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THE METHODOLGY OF EVALUATIONG HARMFUL INFLUENCE OF WATERS

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General methodology for the evaluation (determination) of the harmful effects of water resources is not applicable In Armenia which allows the sizes of such impacts to be evaluated for each emergency situation, to evaluate the negative impact of the disaster and to recover damages to the victims. Instead, such functions are delegated to committees created for special cases who are responsible for the damage evaluation either by themselves as experts or for inviting the expert expert(s) to realize the damage evaluation function.

Key words: water, disaster, resaurce, precipitaion, flood, damage, emergency situation, ecosystem

Introduction

Climatic disasters have sharply increased in recent years which are linked by a number of specialists with global climate change; others view them as a result of human activity. Yet in 2009 it was estimated that more than 40% of the land resources of the planet is considered dry, i.e. they are located in lowland, semi-desert and desert areas. Such situation has direct impact on a quarter of a billion people and has an indirect effect on another billion people. It should also be noted that in some regions a sharp increase in the number of natural disasters such as precipitations is recorded that exceed the capacity of the canals that often lead to waterlogging, endanger the sustainable operation of water infrastructures and the ecosystem stability **[**1].

Conflict settings

The key issues facing the mitigation of consequences of climate-related disasters and damages, including the damages to the population and economic entities are in the centre of attention of the executive body. This is one of the reasons that, for example, it was foreseen to envisage the concept of prevention of natural disasters (drought, hail, etc.) by the programme approved by the Government decision N 1060-A of 18 October, 2016 of the Republic of Armenia **[**2].

Only annual damage to the agriculture as a result of drought, hail, breeze, spring frosts and mudflows is estimated at 15-30 billion AMD in recent years. Moreover, most of the damage is caused by hail. According to the climate change scenarios, it is possible that the frequency of unstable weather accompanied by thunderstorms and hail will increase in spring and summer. In this case, the agricultural fields of the middle mountain belt between the northern and southern regions of Armenia will be the most vulnerable. At present, nearly half of the cultivated lands in Armenia are irrigated and about 70% of crop production grows there. The anticipated reduction of water resources from climate change will cause serious problems in irrigated farming **[**3].

The flood damage in Armenia is the largest and the gradual increase in floods and their consequences is noted. During the period from 1994 to 2007, the flood damage was amounted to $ 41 million, including $ 18 million in Lori region, $ 13 million in Shirak, $ 5 million in Tavush and $ 2.5 million in Gegharkunik **[**4].

Thus, the main preferable directions towards the preventing the damages from natural climatic disasters and decreasing their results in RA include the following according to the regulation:

- Implementation of the system of insurance in agriculture,
- Improving the irrigation system through reducing the damages,
- implementation of water saving modern technologies,

- application of the hail protection structures and technologies,
- correct prediction of natural climatic disasters through application of effective warning methods to rise the level of acknowlegdement of farmers in agriculture,
- promotion of local production of modern methods of struggle against natural climatic disasters in the state-private sector cooperation.

The term "Harmful effects of water" includes: rinsing, erosion, flooding, mudflows, waterfalls, coastal dams and rising of groundwater, soil swamping and salinization, emergence of new gorges, deepening of previous ones, activation of landslide phenomena, drought and the prevention of harmful effects of water is one of the problems of the RA Water Code **[**5].

The study of damage compensation mechanisms written down in the Water Code of Armenia is as follows: the procedure for the elimination of consequences of accidents of hydraulic structures and the order for compensation of damages are defined by the RA Government decision (Article 89) and the emergency situation caused by the harmful effects of water and the order of their prevention envisages the activity of information system about floods, mudflows, landslide and drought (with its sub-systems) and the record of emerging such risky events in State water cadaster (Article 91). The RA Water Code also envisages elaboration of programs to protect settlements, areas of economic value and the population's property from risk of floods, mudflows and landslides with the National Water Program where appropriate measures should be described.

The Code also establishes that the Government creates committees and defines the order of their activities for the recording of the damage caused by natural disasters, by the harmful effects of waters and application of their elimination measures.

The regulation on compensation for damages caused by the use of water resources contains the decision No 1861-N of 16 December, 2004 of the Government of the Republic of Armenia according to which the damage caused to the property of physicall and legal persons, to the lives and health of physical persons as a result of the crash of hydraulic structures is subjected to compensation by law according to the established procedure (point 19 of the decision) **[**6]. Taking into consideration the size of damage caused by the accident, it shall be determined by mutual agreement of the interested parts, and, in case of disagreements, in the manner prescribed by the RA legislation (paragraph 20 of the decision).

Research results

The evaluation of risk of dangerous natural processes and events is done in several ways. The first group of methods for assessing risk can be attributed: those that practically replace the concept of risk with the concept of danger which is fundamentally wrong. Risk is the probability of undesirable consequences and danger is a potential threat. Danger, as a rule, is qualitative characteristics obtained in various ways. Among them one can mention an expert evaluation, a widely distributed scoring. Another group of risk assessment methods include those that assess the likelihood of the consequences. They are, as a rule, based on theoretical and statistical research. The basis is the assertion that risk is a function of exposure, vulnerability and security of an object from a hazardous natural impact. The latter are the most promising methods of risk assessment.

In evaluating the risk of slope processes (mudflows), the following indicators are used: the probability of an event (the frequency of mudflow processes), the vulnerability of the assessed objects (vulnerability in space and vulnerability over time), social economic indicators **[**7]. The proposed method for assessing the economic risk of mudflows is applicable on a small and medium scale.

To assess the risk of mudflows in economic indicators, instead of population density and population size, the values of the conditional gross municipal product in administrative regions were used. Studies have shown that even within the mudflow basin, no more than 5% of the territory falls into the zone of mudflow, and most often the affected area is 1-2% of the mudflow area. The coefficient of vulnerability of objects was used instead of the lethality factor. Therefore, the final formula for calculating the overall economic risk from mudflows is as follows:

$$R_p = P \times Y_t \times Y_s \times S \times K_y\,, \quad (1)$$

where R_p is the complete economic risk, P is the frequency of mudflows, Y_t is vulnerability in times, Y_s is the vulnerability in space, S is the conditional gross municipal product, K_y is the coefficient of the vulnerability of the building.

The vulnerability of the territory in space is determined by the infection of the territory by mudflows which is defined by

$$Y_S = F_{mdf} / F_{tot}, \quad (2)$$

where F_{mdf} is the area of mudflow endangered basins within the administrative regions, F_{tot} is the area of administrative regions.

The vulnerability of the area in time is determined by $Y_t = L_{mdf} / 365$, where L_{mdf} is the duration of mudflow threatened period, 365 is the number of days in a year.

The values of vulnerability index of the objects in the areas of municipal forms are accepted according to dependence from the degree of danger of mudflows, for the territories with low degree of danger - 0,01, in average - 0,02 and for high - 0,05.

The studies show that therefore it is possible to generalize certain approaches and use them in evaluating the damages by water resources [8].

The total algorithm for methodology (block-circuit) includes the following four sections continuing each other:

In block 1 the calculation of the value is determined. It may be helping the subject inside, determining the necessary occasions and evaluation of their effectiveness, the calculation of influence of possible results of ES for the further development of area which is subjected to the impact of the elements. In block 2 in accordance with the purpose set the collection of indicators is determined which characterize the social economic consequences of ES. They can be all or only separate indicators from the list shown in this Methodology.

The direct losses of budget of the governing bodies of different levels connected with unnecessary expenditures for abolition the consequences of ES and reduction of tax incomes include:

- the amount of expenditures for evacuation and resettlement of the population;
- the amount of expenditures for feeding the population;
- the amount of expenditures for rendering medical assistance to the affected population;
- the amount of expenditures for emergency rescue, emergency and recovery;
- the amount of expenditures for other urgent affairs;
- the amount of expenditure for providing communal services to the affected population;
- the amount of expenditures for providing one-time material assistance to the affected population;
- the amount of social benefits and guarantees to ensure the preservation of the living standards of the affected population;
- the amount of non-receipt of tax deductions to the state budget and budget of the territory (region).

Potential losses of budgets of the governing bodies of various levels, related to the need for expenses for the restoration of the functioning of the country's main economic systems include:

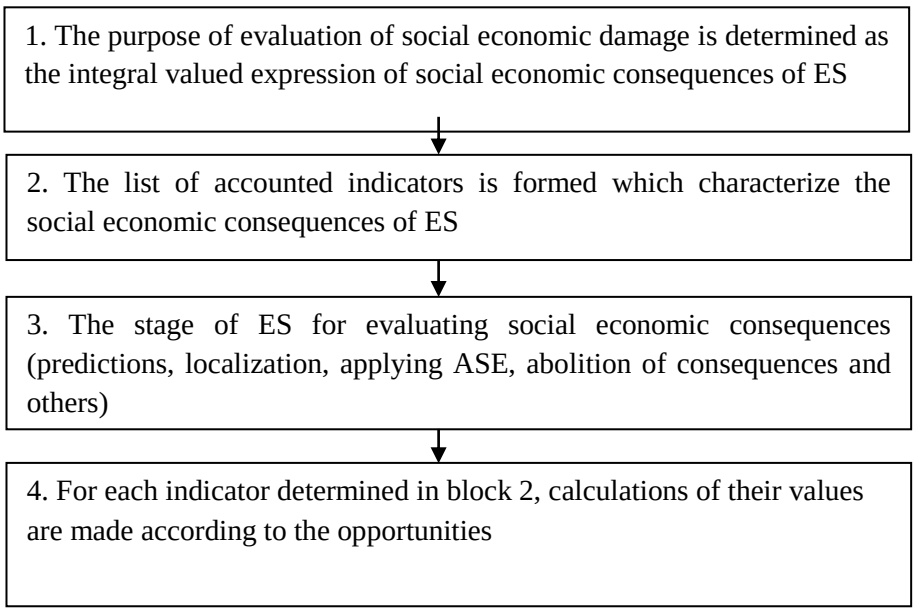
- loss of population;
- loss of labour;
- loss of social infrastructure;
- amount of damage in industry;
- amount of damage in the transport system;
- size of damage in the fuel and energy complex;
- the amount of damage in the social sphere and life welfare infrastructure;

- amount of damage in livestock;
- amount of damage in crop production;
- amount of damage in the ecology.

The summative indicator of evaluating social economic damage is the amount of damage of the region from ES.

In block 3 the certain conditions of evaluating social economic consequences from ES are determined whether this can be the stage of prediction when characteristics of ES are only suggested or this is the stage when the characteristics are already known (localization of ES carrying emergency security activity and so on), but the data was not received from the places on the values of the indicators of social economic consequences or the stage when all factual meanings of those indicators are already known or their separate components with the help of which the real picture can be estimated.

In block 4 the calculation of certain conditions determined by previous blocks to get the starting information from those chosen indicators in block 2 are shown.



Pic.1. The formation of the conditions of calculation and the calculation of evaluation of social economic consequences of emergency situations

The indicators of economic damage are calculated for each ES.

For comparative analysis the indicators are purposefully determined over the branches in accordance with calculation of the data of state statistics as follows:

For techno gene ES and emergencies the indicators are defined for the objects (enterprises):

- industry and construction which include industrial facilities associated with the use, production, storage, transportation through fire hazardous and explosive pipelines, harmful radiation substances, the exploitation of slag ponds and slag accumulators;
- energetics including hydroelectric power stations, thermal power plants, nuclear power plants, hydraulic engineering structures;
- municipal services only for water supply and sewerage facilities, central heating, heat supply systems;
- means of transport connected with transportation of dangerous luggage by cars, railway, water and air transport.

The summative economic indicator of the damage by ES is the damage by ES which presents itself the summary of the following elements:

- cost of lost fixed assets due to emergencies;
- Cost of lost materials of different resources (material storage, ready products, household things etc.) as a result of ES;
- Lost amount of production as a result of ES presenting itself the difference between planned and factual indicators of the amount of production;
- expenditures for realizing search activities in the zones of ES;
- expenditures for passing emergency rescue activities in the zones of ES;
- expenditures for passing the urgent emergency reconstructing activities for the objects suffered as a result of ES;
- expenditures for shopping, delivery and short time storage of material resources for preliminary living support of affected population;
- expenditures for the deployment and maintenance of temporary accommodation and food for evacuated affected citizens within the required period but not more than a month (including the cost of renting buildings (constructions) for living and feeding the affected people, the provision of temporary accommodation and food, the acquisition of household equipment, the purchase of building materials, the payment of works for the construction of sites (towns) for the living and food of the victims, the maintenance of sites (cities) for living and food, the cost of utilities, household expenses, the cost of food and cooking);
- expenditures for reimbursement of expenses related to the abolition of emergency situation;
- expenditures for the repayment of state housing certificates issued to citizens of the Republic of Armenia who lost their homes as a result of emergency situations;
- the expenditures of providing lump-sum material assistance to the affected citizens;
- Expenses for social payments to persons affected by the disaster.

Conclusion

The analysis of current state of disaster prevention shows that it is urgent in this sphere to clarify the state policy and to determine the composition of relevant measures based on that. The studies conducted by us show that in the main directions of prevention of damage caused by climatic disasters (including those from water resources) in Armenia and in the list of proposed solutions the development of the methodology of damage evaluation (as a document) has not found its place.

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ՋՐԻ ՎՆԱՍԱԿԱՐ ԱԶԴԵՑՈՒԹՅԱՆ ԳՆԱՀԱՏՄԱՆ ՄԵԹՈԴԱԲԱՆՈՒԹՅՈՒՆԸ

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Հայաստանում չի կիրառվում ջրային ռեսուրսների վնասարար ազդեցության որոշման (գնահատման) ընդհանրական մեթոդաբանություն, որը թույլ կտար որոշել այդպիսի ներգործության չափերը յուրաքանչյուր արտակարգ իրավիճակում, գնահատել աղետի բացասական ազդեցությունը՝ տուժած անձանց վնասները փոխհատուցելու համար: Փոխարենը, այդպիսի գործառույթների իրականացումը պատվիրակված է առանձին դեպքերի համար ստեղծվող հանձնաժողովներին, որոնք կամ իրենք պետք է ստանձնեն վնասները գնահատող փորձագետի դերը, կամ պետք է հրավիրեն փորձագետներ՝ վնասների գնահատման գործառույթն իրականացնելու նպատակով:

Բանալի բառեր. ջուր, աղետ, ռեսուրս, տեղումներ, հեղեղ, վնաս, արտակարգ իրավիճակ, էկոհամակարգ

МЕТОДИКА ОЦЕНКИ ВРЕДНЕГО ВОЗДЕЙСТВИЯ ВОДЫ

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Ключевые слова: вода, катастрофа, ресурс, осадки, наводнение, ущерб, чрезвычайная ситуация, экосистема