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Earthquake Risk in South - Eastern Africa

South - Eastern Africa is a developing market and constructing new infrastructure is one of the keys to the successful growth and prosperity for the region.

However, the region is prone to various natural catastrophes such as earthquakes, floods, tsunamis, volcanoes, and windstorms that might cause enormous economic and insured losses. South -Eastern African nations are prone to earthquake risks due to the active East African Rift System (EARS).

We present information on earthquake risk for three countries viz. Ethiopia, Kenya, and Uganda in this edition and will provide information for other countries in coming issues.

East African Rift System (EARS)

EARS is one of the world's great continental rifts that extends over 3,000 km from the Red Sea–Gulf of Aden junction in the north to Mozambique in the south. The South-eastern African region is prone to seismic hazard due to the presence of the EARS that crosses the region. Some of the strongest earthquakes occurred are:

- 7.4 Ms Rukwa Tanzania earthquake on 13 December, 1910
- 6.9 MS Subukia, Kenya earthquake on 9 January, 1928
- 7.2 Mw South Sudan earthquake on 20 May, 1990
- 7.0 MW Manica, Mozambique earthquake on 22 February, 2006

Figure 1 and 2 below show EARS and Figure 3 shows epicenters in EARS from 1900- 2012.



Fig 1: EARS

Source: <http://geology.com/articles/east-africa-rift.shtml>



Fig 2: EARS with country boundaries

Source: <http://geology.com/articles/east-africa-rift.shtml>

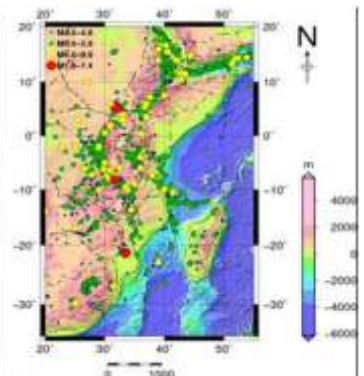
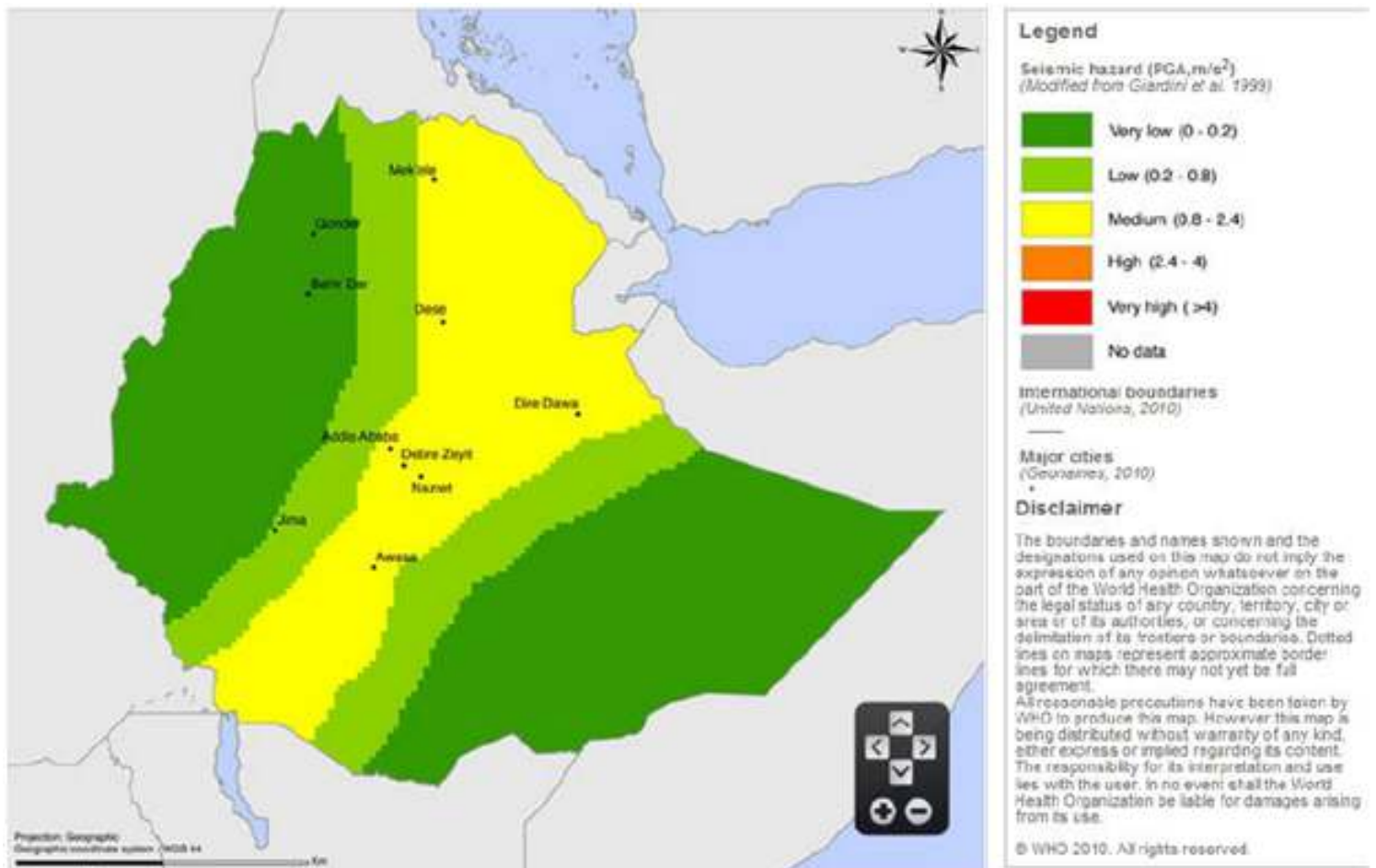


Fig 3: Seismicity in the eastern part of Africa between 1900-2012 for Mw 4.5
Source: *Ibs-vonSehtetal.*



Earthquake Risk in Ethiopia

90 % seismicity in Ethiopia is due to The EARS which cuts through the country in NE-SW direction. Central Ethiopia faces a medium risk of earthquake hazard. The country has experienced a number of earthquakes that caused loss of lives and damaged properties. Table 1 in Appendix shows historic earthquakes with magnitude more than 5.



Seismic Hazard Distribution Map of Ethiopia | Source: *World Health Organization (WHO), 2010*

46 % of population of Ethiopia has “medium” exposure to seismic hazard that includes residents of urban areas too. Addis Ababa, the capital city, is located closely to the western edge of Ethiopian rift valley. There is building code to construct earthquake resistant houses and few buildings in Addis Ababa are designed with strict seismic building code considerations. Nevertheless, majority of concrete buildings are not built to withstand earthquake load. Likewise, due to lack of preparedness and weak infrastructure, people are vulnerable. Historic earthquakes have resulted in economic losses of more than US\$ 7 million. However, with increase in economic activities, loss numbers might increase.



Earthquake Risk in Kenya

Earthquakes in Kenya are likely to be concentrated along the Kenya Rift Valley due to the slow divergent movement of the rift and hydrothermal processes within the geothermal fields. This implies slow but continuous radiation of seismic energy that relieves stress in the subsurface rocks.

Kenya faces a relatively low earthquake hazard in comparison on neighbouring countries with hazard levels highest in the north-west and south-west regions. There have been tremors in the past; but, no significant damage or loss of life despite public alarm. Figure below shows Earthquake Intensity Map of Kenya.

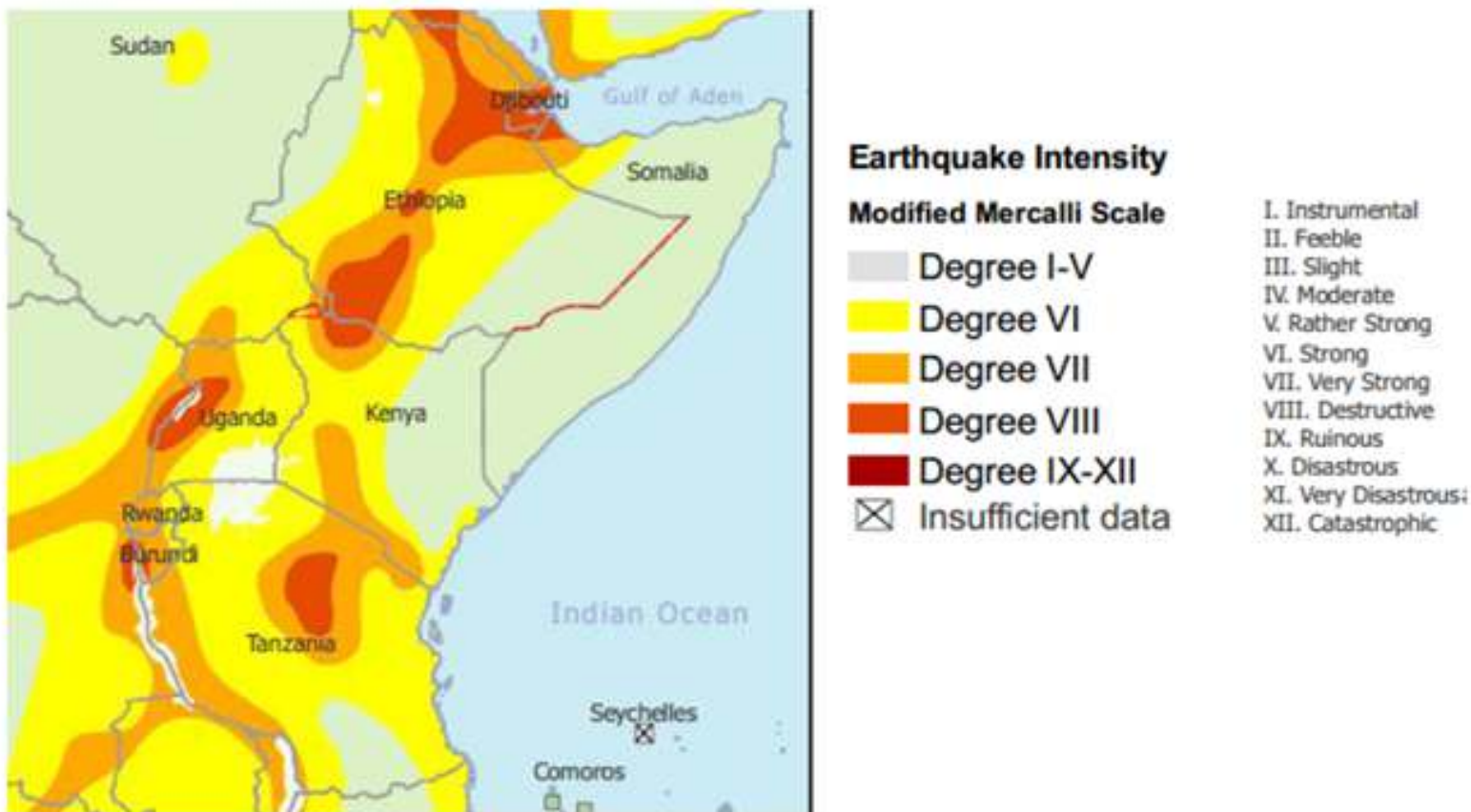


Figure 4: Earthquake Intensity Map of Kenya|Source: OCHA 2007

The cities with the greatest degree of hazard are Nakuru, Eldoret, Kisumu and Kakamega which have a medium degree of seismic hazard. Nairobi faces a low degree of hazard and Mombasa very low.

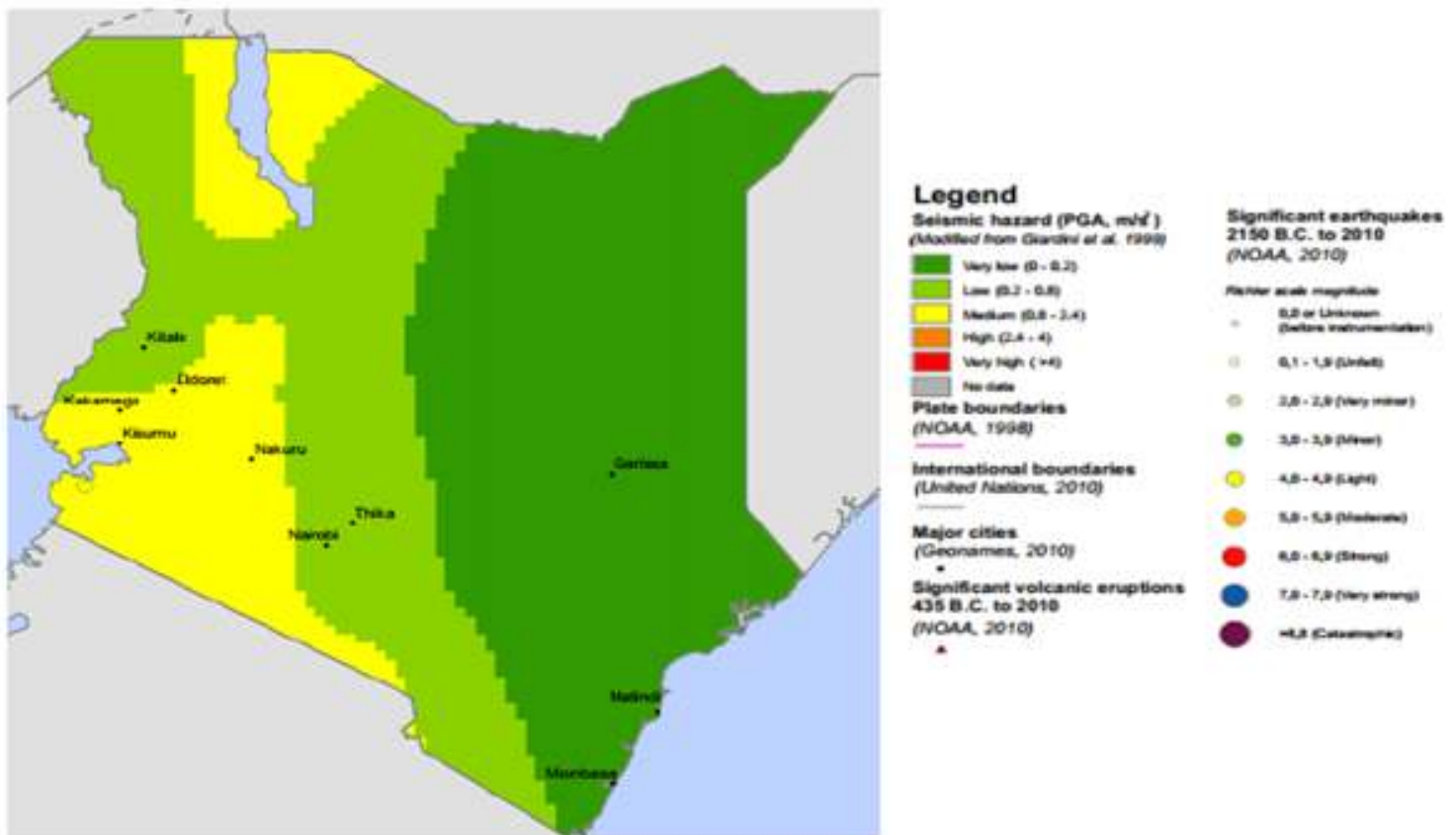


Figure 5: Seismic Hazard Distribution Map of Kenya | Source: *World Health Organization (WHO), 2010*

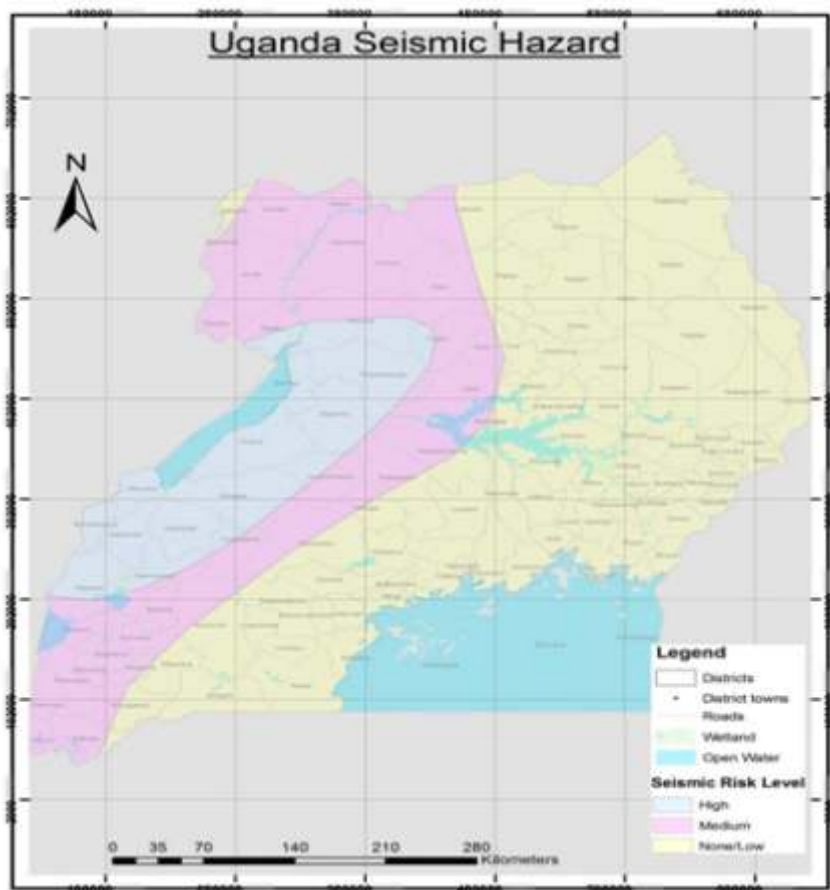
Although Mombasa is located away from the East African ridge, it is located near to aseismically active area of the Davie fracture, at ectonic plate fracture zone, which runs from Kenya due south towards Madagascar. This fracture may be a source of risk for exposure of Mombasa.



Earthquake Risk in Uganda

Earthquake occurrence in Uganda is associated with the EARS. Uganda lies between the two arms of the EARS. Its west border with D. R. Congo lies almost entirely in the western branch of the EARS, while the eastern border is about a few hundreds of kilometers from the Eastern Branch of the EARS; and there is more seismic activity in the western branch than in the eastern.

The Lake Albert region of Uganda is located in the highly seismically active Albertine Rift, which forms part of the Great Rift System. The vulnerability to earthquakes in the Lake Albert region is expected to increase with prospective extraction of oil, which requires construction of the relevant infrastructure such as refineries, roads, and estates development, if these facilities are not designed to resist earthquake motion. The recent discovery of oil in the Albertine region has accelerated the rate at which infrastructure is being built in the region.



Source: Office of the Prime Minister, Uganda

Appendix:

Table 1 Earthquakes in and around Ethiopia

Event Date	Location of Epicentre	Magnitude	Impact
19 March, 2011		5.0	
10 December, 2010		5.0	
20 January, 1995		5.1	
13 February, 1993	Nazrat	5.3	
Dobi Graben Earthquake, 20 August, 1989	200 kilometers from Addis Ababa	6.5	Several buildings damaged
Rift Valley Area Earthquake, 7 October, 1987	200 kilometers from Addis Ababa	5.3	
Langano Earthquake 14 August, 1985	Less than 100 kilometers from Addis Ababa	5.1	Strongly felt in Lake Langano camp, central MER, Cracks in buildings in resort area hotels
Wondo Genet Earthquake; 12 February, 1983	300 kilometers from Addis Ababa	5.3	Damage to steel frames and masonry buildings Hawassa
Sardo Earthquake, 29 March, 1969		6.3	High level of damage to town of Sardo
Kara Kore Earthquake 1961	150 kilometers from Addis Ababa	6.7	Town of Majete destroyed. Kara Kore seriously damaged. Buildings in Addis Ababa were damaged
14 July, 1960	Rift near Chibi volcano	6.3	
4 October, 1928	Westward of Lake Abaya	6.0	
Langano Earthquake 1906	Around 100 kilometers from Addis Ababa	6.8	

Source: USGS

Table 2 Earthquakes in and around Kenya

Event Date	Location of Epicentre	Magnitude
10 September, 2016	Nsunga, north-western Tanzania	5.9
17 April, 2012	Near Nairobi	4.6
15 April, 2011	Rural Tanzania	4.7
18 July, 2007(part of swarm of Earthquakes 12 July - 16 Sept, 2007)	Northern Tanzania	6
5 February, 1994	Kismoro, Uganda	6.2
20 May, 1990	Southern Sudan	7.2
10 March, 1989	Salima, Malawi	6.1
20 August, 1989	Dobi Graben, Ethiopia	6.5
29 March, 1969	Sardo, Ethiopia	6.3
20 March, 1966	Mt. Ruwenzori, Uganda	6.1
1 June, 1961	Kara-Kore, Ethiopia	6.7
14 July, 1960	Awasa, Ethiopia	6.1
18 March, 1945	Masaka, Uganda	6
9 October, 1942	Lake Nyasa	6.7
1937	Lake Turkana, Kenya-Ethiopian border	6.1
6 January, 1928	Mt. Kenya	6.9
8 July, 1919	W. Tanzania	6.7
23 September, 1915	Coast of Eritrea	6.7
1913	Turkana	6
9 July, 1912	N. Uganda	6.7
13 December, 1910	Lake Tanganyika	7.1
25 August, 1906	Central Ethiopia	6.8

Table 3 Earthquakes in and around Uganda

Event Date	Location of Epicenter	Magnitude	Impact
10 September, 2016	Nsunga, north-western Tanzania	5.9 M _w	More than 100 houses were destroyed
3 July, 2013	Lake Albert region	5.7	Not known
5 February, 1994	Kisomoro, Western Uganda	6.2 M _w	8 people dead & destruction of property worth US\$ 61 million in the western districts of Kasese, Bundibugyo, and Kabarole
9 October, 1991	Butiaba on Lake Albert	5.3	Destroyed semi-permanent buildings
7 September, 1990	Lake Victoria close to Kampala	5	Destroyed semi-permanent buildings around Kampala
20 March, 1966	Toro, Western Uganda	6.8 M _w	150 people dead & over 1,300 injured as well as property loss worth millions of dollars
18 March, 1945	Sembabule (40 km north of Masaka town)	6	Entebbe seismograph put out of order, 5 people dead & destruction of some buildings
2 October, 1929	Toro, Western Uganda	5.9	Change of water color in the hot springs and earthquake induced landslides
9 July, 1912	Kitgum close to Aswa shear zone	6 M _w	Partial destruction of buildings in northern and northwestern Uganda

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