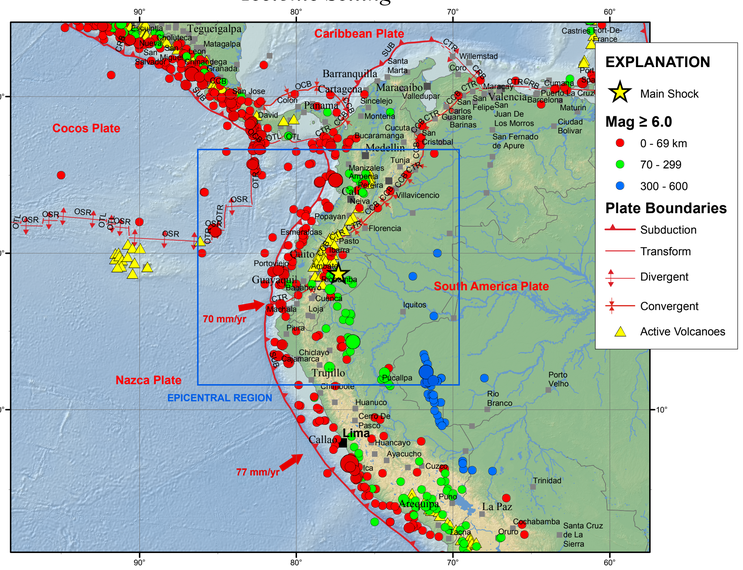
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the Global Seismographic Network

GSN

M7.1 Ecuador Earthquake of 12 August 2010

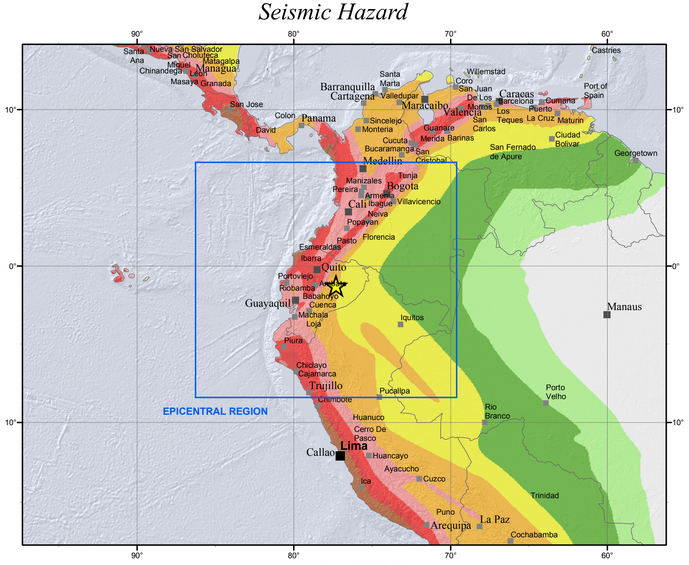
Tectonic Setting



RELATIVE PLATE MOTIONS

In the region of this earthquake, the Nazca Plate moves east-northwest with respect to the South America Plate.

Seismic Hazard

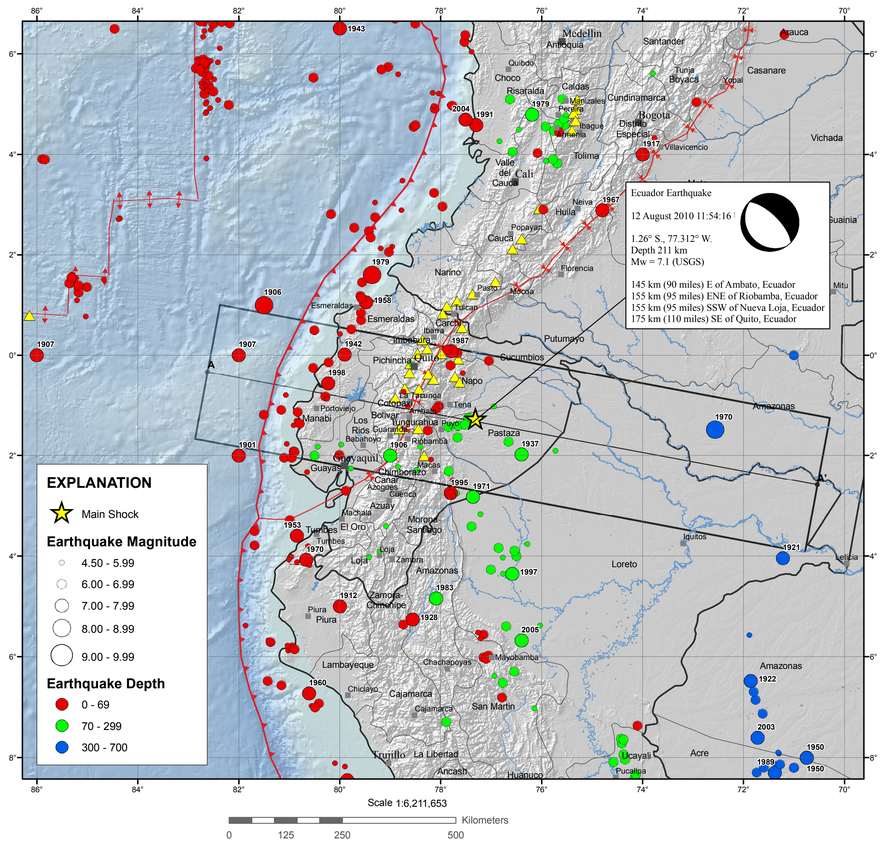


Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

Peak Ground Acceleration in m/sec**2

.2 .4 .8 1.6 2.4 3.2 4.0 4.8

Epicentral Region



TECTONIC SUMMARY

This major earthquake occurred within the lithosphere of the Nazca plate. The earthquakes of Ecuador and most of western South America are due to strains generated by ongoing subduction of the Nazca plate beneath the South America plate. At the latitude of the earthquake, the oceanic Nazca plate moves east relative to the South America plate at a rate of about 70 mm per year. It is overridden by the South America plate at the Peru-Chile trench, west of the Ecuadoran coast, and sinks into the earth's mantle beneath the South America plate. The subducted Nazca plate is seismically active to depths of about 650 km. This earthquake occurred as normal faulting within a segment of the subducted plate that has produced frequent earthquakes with focal depths of 160 km to 200 km beneath the earth's surface.

Earthquakes that have focal-depths between 70 and 300 km are commonly termed "intermediate-depth" earthquakes, as distinguished from "shallow-focus" earthquakes, having depths less than 70 km, and "deep-focus" earthquakes, having depths greater than 300 km. Intermediate-depth and deep-focus earthquakes represent deformation within subducted plates, rather than deformation at plate boundaries. Intermediate-depth and deep-focus earthquakes typically cause less damage on the ground surface above their foci than is the case with similar magnitude shallow-focus earthquakes, but large intermediate-depth and deep-focus earthquakes may be felt at great distances from their epicenters

Significant Earthquakes Mag >= 7.0

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1901	01	07	0029	-2.000	-82.000	0	7.2
1906	01	31	1536	1.000	-81.500	0	8.8
1906	09	28	1524	-2.000	-79.000	150	7.5
1907	06	01	0845	0.000	-82.000	0	7.0
1907	06	05	0318	0.000	-86.000	0	7.0
1912	07	24	1159	-5.000	-80.000	0	7.0
1917	08	31	1136	4.000	-74.000	0	7.1
1921	12	18	1529	-4.043	-71.223	544	7.5
1922	01	17	0350	-6.482	-71.859	358	7.4
1928	05	14	2214	-5.261	-78.559	35	7.2
1937	07	19	1935	-1.978	-76.397	184	7.1
1942	05	14	0213	0.012	-79.902	35	7.8
1943	05	02	1718	6.500	-80.000	0	7.0
1950	07	09	0440	-8.000	-70.750	650	7.0
1950	07	09	0450	-8.000	-70.750	650	7.0
1953	12	12	1731	-3.597	-80.847	19	7.5
1958	01	19	1407	1.054	-79.480	35	7.8
1960	11	20	2202	-6.727	-80.606	52	7.8
1967	02	09	1524	2.889	-74.799	40.4	7.2
1970	07	31	1708	-1.486	-72.563	644	8.0
1970	12	10	0434	-4.079	-80.662	20.1	7.1
1971	07	27	0202	-2.825	-77.362	94.5	7.3
1979	11	23	2340	4.793	-76.190	108	7.2
1979	12	12	0759	1.603	-79.362	24.4	8.1
1983	04	12	1207	-4.845	-78.091	125	7.0
1987	03	06	0410	0.083	-77.785	16.4	7.2
1989	05	05	1828	-8.298	-71.381	593	7.1
1991	11	19	2228	4.585	-77.295	21	7.2
1995	10	03	0151	-2.750	-77.801	24	7.0
1997	10	28	0615	-4.359	-76.585	112	7.2
1998	08	04	1859	-0.560	-80.230	20	7.2
2003	06	20	0619	-7.606	-71.722	558	7.1
2004	11	15	0906	4.695	-77.508	15	7.2
2005	09	26	0155	-5.678	-76.398	115	7.5
2010	08	12	1154	-1.260	-77.312	211	7.1

USGS science for a changing world

USAID FROM THE AMERICAN PEOPLE

M 7.1, ECUADOR
Origin Time: Thu 2010-08-12 11:54:16 UTC
Location: 1.26°S 77.31°W Depth: 211 km

PAGER
Version 2
Created: 11 hours, 10 minutes after earthquake

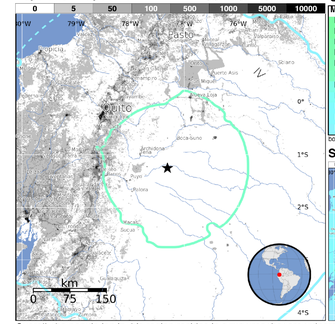
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		- -*	525k*	12.945k	642k	0	0	0	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY		I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING		Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan

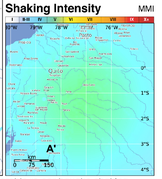


Selected City Exposure

MMI	City	Population
IV	Archidona	7k
IV	Puyo	25k
IV	Tena	17k
IV	Boca Suno	20k
IV	Palora	6k
IV	Latacunga	52k
IV	Quito	1,400k
IV	Guayaquil	1,952k
III	Pasto	382k
III	Mocoa	22k
III	Florencia	130k

bold cities appear on map (k = x1000)

Shaking Intensity



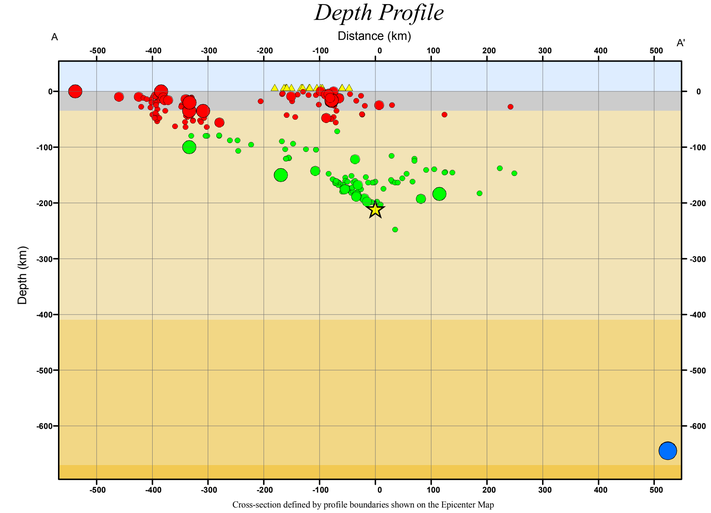
Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 7.1 earthquake 158 km Northwest of this one struck Reventador, Ecuador on March 6, 1987 (UTC), with estimated population exposures of 2,000 at intensity IX or greater and 14,000 at intensity VIII, resulting in a reported 5,000 fatalities. Recent earthquakes in this area have caused landslides that may have contributed to losses.

This information was automatically generated and has not been reviewed by a seismologist.

http://earthquake.usgs.gov/pager

Event ID: us2010zwa5

Depth Profile



Cross-section defined by profile boundaries shown on the Epicenter Map

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
HDF (unpublished earthquake catalog) (Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Finite Fault Model, Chen Ji, UC Santa Barbara (2007)

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models
ESRI Online

REFERENCES

Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027- 80.

Engdahl, E.R. and Villaseñor, A., 2002, Global Seismicity: 1900 - 1999, chap. 41 of Lee, W.H.K., and others,eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academeic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination: Bull. Seism. Soc. Amer., v. 88, p. 722-743.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
12 August 2010
Map not approved for release by Director USGS