Hydrology for Disaster Management

Special Publication of the Nigerian Association of Hydrological Sciences, 2012

http://www.unaab.edu.ng

Social Impact and People's Perception of Flooding in Makurdi Town, Nigeria

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Abstract

This study assesses the social impacts and people's perception of flooding events in Makurdi town which has almost become a yearly occurrence. Data for this study were obtained from questionnaires, interviews, personal observation, archival records of ministries and newpaper reports. A total of 219 respondents, drawn from residents in flood prone areas, were sampled for this study. Descriptive statistics and Likert Rating System were used in the analyses of the data. The results of analyses show that floods in Makurdi occur mostly at the event of rainfall intensity and amount and especially at the peak of rainy season (August/September). And it takes 1 and 2-3days flood water to recede depending on the magnitude of event. Factors other than rainfall identified to substantially influenced flooding in the study area are: Lack of and poor drainage networks, dumping of wastes/refuse in drainage and water channels, topographic characteristics, overflowing of river banks, low infiltration due to high water table and degree of built up areas leading to increased runoffs, and climate change. Despite the flood hazards, occupants in flood prone have remained on the basis of having no alternative, cultural ethnic affinity, family home place where parent were buried, used to flooding as the whole area suffers from flooding, nature of occupation, and cheaper houses to rent. Personal properties and public infrastructures suffer all forms of flood damages. Flood mitigation measures include river rechannelisation, raising house foundations, use of sand bags, bridges and neighbor community efforts. Public enlightenment and necessary legislation and enforcement are recommended to checkmate activities aiding flooding.

Key words: Rainfall, flooding, hazards, causes, measures

Introduction

Floods are the most common and widespread of all the natural hazards. The consequences of floods are vast on the physical environment, economic and social well-being of the inhabitants of an area (Strahler and Strahler,1978; Ward and Smith,1998). In many parts of the world, floods seems to be occurring more often and they seems to be increasing in size. Human activities, however, sometimes exacerbate them. Human often court disaster when they make environmentally unsound decision such as building in an area that is prone to flooding (urbanization) and by cutting down forests (deforestation)(Bryant,1991).

Flood occurs when there is an inundation of an any area which is not normally covered with water, through a temporary rise in the level of a river, lake or sea, and when excess precipitation exceed natural infiltration, evaporation, and possible transmission (Ward,1978; Ayoade,1988). Floods are generally regarded as extreme hydrological events, where there is excess of water which may have devastating effects. According to Ayoade (1988), floods in tropics are partly or wholly climatological in nature, that is, they result from torrential rainfall. Beside, human interference in the hydrological relationship within the watershed can cause flooding.

In Nigeria, the incidents of floods is becoming a reoccurring decimal in most urban area leading to colossal loss of properties and lives. For example in1973, 1974 and 1976, cases of floods were recorded in Ilorin (Jimoh, 2000); in 1973, 1980 and 2011 Ogunpa flood in

Ibadan occurred. Floods in low-lying coastal areas, such as Lagos, Port Harcourt, Warri, Sapele and Yenegoa, as well as the hinterland and arid semi arid places like Ondo, Ilorin, Makurdi, Kaduna, Minna, Borno, okoto, Gombe have formed Nigeria newspaper headlines..Concern over the incidents of floods, especially in urban areas, have attracted several studies focusing on different aspects (Akintola, 1978; Akintola, 1982; Omiunu,1981; Odemerho, 1983; Rashid,1982; Ayoade and Akintola, 1980; Babatolu, 1997; Oriola, 2000; Ologunorisa, 2004; Ali, 2005; Ologunorisa and Tersoo, 2006).

In Makurdi town, flood has almost become an annual event leading to loss and destruction of properties worth millions of naira. In 1996, 2000, 2005, 2007 and 2008, flooding has occurred in different parts of Makurdi town (FEPA, 2008). Ayado (2011) reported in Leadership newspaper that over 300 houses in Makurdi were flooded as a result of heavy downpour which destroyed properties and rendered many homeless. This also halted activities in some schools, churches and markets. Areas covered by the flood include Wadata, Idye, Atsua, Wurukum, Akpehe, Logo1 and Logo 2, Ankpa Quarters extension, Nyiman and Gado villa. According to the report, the rain started at about 2am and lasted till 10am. Ali (2005) has investigated flood damage in Makurdi town, while Ologunorisa and Tersoo (2006) has examined the rainfall pattern and its implication on flood frequency in Makurdi town. This study, however, is an assessment of flood events in Makurdi with the aim of identifying causes, consequences and management options.

The Study Area

The study area is Makurdi town, the administrative headquarter of Benue State. It lies between Lat.7^0 44^N and Long.$8^0 54^E$ and is located within the floodplain of the lower River Benue valley (Figure 1). The physiography span between 73 – 167 m above sea level. Due to the general low relief, sizeable portions of Makurdi is waterlogged and flooded during heavy rainstorms. Makurdi town is drained principally by river Benue which divides it into Makurdi North and South with the banks connected by two bridges (Ocheri, 2010). Other minor rivers that drain Makurdi town and empty their waters into the River Benue includes Idye, Genebe, Urudu, Kpege and Kereke Rivers. The climatic condition in Makurdi town is influenced by two air masses: the warm moist southwesterly air mass and the warm dry northeasterly air mass. The southwesterly air mass is a rain bearing wind that brings about rainfall from the months of May to October. The dry northeasterly air mass blows over the region from November to April, thereby bringing about seasonal drought (Ologunorisa and Tersoo, 2006). The mean annual rainfall total is 1190 mm and ranges from 775-1792 mm. The mean monthly relative humidity varies from 43% in January to 81% in July-August period. Temperatures are generally high throughout the year, with February and March occurring as the hottest months. Temperature in Makurdi varies from a daily of 40^o and a maximum of 22.5^oC (Ologunorisa and Tersoo,2006).The geology of Makurdi town is of cretaceous and consists of fluvio-deltaic sediments with well-bedded sandstones which are of hydrogeological significance in terms of groundwater yield and exploitation (Kogbe et al.,1978).

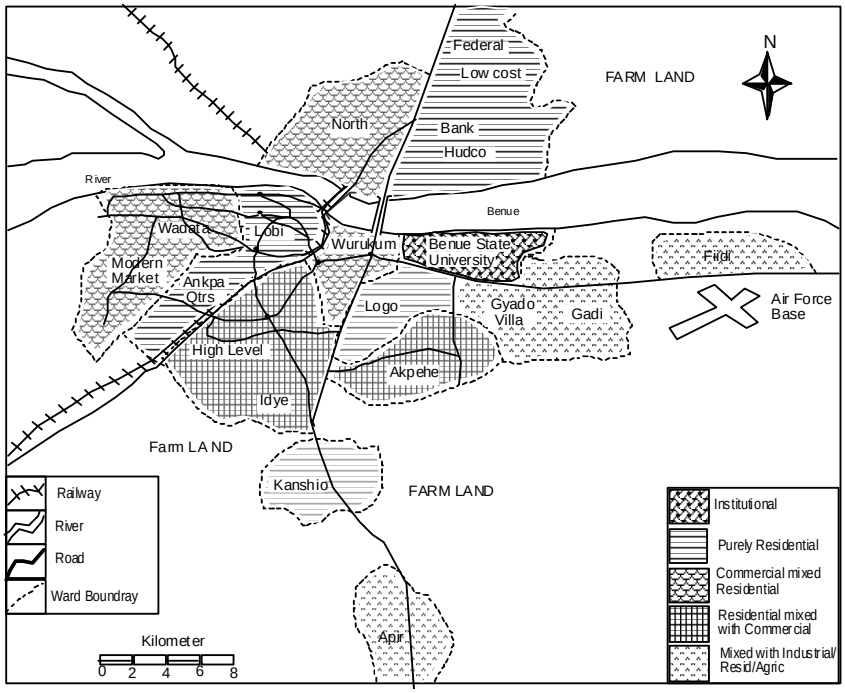

Figure1: Location and land use map of Makurdi town

Materials and Methods

Data for this study were obtained from both primary and secondary sources. Primary sources included the use of questionnaires, interviews and personal observations, supplemented by newspaper reports and official document of relevant Government Ministries and Agencies. Data were collected on sex, educational status, residence, duration in the place and damages incurred as result of flooding from respondents. Other information were gathered on places of flood occurrence, period of occurrence, frequency of flooding, flood receding time, flood damage, causes of flooding, human response to flooding and severity of flooding. A total of 219 respondents in floodable areas were sampled for this study through questionnaire administration. The analyses was done using simple descriptive statistics and Likert Rating Scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

Results and Discussion

The respondents, comprised 169 (77.2%) males and 50(22.8%) females. This population was drawn from residential areas that have experienced flooding. These include Wadata, Demekpe,Wurukum/Angan Jukun, Logo/Akpehe, Idye, Atsua and Nyiman. Up to 69% of the respondents have lived in these areas for 5-10years, as such, they have sufficient knowledge of the flood events in the areas. All respondents (100%) indicated that they have experienced flooding in their area. This cut across indigenous ethnic groups such as Tiv, Idoma, Igede, Jukun, Etulo and other tribes like Hausa, Ibo, Yoruba and others.

Perception of Flooding in the Study Area

On period of flood occurrence, 48.4% and 42.5% of the respondents observed that flooding occur in their areas when there is heavy rainstorm and at the peak of rainy season August/September respectively. It takes 1day and 2-3 days for flood water to recede depending on the intensity and amount of rainfall, as noted by 37.9% and 58.5% of the respondents respectively. Flooding experienced in Makurdi may be categorized into flash and river flood. Because of the low-lying and waterlogged nature of the environment, at the event of heavy rainstorm, most of these areas are inundated resulting into flash floods as observed by 62.5% of the respondents. This is common in Logo/Akpehe, Idye and Atsua areas of the town. River flooding is experienced in places such as Wadata, Demekpe, Wurukum/Angwan Jukun where River Benue and other streams drain the area as observed by 59.8% of the respondents. At the instance of every prolonged rainfall and intensity, these river/streams swell in size thus overflowing their banks thereby flooding the adjacent land. Flooding in Makurdi town was rated to be very high by over 50% of the respondents.

Effect of Flooding

According to Etuonovbe (2011), floods are the most devastating natural disasters in the world, claiming more lives and causing damage to properties than any other natural phenomena. In Nigeria, though not leading in terms of claiming lives, flood affects and displaces more people than any other disaster. It also causes more damage to properties and at least 20% of the population is at risk of one form of flooding or the other. Ayado (2011) reported that over 300 houses in Makurdi were flooded as result of heavy downpour which destroyed properties and rendered many homeless. According to him, rain that started at about 2am lasted till 10am the following day. Table 1 shows the summary of how flooding has affected the respondents used in this study.

Table 1: Effect of flooding on the respondents

Effect	Respondent	% respondent
House flooded with water	127	57.9
House collapse due to flooding	50	22.8
Prevented from moving out	81	36.9
Source of water polluted	44	20.1
Heath problems due to flooding	49	22.4

From Table 1, 57.9% of the respondents have their houses flooded, 36% prevented from moving out, 22.8% houses collapsed, 22.4% suffer health problems and 20.1% have their sources of water, especially hand dug wells, polluted. Beside the personal effects of flooding, all the respondents noted that flooding has affected public infrastructures such as roads been submerged, electric and telephones pulled down, markets, schools and churches flooded and drainage channels blocked with wastes.

Causes of Flooding in Makurdi town

The causes of flooding in Nigeria urban areas include long hours of rainfall, type of land use pattern, dumping of refuse into water channels, lack of and poor drainage networks, topography, nature of urban land surface and building types, and stream basin parameters

(Ayoade,1988; Akintola,1978; Olaniran,1983;Babatolu,1997; Oriola,2000;Ali, 2005; Ologunorisa and Tersoo, 2006). Table 2 summaries the results obtained of the causes of flooding in Makurdi town.

Table 2: Causes of flooding in Makurdi

Causes	SA	A	D	SD
Heavy rainfall	127(57.9%)	46(20.0%)	1(0.4%)	0(0%)
Overflowing of river banks	85(38.8%)	39(17.8%)	22(10.0%)	6(2.7%)
Topography	97(44.3%)	81(36.9%)	12(5.4%)	17(7.7%)
Infiltration	74(33.7%)	63(28.7%)	9(4.1%)	16(7.3%)
Lack of drainage network	160(73.1%)	31(14.2%)	3(1.3%)	6(2.7%)
Poor drainage network	147(67.1%)	39(17.8%)	2(0.9%)	6(2.7%)
Building on water channels	86(39.2%)	42(19.1%)	22(10.0%)	24(10.9%)
Dumping of wastes on channels	102(46.5)	26(11.8%)	9(4.1%)	29(13.2%)
Climate change	24(10.9%)	68(31.1%)	16(7.3%)	54(24.6%)

From Table 2, 57.9% strongly agree and 20.0% agree that heavy torrential rainfall is one of the causes of flooding in the study area. Rainfall intensity, duration and amount are generally believed to be the principal factors in most flood events in the tropics which are partly or wholly climatological in nature (Ayoade, 1988).Other factors only aided the incidence of flooding in urban areas of Nigeria. This has been confirmed by several studies (Omiunu, 1981; Oriola, 2000; 2004; Ologunorisa, 2004; Daily Trust, 2007; This Day, 2008, Ayado, 2011; The Nation, 2011; Etuonovbe, 2011).

Overflowing of river banks was also noted to be responsible for flooding in parts of Makurdi as indicated by 38.8% and 17.8% of the respondents who strongly agree and agree respectively. This is prominent in Wadata, Demekpe, Wurukum/AnganJukun, Logo/Akpehe and Idye areas that are drained by River Benue and other sreams. However, 12.7% of the respondents disagree because their places of above are not close to rivers. The topographic configuration of Makurdi town substantially influences the incident of flooding in the area. Makurdi is located within the floodplain of River Benue, a low lying terrain spanning 73-167 m above sea level. It is therefore susceptible to flooding at the event of every torrential rainstorm. This was believed to be true by 81.2 of the respondents living in parts of Wadata, Wurukum,Logo/Akpehe, Idye and Atsua. Respondents representing 62.4% believed that low infiltration resulting from rise in groundwater table aid flooding, especially in waterlogged areas of Wadata, Wurukum, Logo/Akpehe and Atsua . Ocheri et al. (2010) observed shallow well in Makurd1 town are full to the brim during rainy season and water could easily be fetched without the use of ropes and buckets. Beside, the degree of built up area limits infiltration and increase run off as noted in parts of Wadata . This is consistent with findings from studies carried by Anderson (1970), Akintola (1978), Olaniran (1983) and Oriola (2000) in Virginia, Ibadan, Ilorin and Ondo towns respectively.

Lack of drainage network in the disposal of flood waters is believed to be a major factor substantially aiding flooding in the study area . The respondents representing 87.3% of those sampled agreed that lack of drainage network is a chief factor that facilitated events of flooding in Makurdi town. Closely related is the factor of poor drainage network, which is believed by 84.9% of the respondents to be inhibiting disposal of flood waters . This is a

common scenerio in parts of Wadata, Wurukum/Angwan Jukun, Logo/Akpehe, and Idye and Atsua areas of the study area. Lack of and poor drainage network is generally believed to be responsible for urban flooding, essentially due to the rapid rate of urbanization in the study area. Respondents representing 58.3% of those sampled believed that building structures on water channel is responsible for flooding in parts of Wadata, Wurukum, Logo/Akpehe and Idye/Atsua areas of Makurdi town. This results from high demand for land for residential, commercial and industrial developmental purposes.

The unwise behavior of urban dwellers has resulted into all kinds of environmental abuses as common in Nigeria cities. Heaps of wastes are indiscriminately dumped on streets, in drainage and water channels, thereby causing not only health hazards but also aiding incidence flooding. Respondents, representing 58.3% believed that indiscriminate dumping of wastes/refuse in drainage and water channels was responsible flooding in Wadata, Demekpe and Wurukum of the study area.This is particularly aided by cultural habits of ethnic groups such Jukuns and Hausa dominated areas of Wurukum and Wadata where they seems to less regard for healthy environment.

Climate change and variability have been indicated as contributing to flood disaster in some cities. According to Ololade (2011), increased storm frequency and intensity, related to climate change, are exacerbated by such local factors as occupation of flood plain, increased runoff from hard surfaces, inadequate waste management, inadequate and silted up drainage systems. The respondents, representing 42.0% of those sampled in this study agreed that climate change and variability contribute to incidence of flooding in Makurdi, while 7.3% and 24.6% disagreed.

Based on the respondent opinion, factors identified to have influenced flood event in Makurdi town in order of magnitude are as follows: rainfall intensity, duration and amount, lack of and poor drainage networks, dumping of wastes/refuse on drainage and water channels, topographic characteristics, overflowing of river banks, low infiltration and climate change.

Human Response to Flooding in Makurdi Town

Man responds to flood hazards through adjustment, flood abatement and flood protection measures. Adjustment covers any action to minimize or ameliorate flood hazards; flood abatement relates to landuse modification within a river basin to reduce the risk of flooding, and flood protection has to do with physical construction such as embankment, dykes, levees, river channelization, flood diversion channels and storage of flood waters (Ward, 1978).

In this study, respondent were asked to suggest appropriate measures to reduce the risks of flooding in Makurdi town. This result is presented in Table 3. For relocation from floodable areas to avoid flood hazards, a total of 52.2% of the respondents disagreed while 35.9% accepted. River rechannelisation as way of checkmating the risks of flood was upheld by 68.4% of the respondents. However, 15.9% of the respondents, who do not experience river flooding, objected the option.

Table 3: Flood mitigating control/ measures in Makurdi town

Measures	SA	A	D	SD
Relocation	28(12.7%)	29(13.2%)	73(33.3)	42(19.2%)
River Rechannelisation	97(44.2%)	53(24.2%)	25(11.4%)	10(4.5%)
House foundation raised	96(43.8%)	58(26.4%)	13(5.9%)	18(8.2%)
Use of sand bags	22(10.0%)	52(23.7%)	40(18.2)	43(19.6%)
Bridge	21(9.5)	46(21.0%)	50(22.8%)	32(14.6%)
Neighbours	63(28.7%)	57(26.0%)	15(6.8%)	15(6.8%)

The suggestion that house foundation should be raised high enough to keep above flood water was assented to by 70.2% of the respondents while 33.7% believed that flood prone residential areas should adopt use of sand bags as levees to keep away flood water. Building temporal bridges to connect houses to dry points was accepted as a good measure by 30.6% of the respondents especially where people may be trapped in their houses during flood events.

The usual call during disasters is for government to come to the aid of victims. However, what the public can do in case of flood events was explored. Respondents representing 54.7% agreed that instead of waiting for government to intervene, neighbours should come together to see what they can do to help the victims.

Human Adjustment to Flooding in Makurdi Town

It is expected that where life is threatened as result of natural hazards, such as flooding, people should relocate to safe places. This study has proved the contrary, as those who have suffered from flood hazards remained in the same area. The reasons are presented in Table 4.

Table 4: Continuous occupation floodable areas of Makurdi town

Reason	Respondent	%respondent
Family place where parent was buried	70	31.9
Cultural ethnic affinity	72	32.8
Nature of occupation	50	22.8
Houses are cheaper to rent	44	20.0
Whole place do get flooded	60	27.3
We are used to flooding	58	26.4
Have alternative	90	44.9

The respondents, representing 44.9% of those sampled, indicated that they had no alternative to living in the place because they own the property and that the occupation of their houses would be cheaper than staying in rented quarters . Another reason is cultural ethnic affinity (32.8%) as people migrating to cities prefer living where most of ethnic group is concentrated. This is common with Hausas and Jukuns in the study area. Up to 27.3% of the respondents believe that when flooding occurs in their area it will subside after some days as such do not see the need of relocating from such a place. Nature of the occupation such as fishing and farming in floodplain areas was accepted by 22.8% of the respondent for their continous stay in the floodable area of the Makurdi town.

Implication for Management

Our study has shown that flood severity is rated very highly in Makurdi town and that flooding in the town can be attributed to both physical and humanly activities. While factors, such as rainfall intensity and duration, cannot be controlled, early warning of flooding based on climatic variability will help people in flood prone areas to prepare ahead of time. Federal Ministry of Environment/UNDP (2012) have launched a web – based Early Warning System (EWS) to alert people living in flood prone area to prepare ahead of time.
Construction and improvement of drainage networks to effectively dispose flood water will go a long way in reducing the risks of flooding. Indiscriminate dumping of wastes in drainage and water channels prevents the disposal of flood water thereby leading to flooding of houses, schools, churches and markets. Lastly, public enlightenment and education can result in change of behavior toward environment abuses.

References

Akintola, F (1978). The hydrological consequences of urbanization: A case study of Ibadan city In: Sada, P. O. and Oguntoyinbo, J. S. (eds) Urbanisation processes and problems in Nigeria, 151-160, Ibadan University Press, Nigeria.

Akintola, F(1982). Flooding problems at Ibadan Western Nigeria, Nigeria Geographical Journal, Vo.9, 101-112.

Ali, P. I. O.(2005). Flood damage assessment in Makurdi town, Unpulished M.Sc Thesis, Department of Geography, Benue State University, Makurdi, Nigeria.

Anderson, D. (1970). Effect of urban development on flood in Northern Virgina, UGSS Water Supply paper, 1591-1598.

Ayado, S. (2011). Nigeria: 300 houses, markets flooded in Makurdi downpour, Leadership Newspaper, 7th October, 2011.

Ayoade, J. O. and Akintola, F. (1980). Public perception of flood hazards in two Nigerian cities, Environmental International,Vol.4,277-280.

Ayoade, J.O. (1988).Tropical Hydrology and Water Resources, MacMilan Publishers, Ibadan.

Babatolu, J.S. (1997).The June 24th 1995 Flood in Ondo Antecedent and Incident, Ife Research Publications in Geography,Vol.6, 125-136.

Bryant, E. A. (1991). Natural hazards, Cambridge University Press, United Kingdom.

Colman, E. A. (1953).Vegetation and watershed management, Ronald, New York.

Daily Trust Newspaper (2008) July 7th 2008.

Etuonovbe, A. K. (2011).The devastating effect of flooding in Nigeria, Hydrography and Environment, TS06J, Epworth, Zimbabwe.

Federal Ministry of Environment/UNDP (2012). Automated web-based Early Warning System (EWS) launched in Abuja.

Kogbe, C. A., Torkshi, A., Osijuk, D. and Wozney, D. E. (1978).Geology of Makurdi in the Middle Benue Valley Nigeria. Ocassional Publication of the Department of Geology, Ahmadu Bello University, Zaria.

Obeta, M. C. (2010).Flood incidences in the Lower Niger River Basin, Nigeria, Journal of Geography and Development,Vol.2 (2),300-311.

Ocheri, M. I, Mile, I. I. and Obeta, M.C. (2010).Seasonal variation of nitrate levels in hand dug wells in Makurdi metropolis, Pakistan Journal of Nutrition, Vol.9, 539-542.

Odermerho, F.O. (1988).Case study of urban flood and problems in Benin City in Sada, P. O. and Odermerho, F. O. (eds), Proceedings of the National Conference on Environmental Issues and Management in Nigerian Development,179-195.

Ologunorisa, E. T. (2004). An assessment of flood vulnerability zones in the Niger Delta, Nigeria, International Journal of Environmental Studies,Vol.61,31-38.

Ologunorisa, E. T. and Tersoo, T (2006).The changing rainfall pattern and its implication for flood frequency in Makurdi, Northern Nigeria, Journal of Applied Science and Environmental Management, Vol.10(3) 97-102.

Ololade,O. (2011). Nigeria's flood management challenge, The Nations Newspaper,14th May, 2011.

Olaniran, O. J. (1983). Flood generating mechanism at Ilorin, Nigeria, GeoJournal,Vol.36,2-10.

Omiunu,F.G(1981).Ogunpa flood disaster:An environmental problem or cultural fiction, Aman,110-120.

Omiunu, F. G. H. (1988). Flooding and traffic management in Benin City Region In: Sada, P. O. and Odermerho, F. O. (eds) Environmental Issues and management in Nigeria Development.

Oriola, E. O. (2000). Flood and flood management. In: Jimoh, H. I .J. (ed) Contemporary issues on environmental management, Haytee Press,Ibadan,100-109.

Ward, R. C. (1978). Floods: A geographical perspective, Macmillan, London.

Ward, R. C. and Smith, K. (1998). Flooding: Physical processes and human impacts, John Wiley and Jones Ltd, England.

Rashid,H. (1982). Urban flood problems in Benin City, Nigeria: Natural or man- made, Malasyian Journal of Tropical Geography, Vol. 6, 17-30.

Strahler, N and Strahler, A (1978). Geography and man's environment, John Wiley and Sons, U.S.A.

This Day Newspaper (2007). July 15th

This Day Newspaper(2008).July 2008.