

The Impact of Natural Disasters on the World's Ecological System

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Abstract. This article examines the impact of catastrophic factors on the ecology of the Earth. Natural cataclysms of geophysical, geological, hydrological, atmospheric and other origin, can have a devastating effect on human life, its economic activity, as well as on the entire ecological system. Disturbances of the landscape environment, affect the ecological conditions. They lead to destruction of flora and fauna, redistribution of water reserves, human and animal habitats. In connection with this problem, work has been done to study all types of earthquakes and their impact on the world's ecology. Comparative characteristics of magnitudes according to G.F.Richter scale, focal depths and number of earthquakes occurring in the world during the year are given. Observations show that the damage caused to man and the world ecology in the aftermath of disasters depends on the amount of energy released during fluctuations of the earth's surface.

1 Introduction

Natural disasters can cause many accidents and disasters. In the bowels of the earth are constantly running internal processes that affect the surface of the earth. Most of the time they occur unnoticed. An earthquake is a natural disaster or shaking of the earth characterized by a sudden release of stress energy in the earth's crust, a destructive force. It can cause surface fractures, tremors, vibrations, liquefaction, landslides, and tsunamis. In places of natural destruction associated with landslides, rock shifts, the surface of the Earth is severely affected. After such a natural disaster, people often leave cities, devastating entire neighborhoods. Severe earthquakes are second only to typhoons in their catastrophic nature and many times ahead of volcanic eruptions.

In this regard, the purpose of our work was:

To study earthquakes as natural disasters.

The following tasks were set:

1. Characterize the four types of earthquakes in the world.
2. Explore the effects of natural disasters.

2 Research methodology

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The object of the study were earthquakes of all types. Considered the major earthquakes of our and past days [1]. Described natural disasters such as the events in Chile in 2010. Turkey and Syria in 2023, which have taken hundreds of thousands of lives and caused immense damage to infrastructure and the entire ecosystem of these territories.

Every year a huge number of earthquakes occur on Earth, and only some of them are large-scale, the damage from which is irreparable[13]. One of the causes is the displacement of a section of the Earth’s crust, during which about 1020 J of potential seismic energy is released.

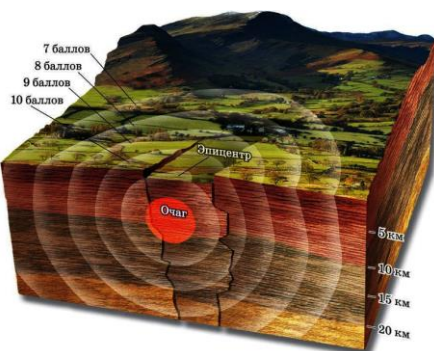


Fig. 1. Location and epicenter of the earthquake

Earthquakes have their origins below the earth’s surface, where rock fractures and shifts occur. They occur at depths of up to 10 km. The strongest vibrations are felt at the epicenter (Figure 1). The farther away from the epicenter of the earthquake, the weaker the vibration of the earth’s surface [2]. Given the consequences, the severity of an earthquake is rated on a scale of 1 to 12.

Table 1. Scale of G.F. Richter. Methods of measuring seismic activity

Magnitude	Focal point or hypocenter(km)	Number of earthquakes per year	Description
8,9	10	1	Strong earthquakes
6,0-6,9	5,0	799	Moderate destruction
4,0-4,8	3,0	6100	Weak shocks resulting in minor damage
2,0-3,0	1,0	4901	The weakest felt tremors

Table 1. The value of activity measurement according to the G.F. Richter scale is shown. Any seismic activity is characterized by its signs, which are given in this table. Magnitude equal to 2 corresponds to weak shocks, its source is located at the depth of 1 km. Frequency of such oscillations is about 50 thousand per year. Shocks with small destructive force correspond to magnitude 4.0-4.8, their epicenter is located at a depth of 3.0 km, the number of earthquakes per year is 6100 000. Moderate ruptures, where seismic intensity corresponds to 6.0-6.9, their epicenter is located at a depth of 5 km. The number of recurrences is about 799 per year. The most terrible and dangerous for a living organism earthquakes occur once a year, the epicenter of such oscillations is located at a depth of 10 km, and the intensity of destructions is 8.9 points on the Ch.F. Richter scale [3].

Activity of the highest magnitude is extremely rare and has serious consequences. Environmental hazards are always studied together with the processes occurring in

nature[8]. It has its stages of preparation, implementation and consequences, which cover the lithosphere, hydrosphere (mainly its underground part) and the biosphere. Therefore, no strong earthquake is independent. It occurs not only on land, but also on the bottom of the seas and oceans. In such cases, it is called a marine earthquake. Think of the earthquake and tsunami that hit Chile in 2010 [4]. Natural disasters in these areas have led to significant and unexpected changes in the ecosystems of these regions, giving scientists an opportunity to investigate how natural disasters can affect life and how rising ocean levels can affect the environment. A magnitude 8.8 earthquake in Chile changed the coastline where most of the country's population lives. The earthquake was followed by a powerful tsunami with waves up to 10 meters high, which naturally wreaked havoc on the coast: more than 500 people were killed, 1,200 or more were injured, and some 370,000 homes were destroyed or damaged. There is no doubt that earthquakes of this magnitude always have dramatic consequences for the ecosystem. However, unless scientists have data on the environment in the area before the earthquake, it is very difficult to assess the consequences after the catastrophe. During a disaster of this magnitude, the sandy beaches of Chile underwent significant changes. In particular, the coastline changed somewhat, which had a significant impact on the local ecosystem. The ecosystem's response was highly dependent on changes in land level, how mobile the animals were, the type of shoreline, and the extent to which humans changed the coastline [5]. For example, in places where part of the beach was submerged and no protective structures were made to prevent water from entering the shore, the living organisms in the tidal zone (that is, the area submerged by the tides and exposed by the tides) disappeared because their habitat was completely submerged. The most unexpected effects were observed on upland sandy beaches. Previously, tidal species had avoided these beaches because breakwaters had been erected there. After the earthquake, these species quickly began to fill in areas that were slightly elevated above the breakwaters. Plants began to return to places where they had long been absent. Of course, this is not the first ecological response to be expected from large earthquakes and tsunamis. Research in these areas can help understand what changes to expect after natural disasters. This is especially important for those who live near the shores of seas and oceans. Earthquakes have happened at all times and have claimed millions of lives [6]. And even in our time, scientists cannot predict in advance a catastrophic, natural phenomenon born from deep within the Earth. Apart from strong tremors, every year there are many small, underground tremors, which are harmless for people, animals and plants.

There are four different types of earthquakes: tectonic earthquakes, volcanic earthquakes, landslide earthquakes, and induced or man-made earthquakes.

3 Results and Discussions

Biological characteristics of growth and development of the objects of research, are decisive for the varietal characteristics of cherry, corresponding to the zonal conditions of cultivation and applied agronomic techniques.

Indicators of crown size - its diameter and volume, in corresponding units, trunk diameter, tree height, indicators of crown width along and across the row, refer to biometric parameters. In this work, biometric parameters of the research objects were also determined under the influence of medium-growing, dwarf and strong-growing rootstock VSL-2 (cherry-plum hybrid, F12/1 rootstock, Gizella and Gizella-5 rootstocks), on which experimental sweet cherry varieties were grafted [7].

Table 2. biometric indicators of the research objects are given

№	Indicators/ Variety	Regina	Cordia	Carina
1	Stem diameter, cm	3,0	6,5	2,5

	deviation, cm	x	-3,5	-0,5
2	Tree height, m	2,5	4,5-5,0	2,0
	deviation, m	x	-2,0-2,5	-0,5
3	Crown width along the row on both sides of the trunk, m	1,5	2,2	2,0
4	clearance with distance between trees = 2 m	0,0	2,5	0,5
5	Crown width across the row on both sides of the trunk, m	2,5	4,7	3,0
6	clearance between the crowns of the trees at a distance of 5 m between the rows,	2,5	3,8	3,0
7	Crown diameter m	1,6	2,8	2,1
	deviation, m	x	-0,6	-0,5
8	Crown volume, cu.m.	3,3	4,7	3,8
	deviation, cu.m.	x	-1,4	-0,5
9	Angle of departure of skeletal branches of young trees, degrees	30,0	62,0	35,0
	deviation, degrees	x	-32,0	-5,0

Table 2. data of biometric parameters of research objects are given, where a positive value of deviation, means increase of value of indicator of research object, and a negative deviation - decrease. Hence, under the scheme of planting the orchard 3x4 m, the diameter of the trunk was 42,5 cm [8]. In conditions of intensive horticulture, it is an important feature that sweet cherry varieties with a smaller diameter of the trunk were characterized by less active growth, as it is more convenient to harvest from lower trees. A huge influence of modern technology on the formation of the crown and fruits. The most important element of intensive horticultural technology, which depends on the technologicity of the variety, features of pruning of fruit-bearing trees, is the angle of departure, ranging from 40 to 60 degrees [9]. Meeting modern requirements varieties, with crown formation on the type of “French axis”, “artificial spindle”, etc., which greatly increase the possibility of using them in intensive cultivation. One of the main elements in intensive horticultural technologies is: density of tree placement schemes, when selecting which, take into account the varietal specificity of shoots growth along and across the row, diameter, width and volume of the tree crown. Determine also, the activity of tree growth, the choice of the crown shape of a fruit tree, the type and nature of pruning work. The density of crowns should not hinder the growth of neighboring trees, with dense planting schemes. The distance between two trees of the same row, taking into account the gap between them, determines the index of crown width along the row. It was found that towards the less shaded space, the growth of tree branches is less active, and therefore, the distance between the row should be greater than the distance between trees along. In the experimental planting scheme of 3,0x4,0 between seedlings, there should be actually no gap [10]. The gap between tree crowns at a certain distance between the rows, suggests the possibility of reducing the row spacing, to increase the intensity of plantings, taking into account the allowable value of the gap between tree crowns, equal to 2.6 m.

Biometric indicator of the cherry varieties under study (volume of leaf surface, number of leaves), involved in photosynthesis, is involved in the main process of formation of more than 90% of dry matter required for the life of the tree.

Table 2. Description of earthquake types.

Name of earthquakes Characteristics

Tectonic earthquakes occur due to the destruction of the Earth's crust, due to geological forces acting on rocks and plates.

Volcanic earthquakes are less common in nature than tectonic ones. They are the result of volcanic activity.

Landslide earthquakes Small effect of seismic waves causing earthquake collapses in underground tunnels and mines

Induced or artificial (explosive) earthquakes usually caused by the detonation of a nuclear or chemical bomb

Table 2. A comparative characteristic of all types of earthquakes that can damage our ecosystem is given [11]. Tectonic earthquakes are earthquakes caused by plate tectonics. [10.C.240]. Two giant belts - the Pacific and the Mediterranean-Asian, when the collision of lithospheric plates form mountains. A striking example of a tectonic earthquake, are the events of our days (February 6 in the province of Kahramanmaraş, Turkey, has been a terrible earthquake of magnitude 7.7. The number of earthquake victims in southeastern Turkey rose to 47,975 and in Syria, in the city of Aleppo, to 8,476, tens of thousands more were affected). Until now, the material damage caused by nature and, presumably, by man (negligence of architects to building structures in the disaster area) has not been fully investigated.



Fig. 2. Earthquake in Turkey 06.02.2023



Fig. 3. Earthquake in Aleppo. Syria 2023

Fig. 2, 3 (Turkey and Syria after the catastrophe of 2023) shows the devastating tectonic earthquake, which was called the “catastrophe of the century”.



Fig. 4. Volcanic earthquake

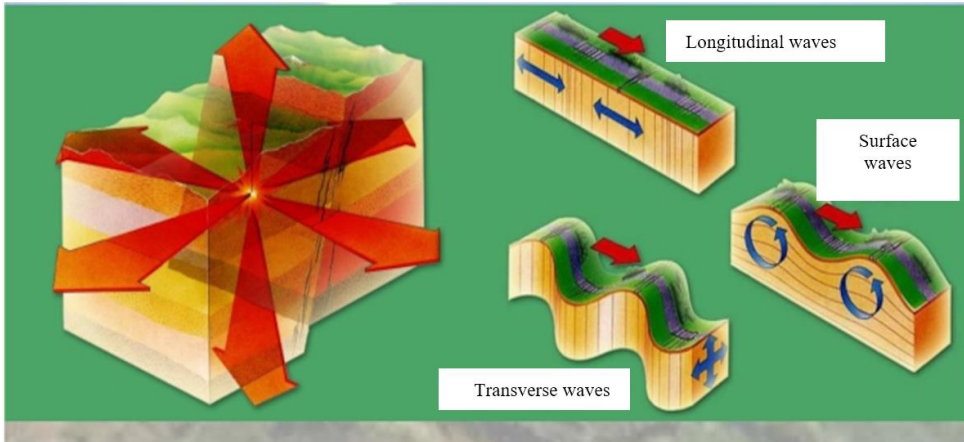


Fig. 5. Seismic wave propagation

A volcanic earthquake is characterized by sudden temperature variations due to magma, resulting in an explosion. Against the background of such an explosion (see Fig. 4), a devastating earthquake occurs [12].

Strong earthquakes often occur in karst areas or near mining operations (Fig.5) describes the propagation of seismic waves:

- a) primary or longitudinal P-type waves, which can push and stretch the surface of the earth at a speed of 10 km/s.
- b) secondary or transverse S-type waves, which move particles of matter up and down at a speed of 5 km/s.
- c) surface waves, which propagate along or parallel to the ground, the speed of such waves-3.1/4.5 km/s. [2.P.50-56].

Earthquakes are considered as unpredictable natural phenomena, therefore correct determination of seismic hazard, remains the main task of seismologists.



Fig. 6. Induced or explosive earthquakes

Human intervention in the natural environment is great: tunneling, geothermal projects, and hydraulic fracturing cause induced earthquakes (see Figure 6). The consequences of such natural phenomena can be the most terrible and unpredictable, capable of depriving lives, shelter, contaminating drinking water and, as a result of unsanitary conditions, leading to outbreaks of disease [13]. Earthquakes are natural disasters that affect the environment. They can lead to atmospheric pollution, releasing huge amounts of dust, gases

and other harmful substances. Air pollution negatively affects human and animal health. Natural disasters and their anthropogenic effects disrupt the natural balance, which affects the environment.

Let's list some of them:

- Fires at anthropogenic objects, leading to environmental consequences.
- Discharge of water reservoirs with the formation of water shafts below the dams.
- Oil, gas and water pipeline bursts, oil product spills, gas and water leaks.
- Ammunition explosions.

In turn, earthquakes can not only negatively but also positively affect the earth's crust. They can displace rocks, expose new areas for exploration and form oases, which contributes to the development of the ecosystem. Earthquakes give control to the interior of the Earth, creating terraces, ridges, and forming minerals, minerals, and natural sources of energy. During earthquakes, the earth's surface rises, breaks, and cracks, creating beautiful landforms that add to the splendor of our planet. In general, these processes lead to the formation of new ecological zones and communities.

4 Conclusions

1. When studying the problem of natural disasters, a comparative characteristic of 4 types of earthquakes is given.
2. Methods for measuring seismic activity are described.
3. The consequences of natural disasters, as well as damage to humanity and the ecosystem, are considered, using the examples of earthquakes in Chile, Turkey, and Syria.

Based on the results obtained in the course of this work, we can say that along with natural factors, humans make a negative contribution to the destruction of the environment. The main problem of people today is that they destroy everything with their own hands - they pollute the atmosphere, natural water sources, cut down forests, treat the bowels of the earth carelessly. All this gradually leads to the destruction of the ecosystem. At this point, man needs to make every effort to preserve the environment. It is necessary to control the wastage of natural resources, land use, deforestation, pollution and salinization of soils and underwater waters. Preserve the biota as much as possible. If we do this today, we will have a good ecology for our children to live in tomorrow. Take care of pristine nature, and it will keep our planet green.

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