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THE MAIN FACTORS OF MUDFLOW FORMATION ON THE SLOPE AREAS OF THE CARPATHIANS

ОСНОВНІ ЧИННИКИ УТВОРЕННЯ СЕЛЕВИХ ПОТОКІВ НА СХИЛОВИХ ТЕРИТОРІЯХ КАРПАТ

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Abstract. *The earliest studies of mudslides in Ukraine were recorded at the end of the 19th century in Crimea. The occurrence of mudslides is usually periodic and depends on the accumulation of loose debris in areas prone to mudslides and the occurrence of dangerous meteorological conditions (prolonged rains, heavy downpours, etc.).*

In addition to the destructive force, which often has a negative impact on the biosphere, including leading to human casualties and material damage, it is necessary to note the great geodynamic role of mudslides in denudation processes. Mudslides can also be caused not only by intense precipitation, but also by low-intensity precipitation, if they last for a long time. The main reasons for the development of mudslides are heavy rainfall, the presence of rocks and the accumulation of loose debris that are easily eroded, as well as soil erosion caused by deforestation and intensive grazing of livestock. The movement of debris down slopes can occur not only under the influence of rainwater, as gravitational and atmospheric processes are also of great importance.

Keywords: *mudflows, floods, flooding, landslides, anthropogenic impact.*

Анотація. *Найдавніші дослідженнями селів на території України були зафіксовані ще в кінці 19 століття у Криму. Виникнення селевих зсувів зазвичай має періодичний характер та залежить від накопичення сипучого сміття в районах, що схильні до селевих зсувів, і виникнення небезпечних метеорологічних умов (тривалі дощі, сильні зливи та ін.)*

Крім руйнівної сили, яка часто має негативний вплив на біосферу, у тому числі призводить до людських жертв і матеріальних збитків, потрібно відмітити велику геодинамічну роль селів у процесах денудації. Селеві зсуви можуть бути також зумовлені не лише інтенсивними опадами, а й опадами малої інтенсивності, якщо вони тривають довгий час. Основними причинами розвитку селів є сильні зливи, наявність гірських порід та накопичення сипучого сміття, що легко піддаються розмиву, а також ерозія ґрунтового покриву викликана вирубкою лісів та інтенсивного випасання худоби. Рух сміття по схилах може відбуватися не лише під впливом дощової води, оскільки велике значення також мають гравітаційні і атмосферні процеси.

Ключові слова: *селеві потоки, паводки, повені, зсуви, антропогенний вплив.*

Introduction.

The earliest studies of mudslides in Ukraine were recorded at the end of the 19th century in Crimea. This is due to their destructive effect, which leads to significant economic losses in areas where such phenomena are observed. In the 40s of the 20th century, floods caused by large-scale deforestation became especially active. The occurrence of mudslides is usually periodic, namely 9-10, 14-19 years, etc. It depends on the accumulation of loose debris in areas prone to mudslides and the occurrence of dangerous meteorological conditions, in particular prolonged rains, heavy downpours, etc. [1]. In addition to the destructive force, which often has a negative impact on the biosphere and leads to human casualties and material damage, it is necessary to note the great geodynamic role of mudflows in denudation processes. It is known that a mudflow in a small mudflow basin can carry as much loose debris material at one time as a normal water flow would be able to carry in just a few centuries [2].

The main text

Cases of mudslides are observed in many countries of the world, in particular, more than 15% of the Earth's landmass is to one degree or another prone to mudslides. In Ukraine, the areas prone to mudflows include Crimea and the Carpathian region. The main reasons for the development of mudflows are heavy rains, the presence of rocks and the accumulation of loose debris that are easily washed away, as well as soil erosion caused by deforestation and intensive grazing of livestock. Most often, mudflows are observed during intense summer rains, but occasionally mudflows occur in winter. In June 2024, a mudflow descended on the tracks within the Solya-Velykyi Berezny section on the route from Lviv to Uzhgorod, causing damage to the transport infrastructure (fig. 1) [2, 3].

The most typical conditions for the formation of mudslides are rains of 50-100 mm/day - 53% of cases, and 20-50 mm/day - 30% of cases. Precipitations with an intensity of more than 100 mm/day are relatively rare and occurred in 14% of cases of mudslides. As for small rains with an intensity of 10-20 mm/day, they formed

mudslides only in 3%. Mudslides can also be caused not only by intense precipitation, but also by precipitation of low intensity, if they last for a long time. Such precipitation leads to the occurrence of mudslides due to the flooding of rocks on the surface of the slopes. Moreover, in this case, mudflows are longer than with intense precipitation [1].

Fig. 1. The descent of a mudflow through a railway track on the way from Lviv to Uzhgorod (Transcarpathian region) https://t.me/UkrzalInfo/5793

The territory of the Ukrainian Carpathians is the central part of the Carpathian Mountains, the total length of which is about 240 km and the width is 50 km. A characteristic feature of these mountains is the presence of ridges that run almost parallel to each other. According to the Carpathian station Selestok, the formation of mudslides in the studied area occurs during intense rainfall. The removal of loose material occurs due to the violation of the self-drainage of the riverbed, intensive washing of the banks and undercutting of slopes in landslide areas [1].

The movement of debris on slopes can occur not only under the influence of rainwater, since gravitational and atmospheric processes are also of great importance. Therefore, the movement of debris has 2 types. The first is the movement of debris by sliding or rolling along the surface of the slope, and the second movement of debris is associated with temperature fluctuations due to changes in the volume of debris, freezing and thawing of water in the pores of the soil formed by ice. When the fragment reaches the limiting angle of inclination, it falls onto the face and moves down the slope.

Conclusion and findings.

Therefore, in addition to the destructive force, which often has a negative impact on the biosphere, including leading to human casualties and material damage, it is necessary to note the great geodynamic role of mudflows in denudation processes.

The main reasons for the development of mudflows are heavy rains, the presence of rocks and the accumulation of loose debris, which are easily eroded, as well as soil erosion caused by deforestation and intensive grazing of livestock. The movement of debris along the slopes can occur not only under the influence of rainwater, since gravitational and atmospheric processes are also of great importance.

References:

1. Budnik Svetlana Main Factors of Mudflows Formation and Tracking of Movement of Mountain Rock Fragments. International Journal of Mining Science (IJMS). Volume 9, Issue 2, 2024, PP 9-12. http://doi.org/10.20431/2454-9460.0902002

2. Кузьменко Е.Д. Прогнозування селевих процесів: монографія / Е. Д. Кузьменко, Т. Б. Чепурна - Івано-Франківськ: ІФНТУНГ, 2014.-254с.

3. Snitynskyi Volodymyr, Khirivskyi Petro, Hnativ Ihor, Hnativ Roman. Landslides and erosion phenomena in the foothills of the Carpathian region rivers. Scientific Journal “Theory and building practice” (JTBP). Lviv: LPNU. 2020. Volume 2, Number 1. P. 9-15. https://doi.org/10.23939/jtbp2020.01.009

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