
291 occurred in Businga territory. They are able to give reliable information in the field of disaster
292 prevention and management in this area.

293

294 Figure 1 shows the distribution of vulnerable areas to environmental disasters in Businga territory.



295

296

Figure 1: Areas vulnerable to environmental disasters

297

298 It is clear from this figure that all sectors Businga territory present disaster-prone areas. These
299 areas are divided as follows 41% in the Businga sector in the area of flooding, 33% in the Karawa
300 sector for the bushfire, 23% in the Bodangabo sector for the bushfire and 3% in the city of
301 Businga for the flooding. Thus, the sector Bodangabo and that of Karawa present 56% of areas
302 which are vulnerable to the bushfire while 44% of the flood in the area of Businga.

303

304 3.2. Knowledge on the prevention and management of environmental disasters

305 The level of knowledge on different aspects of prevention and management of environmental
306 disasters of the respondents is presented in the table below.

307 Table 2: Level of knowledge on the prevention and management of environmental disasters in
 308 Businga territory

Variables	Frequency (n=150)	Percentage (%)
Knowledge on prevention and management of environmental disasters		
Yes	138	92
No	12	8
Origin of environmental disasters		
Flooding	81	54
Bushfire	69	46
Level of satisfaction on the environmental disaster support system		
Satisfied	120	80
Not satisfied	30	20
Types of support for victims		
Food supplies	90	60
Primary healthcare	60	40

309
 310 It was observed that 92% of respondents are aware of environmental disasters while only 8% are
 311 not aware of these disasters i.e. the local population knows the reality happening to them. This
 312 high level of knowledge may help so much in the management of these disasters.

313
 314 In regards to the level of satisfaction on the environmental disaster support, it is observed that
 315 only 20% of respondents are satisfied on the support received after the disaster, while 80% of
 316 respondents are not satisfied with that support. The support in the field of disasters is almost non-
 317 existent i.e. EPVH is unable despite its plea to the provincial and/or national authorities and
 318 different partners, to come in support of the victims of environmental disasters.

319
 320 Depending on the nature of disasters occurring in this area, 54% of disasters originate from the
 321 bushfire while 46% originate from the flood. The bushfire is much more evident in the Bodangabo
 322 sector and that of Karawa while the flooding is perceived in the Businga sector as the ¾ of this
 323 sector is largely surrounded by rivers namely Likpolo, Lokame, Legbala and Mongala.

324
 325 It is clearly observed that 60% of respondents received food supplies as support while 40%
 326 received the primary healthcare support. Mwape [18], reported the damages of flooding on crops
 327 and different infrastructures. If crops are destroyed, this will bring hunger and drought, hence the
 328 need of food supplies so that the victims may survive. However, flooding plays an important role in
 329 the outbreak and the spread of infectious diseases as it creates conditions for the multiplication of
 330 pathogens and vectors [14]. One of the most effective health interventions to avoid the outbreak of
 331 infectious diseases resulting from flooding is to develop Early Warning Systems for infectious
 332 diseases by considering flooding trends. It allows those at risk to either evacuate or take
 333 precautionary measures and the public health sector to sufficiently prepare for the eventualities
 334 [14]. On the other side, the emergency response planning constitutes also another health
 335 intervention. This should entail well planned emergency procedures for health systems designed
 336 and established well in advance of the flooding hazard in order to provide a basis for effective
 337 health care during and after flooding [41].

338 The occurrence period of environmental disasters in Businga territory is given in the figure 2.

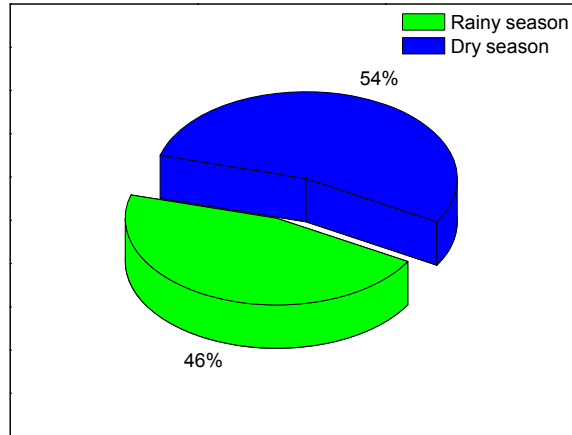


Figure 2: Occurrence Period of environmental disasters in Businga territory

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The occurrence period of environmental disasters is mainly in the dry season precisely the bushfire which occurs between December and February, while the flooding as a disaster occurs in the rainy season. This phenomenon is mostly observed between September and October. Mwape [14] reported that the most common causes of floods are climate related, most notably rainfall. Prolonged rainfall events are the most common cause of flooding worldwide. These events are usually associated with several days, weeks or months of continuous rainfall.

The duration of the disaster occurrence is described in the figure below.

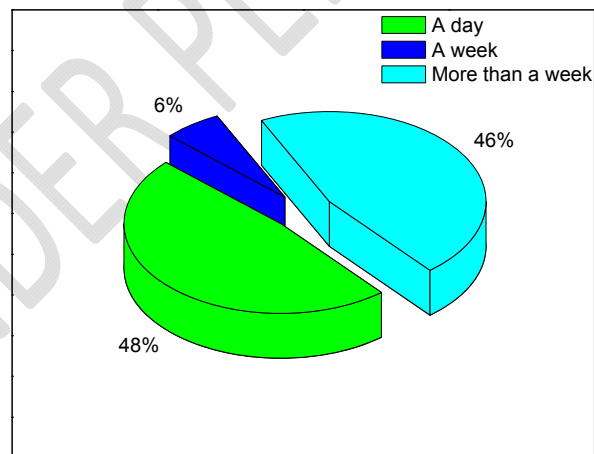


Figure 3: Duration of disasters

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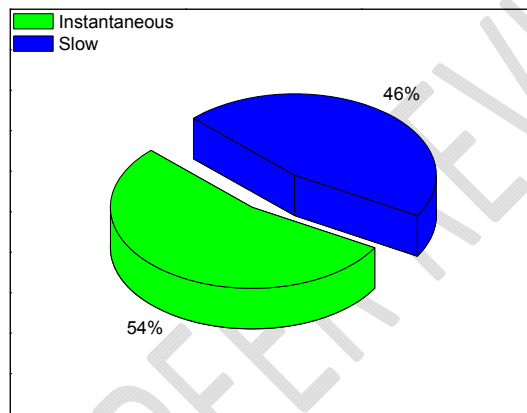
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The duration of disasters varies from one day to one week for bushfire and more than a week for flooding. Since the existing support system is inoperative, the more the catastrophe, the more the population is exposed to the vagaries. Being in this situation, the population of Businga are exposed to different pathologies which have bad consequences on their health. Okaka *et al.* [14] reported that flooding has a wide range of health consequences such as drowning, injury, outbreak of gastroenteritis, respiratory infections, poisoning, communicable diseases, epidemic

358 diseases such as cholera, diarrhea, and dengue fever, poor mental health, and disability. On the
 359 other side, public health interventions are really needed in order to reduce the vulnerability to
 360 infections as a result of flooding i.e. interventions range from those made before, during and after
 361 flooding. Bushfires are accompanied by a range of acute health impacts, and an increase in
 362 number of patients seeking for emergency services [42]. These adverse impacts include:
 363 respiratory conditions, cardiac problems, heat stress, trauma, mental health even death. The
 364 health impacts of bushfires can be severe and long lasting, but can be reduced through bushfire
 365 prevention, preparation and education. All these health disturbances are due to toxic compounds
 366 released by bushfires smoke like carbon monoxide [42]. After the bushfire occurrence, the
 367 cleaning up can expose workers to hazardous materials including asbestos, lead, copper,
 368 chromium and arsenic, or ash containing those substances [42].

369

370 Figure 4 shows the different velocities of disaster occurrence.



371

372

Figure 4: Speed of emergence of environmental disasters

373

374 The speed of disaster occurrence is instantaneous in terms of bushfire and slow for flooding while
 375 it is very difficult to manage when this starts. This is due to the poor use of fire in the bush during
 376 the dry season and to a gradual increase in water level.

377

378 **3.3. Attitude of respondents on disaster prevention and management system, existence of policy**
 379 **at provincial and community levels and the role of humanitarian watch team**

380

381 The attitude of respondents on different aspects on disaster prevention and management system
 382 is presented in table 3 below.

383

384 **Table 3. Attitude of respondents on different aspects of disaster prevention system, existence of**
 385 **policy at the provincial and community levels and the role of humanitarian monitoring**
 386 **team**

Variables	Frequency (n=150)	Percentage (%)
Possibility of prevention		
Yes	18	12
No	132	88
Mode of prevention		

Sanitation of the area	93	61
Avoid the anarchic constructions	57	39
Existence of policy on prevention and management of environmental disasters at provincial level		
Existent	144	96
Non-existent	6	4
Existence of policy on prevention and management of environmental disasters at community level		
Existent	138	92
Non-existent	12	8
Existence of disaster warning system		
Existent	25	17
Non-existent	125	83
Possibility of existence of the provincial humanitarian monitoring team		
Existent	108	72
Non-existent	42	28
Role of humanitarian monitoring team		
Existent	102	68
Non-existent	48	32
Past disasters and their periods of occurrence		
Flooding 2012, 2014, 2016	69	46
Bushfire	81	54
Difficulties on prevention and management of disasters		
Lack of awareness	102	68
Lack of qualified personnel	48	32

387

388 The mode of disaster prevention in Businga territory is ineffective, as NGOs responsible for
 389 disaster prevention and management are not equipped for disasters. The minority proposed the
 390 system for the prevention of environmental disasters to be used in Businga territory. **Therefore,**
 391 61% proposed the sanitation and environmental management in order to avoid **bushfire** while 39%
 392 suggested that the population should avoid the anarchic building in swampy environments **to**
 393 **avoid flooding.**

394

395 **Regarding the existence of policy at the provincial level,** 96% of **respondents** denied the
 396 contribution of the provincial government while 4% of **respondents** confirmed the provincial
 397 government contribution to these disasters i.e. **the existence of** a policy that the government has
 398 set in order to manage disasters. However, the contribution is often from NGOs via national and
 399 international partners. **Concerning the existence of policy on prevention and management of**
 400 **disasters at the community level,** 92% of **respondents** reported the complete absence of the policy
 401 **on** prevention and management of environmental disasters **at the community level.**

402

403 **Concerning the early warning system, this device** was **supposed** to be installed throughout the
 404 territory **under** EPVH **direction** in order to transmit good information on environmental disasters is
 405 not found in all sectors of Businga. **That's why, at the occurrence of a disaster there is no**
 406 **concordance on the outcome reported, because stakeholders report information collected from**
 407 **their structure located in Businga. The need of early warning system is requested in Gbadolit **

408 though DRC always possesses an early warning system for disaster management with the help of
409 Catholic Relief Services and UNICEF, and it was implemented in two provinces namely Katanga
410 and Kasai. Unfortunately, this system was not efficient [43].

411

412 However, the set of capacities needed to generate and disseminate timely and meaningful
413 warning information to enable individuals, communities and organizations threatened by a hazard
414 to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss
415 [44]. This definition encompasses the range of factors necessary to achieve effective responses to
416 warnings. A people-centred early warning system necessarily comprises four key elements:
417 knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or
418 dissemination of alerts and warnings; and local capabilities to respond to the warnings received.
419 The expression “end-to-end warning system” is also used to emphasize that warning systems
420 need to span all steps from hazard detection through to community response [44].

421

422 With regards to the role of humanitarian monitoring team, 62% of respondents confirmed that the
423 EPVH team does not exercise its role of bringing together stakeholders involved, raising
424 awareness and advocating to the stakeholders. This situation is due to the lack of funding.
425 Reason why there is slowness in the prevention and management of environmental disasters in
426 Businga territory. However, it is important to draw on the experience of other countries. To this
427 end, the system of prevention and management of environmental disasters in Cameroon with
428 regard to international environmental law shows that this country had set up a strategy dealing
429 with degradation by reducing these disasters through prevention and reduction of threats [10].
430 This system can be applied in the territory of Businga in order to reduce the threats and frequency
431 of occurrence of these disasters (figure 5). The three levers alluded by Provitolio *et al.* [45]:
432 development policies, civil engineering and population training so that they can best adapt their
433 behavior to disaster situations, are a solution to the problems of environmental disasters in the
434 territory of Businga.

435

436 Schelf, [15] gave some recommendations which help to find solutions to flooding, many of which
437 overlap the mitigation measures. These recommendation are the following: (i) a flood early
438 warning system, (ii) improved storm water management and delimitation of zones at-risk of
439 flooding, (iii) enforcement of zoning laws, (iv) building houses with concrete, and (v) risk
440 management plans. These recommendations are also valuable for the case of DRC where the
441 government needs to install an early warning system against environmental disasters.
442 Furthermore, participants indicated the need for education about flood risks and one public official
443 mentioned the need for direct involvement of the population in flood risk management. The
444 primary solutions recommended can be summarized as better finances for risk reduction,
445 investment in the necessary human resources, and development and implementation of an early
446 warning system [15].

447

448 From the past disaster occurrence, it is clearly shown that floods are sporadic i.e. almost every
449 two compared to the bushfire which is manifested each year in Businga territory, Nord Ubangi
450 province, DRC. The latest floods which occurred in Businga was at the space of two years. This
451 observation helped to state flooding occurred each two years in this neighborhood.

452

453 Concerning difficulties on the prevention and management of environmental disasters, 68% of
454 respondents reported difficulties are due to the lack of awareness because of the lack of financial
455 means compared to 32% of respondents who reported the shortage of qualified personnel in the
456 prevention and management of these disasters. Several factors have inhibited the response to
457 disasters include, lack of a national-level plan policy, absence of an institutional framework at the
458 center / state / district level, poor inter-sectoral coordination, lack of an early warning system, slow
459 response from the relief agencies, lack of trained / dedicated search and rescue teams, and poor
460 community empowerment [5]. For instance, Indian government has integrated administrative
461 machinery for the management of disasters at the National, State, District, and Sub-District levels.
462 The basic responsibility of undertaking rescue, relief, and rehabilitation measures in the event of
463 natural disasters, as at present, is that of the concerned State Governments. The Central
464 Government supplements the efforts of the State by providing financial and logistic support.
465 Besides this, the Indian Armed Forces are called upon to intervene and take on specific tasks if
466 the situation is beyond the capability of civil administration [5]. The Congolese government has to
467 follow the above example of the Indian government for instance so that he can improve its
468 management at all levels.

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Figure 5: Some illustrations of the disasters happening to the Businga territory (Source: Nzamonga, 2017)

496

4. CONCLUSION AND SUGGESTIONS

497 The aim of the current study was to assess the knowledge, perceptions and attitudes of victims
498 and stakeholders on environmental disasters in Businga territory. The findings showed that the
499 most common environmental disasters occurring in Businga territory are flooding and bushfires.

500 The flooding period occurrence is every two years precisely during the raining season. While the
501 bushfire period occurrence is of a year mainly during the dry season. This situation is due to the
502 irresponsibility of the community along with the stakeholders of Businga sectors.. The lack of
503 prevention and management of environmental disaster policy both at the provincial and
504 community level is at the base of this high frequency occurrence. Henceforth, the necessity of
505 installing the early warning system for a better prevention.

506

507 Moreover, there is an emergency of settling a provincial body which responsibility would be to
508 alert and advocate with the stakeholders involved in the prevention and management of
509 environmental disasters in Businga territory seeing the inefficiency of the humanitarian monitoring
510 team. This body would help in monitoring the humanitarian team and giving clear and reliable
511 information on disaster occurrence in this area, which would sensitize the community so that they
512 can mitigate disaster frequency. Anyway, sanitation measures and the implementation of the
513 humanitarian monitoring team will be needed to mitigate environmental disasters in this part of
514 the Nord-Ubangi together with the local community.

515

516 COMPETING INTERESTS

517

518 Authors have declared that no competing interests exist.

519

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