Joint Strategy on the sustainable management of risks of excessive insect proliferation in the Cross-Border Region Romania-Bulgaria

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CONTENTS

PROIECT 15.3.1 0.3

12.1

TRADUCĂTOR AUTORIZAT OLTEANU ADELINA GEORGIANA CĂLĂRAȘI-ROMÂNIA

GENERAL INFORMATION

The largest part of the Cross-Border Area Romania-Bulgaria is crossed by the waters of the Danube, hosting on its shores favourable environments for the development of mosquito fauna (culicidae) and other vector arthropods.

Romania and Bulgaria have constantly faced the presence of various vector insects species in abundant populations and with the maladies carried by these, because of the extended range of natural and antropic ecosystems and because of favourable habitats for their development. Lately, an increase in their development connected with the environmental changes (especially those related to climate) is noticed, leading to the increase of occurrence and reoccurence of maladies carried and transmitted by these vectors.

The evaluation of these potential risks is what imposed the studies of the project and the development of the Strategy.

I.Institutional and Regulatory Framework

The European Union member states have developed strategies, laws and methodologies for application regarding the sustainable management of excessive insect proliferation risks.

We mention that there is a specific legislation, applicable at European level, that marks the framework that should be considered by each member state of the European Union. It is clear that national legislation must be harmonized with the European Union directives and regulations.

The general framework generally accepted at European level was set by the Biocide Product Directive (98/8/EC), replaced with the Biocide Product Regulation (528/2012).

The 98/8/EC Directive regarding the market placement of biocide products was transposed in the Romanian legislation through the Government Decision no 956/2005, regarding the market placement of biocides.

PROIECT 15.3.1.0.0

These biocide products, according to the GD 956/2005, are **active and prepared substances** containing one or more active conditioned substances in the form in which they are provided to the user, **having as purpose** to destroy, prevent, render harmless and prevent action or exercise another control effect on any harmful organism, through chemical or biological means. **The biocides are, in fact, products** that are based on substances that kill a living organism. They are classified in 23 types of biocide products, of the following **4 main groups:**

- group 1: Disinfectants and general biocide products;
- group 2: Conservatives;
- group 3: Non-agricultural pesticides;
- group 4: Other biocide products;

and are used in various fields: food industry (conservatives), feed preparation industry, cosmetics industry (conservatives), textile and leather industry (conservatives), wood treatment, rubber treatment, paint production industry, masonry materials (in fixing paints), cleaning spaces, purifying water, air, sanitary and sanitary and veterinary prophylaxy, etc.

The institution that deals with these products' analysis and the auhorization in Romania is the National Public Health Institute, through the Technical Secretariat for biocide products. Through the National Centre for Risk Monitoring in the Community Environment, the National Public Health Institute ensures the monitoring of any aspects that could constitute dangers for the public health.

At the European Union level, the Centre for Disease Prevention and Control is the one publishing guidelines and report on the transmissible diseases caused by vectors, while the European Agency for Chemical Products has the role of approving the active substances, authorizing biocides and managing any aspects connected to research and development in the field.

At national level, the public authorities which carry out activities of disinfestation, disinfection and pest control are based on the following relevant laws and decisions:

PROIECT 15 3.1 0.6

- LAW no 101/25.04.2006 regarding the local sanitation service;
- ORDER no 119 of 2014 for the approval of the Hygiene and Public Health Rules regarding the population living environment;
- DECISION o. 857 of 2011 regarding the establishment and sanctioning of contraventions to the public health rules and regulations;
- DECISION no 745 of July 11th 2007, for the approval of the Regulation on the issuance of licenses in the field of public utility community services;

Moreover, the pest control and management of harmful organisms are services that are achieved with the observance of Law 95/2006 regarding the health reform.

For the Bulgarian Territory, the following legislation stands as landmark:

- Directive 98/8/EC regarding biocide products
- The first Revised Regulation (Regulation EC No 1896/2000)
- The secont Revised Regulation (Regulation EC No 2032/2003)
- The Law of Protection against the Impart of Chemical Products
- The Ordinance regarding terms and conditions for market introduction of biocide products

Additional conditions are applied for the human resource involved in the development and providion of disinfestation, disinfection and pest control services, respectively level of qualification of staff and specific authorizations:

The staf that carries out services for disinfestation, disinfection and pest control must present the "Certificate of professional qualifications" for the occupation "Desinfestation and Disinfection Agent", according to the Government Emergency Ordinance no 129/2000 republished regarding adult professional training and the Government Decision no 522/2003 for the application of the GEO 129/2000 and its further modifications.

In a larger framework, the legislation can be synthesized as:

I. Legislation for risk prevention and management in general;
II. Legislation for disinfestation, disinfection and pest control, but also all aspects related to insect proliferation;

PROIECT 15.3.1.6.3
12.1

III. Legislation on public procurement and particularities related to DDD public procurement procedures.

The laws above have been analysed largely in the Preliminary Study, annexed to the Strategy.

Amongst the similar institutions in the two states, which are key stakeholders interested in the topic, we can nominate:

- The Romanian Ministry of Health and its coordinated and subordinated institutions / The Bulgarian Ministry of Health
- The General Emergency Situations Inspectorate and its county/regional institutions
- The Ministry of Environment and the Ministry of Waters and Forests in Romania / the Ministry of Environment and Waters in Bulgaria
- The National Public Health Institute / The National Public Health and Analyses
- The National Sanitary-Veterinary Authority

Also, the particularities of legislation regarding specific public procurement and biocide products are treated at length in the Preliminary Study.

II. General Presentation of the Risk Management process / Needs Assessment / Risk Zones Definition

Nowadays, the causality of phenomena is no longer considered a reference parameter in the definition of hazards, as the focus has moved on the uncertainty of the occurrence moment and of the manifestation manner of a phenomenon.

Within the didactic approach, but also in the scientific approach, it is necessary to establish a common terminology that is unanimously accepted. Common language and concepts represents the foundation of development, understanding and effective increase of hazard reduction. Each term is used and defined for the logical and consistent explanation of the desired message. In various sciences definitions for the

same terms were developed simultaneously.

Concepts such as vulnerability or risk involve complex and interconnected parameters and processes. Lately, in the field of hazards and risks problems occur that relate not only to natural sciences, but also to social sciences. Natural risks (natural hazards) are diverse. For the present work, the risks of interest are biological risks such as epidemics, epizootics and zoonoses.

Risks can be classified either by the way of manifestation (slow or fast), either by cause (natural or antropic). These provoke less or more damage, depending on their amplitude and the favouring factors in the place or region of occurrence.

Another form of risk definition consists of the following formula:

Risks = Vulnerabilities + Hazard

The concepts of the formula can be defined as follows:

Vulnerabilities = urbanization, environmental degradation, lack of education, population growth, fragility of the economy, poverty, bureaucratic emergency structures etc.

Hazard = rare or extreme phenomenon of natural or human nature, that affects life, properties and human activities, whose expansion can lead to disasters;

Hazards can be:

- environmental (environmental pollution, epizootics, desertification, deforestation);
- epidemics and industrial accidents.

Risk assessment is a process of application of methodologies for risk evaluation, taking into account their definition, probability, frequency of manifestation and people and goods exposure to their action, as well as consequences of the respective exposure.

There are three steps in risk evaluation: risk identification, risk analysis and evaluation of vulnerability.

BIOLOGICAL NATURAL Risks: are represented by epidemics, insect invasions, plant maladies, infectious contaminations. Apart from damages occurring in agriculture, they negatively influence the natural environment and cause its degradation.

Epidemics are characterized by mass sickness within the population, due to pathogen agents such as viruses, rickettsioses, bacteria, fungi and protozoa.

Large epidemics are also called pandemics and have generated millions of victims, particularly in the Middle Ages (bubonic plague, in Europe). These are favoured by poverty, lack of hygiene, water infestation, agglomeration of household waste, rat reproduction. Natural disasters, such as floods or big earthquakes, are also accompanied by the danger of epidemics manifestation.

Epizootics and zoonoses represent the mass spread of infectious-contagious illnesses among animals, some of which can be passed on to humans through direct contact with the sick animals or through the consumption of contaminated animal products.

II.1. Needs Assessment for the Cross-Border Region România - Bulgaria

	Needs of material investments	Needs for policy and regulations	Needs for institutional development and technical assistance
Environment and Natural Resources Protection			
Biodiversity and Management of Ecosystems	- preservation and rehabilitation of biodiversity -development of desilting works and other hidrological improvements -ecological restauration, including reforestation -development of monitoring and information facilities -reducing waste pollution in natural areas	- ensuring participation of local population and representative associations in the decision making process	- Monitoring and evaluation of the preservation status of species and habitats - organization of information / awareness campaigns regarding biodiversity and environmental protection - Consolidated Environmental and Localities Management
Risk Management in Cases of	- development of necessary infrastructure	- development of a methodology for risk	- Development of an integrated informational disaster /danger

Disaster Occurrence	and procurement of boats, vehicles for increasing interventions efficiency - protection works against floods mainly - equipment for pollution monitoring -supporting the procurement of equipment for local emergency situations services	assessment - implementation of a boat monitoring system - Studies referring to the environmental responsibilities and the data exchange on biological incidents	management system - Assessment of risks of floods, earthquakes, coast erosion and forest fires; - Development of intervention plans in cases of disasters -Organization of public education and awareness campaigns
Environment and Natural Resources Protection			
Tourism	- improving the access (roads around attraction point, signaling, paths, docks), focusing the priority on water access and services -development of the tourism infrastructure and restauration of cultural sites	- ensuring safety, security and health policies in the tourism sector - guidelines/ destination management policies -ensuring the correlation with policies and plans and national level	- sustaining activities for tourism promotion in the region - developing tourism based on natural and cultural heritage - ensuring institutional collaboration at national, local and cross-border level
Fishing and aquaculture	- setting up areas for recreational / sport fishing - defining areas for fishing - ecological certification of capture fish	-modification of legislation to allow direct sales of fish by fishermen, with the application of sanitary-veterinary legislation	- Ensuring the monitoring of water quality - Strengthening the fishing communities in what concerns local development and governance of local fishing resources and related activities
Agriculture and Rural Development	- establishment and modernization of facilities for production/processing/ selling of agricultural products	- expansion of the access to vocational training -modernized agricultural quality	- encouragement of the local community in the involvement of local development placed under community responsibility -supporting producers groups

	-rehabilitation of irrigation infrastructures	control systems	
Improvement of connectivity			
Transport	ignalling lakes and channels in the Danube area -development of infrastructures and facilities for passenger ships, pleasure boats, and fishing boats -reducing the impact of naval transport on the environment	- organization of a system for local public transport that is more effective and more adapted to the natural conditions throughout the entire Danube region -port regulations	- analyses and impact studies
Information Technology and Communications (ITC)	- modernization of / expanstion of ITC infrastructure in the entire border area, including solutions adapted to the local conditions -procurement of equipment for the Public Internet Access Points	- Policies in the field of open data -Development of local e-government services	- Facilitating the use of Information Technology and Communications -Development of a GIS portal and a smartphone application
Ensuring Public Services			
Waste management	- expansion/rehabilitation of water supply and wastewater collection and treatment systems (new or rehabilitated systems) in the study area for the improvement of services quality and efficiency -development of systems for selective waste	- updating te national and regional programs for waste management -strengthening the regulation, control and application of the law in the sector	-development of feasibility studies (SF) and investment plans design -strengthening rhe capacity of operators -preparing services contracts -institutional collaboration and inter-city/inter-municipality cooperation - development of a study on

	management -development of waste collection points and specific facilities -procurement of equipment for the collection of floating waste -increase the degree of valorification of waste collected from population and economic agents		the financial sustainability -development of studies regarding waste composition - development of awareness programs dedicated to the public
Education	- Ensuring access to information on risks of increased haematophagous populations	- Stimulents to participate in training programs on environmental protection	-Improved schools, programs and student counseling, other educational programs for youth -First aid training for the population in the Danube area
Health	- rehabilitation of buildings -procurement of laboratory and IT equipment, boats for emergency operations and shelters near hospitals -modernization of sanitary installations in schools	- revision of payment systems for the providers of primary care services in rural and isolated areas	- Improvement of the institutional capacity of the Public Health Directorate (PHD) -Development of diagnosis laboratories -Training od emergency intervention staff -Development of abilities in the field of public health laboratory management - Organization of information/education campaigns
Promoting efficiency, accessibility and sustainability			
Sustainability	- payment of web-hosting / operation of the GIS Portal - payment of human maintenance operators / data input operators	- Formulation of operation and maintenance policies (O&M)	- Revision of requirements, responsibilities and capacity in terms of O&M

PROIECT 15.3.1.6.9

12.1

Administrative Capacity	Development of facilities, procurement of vehicles and office equipment	- Improvement of the general project management capacity after the project implementation - Strengthening the coordination capacity between public institutions with responsibilities in preserving biodiversity - Facilitating the public's access to public information and services	-Providing technical assistance for the priority administrative functions, which include (without limiting) the updating / filling in the GIS tools

II.2. Defining risk areas in the Cross-Border Region România - Bulgaria

The territory of the Romania-Bulgaria cross-border area included in this project for monitoring and control has a varied relief including plains, hills, plateaus and mountains, relief embedded by a rich hydrographic network and over which man has a strong impact through his activities

According to the principles of systemic conception in this territory, there are many types of ecological systems, which are integrated into complexes of ecosystems with hierarchical relations.

The structure and functions of mosquito populations are the result of interaction with the abiotic and biotic components in the ecosystems in which they are found, as well as the influences from the complexes of ecosystems in which they are integrated.

There are, for example, differences between mosquito populations whose larvae live in

a pond lying between cultivated land and another situated in a forest or meadow. On the other hand, mosquitoes have different habitats in different stages, larvae being aquatic, and adults being terrestrial and also having different functional niches.
Integrated control programs of the culicide populations in different territories will need to use highly effective measures but with less disturbing implications and effects on the ecological systems in which they are applied.
The Romanian Plain has a temperate continental climate with high annual thermal averages (10 ° -11 ° C), among the highest values in the country but with low rainfall (450-600 mm / year) and frequent droughts , especially in its southeastern part.
River navigation is practiced on the Danube, where ships with smaller tonnage circulate, up to 2 meters draft.

II.2.1. RISK AREAS-DELIMITATION OF HABITATS

In this area, there are a multitude of natural ecosystems and natural habitats favorable to mosquito populations, as well as numerous urban and rural anthropic ecosystems where human activities lead to the appearance of numerous typical artificial habitats:

- deficiencies in the maintenance of drinking water supply systems and waste water and other waste disposal systems, especially in urban areas;
- artificial outbreaks related to livestock breeding and maintenance of vegetable crops within rural areas;
- artificial outbreaks in rural type households existing in urban areas.

The knowledge of all potential habitats capable of turning into active habitats of mosquito larvae development (but not only) is the essential condition for the organization of the entomological surveillance and control system to ensure the application of anti-dulling measures, this being reflected in the identification and mapping of these habitats and in developing standardized surveillance records for each habitat. The identification of culicidal adult habitats and their distances to the larvae

development habitats is also needed to develop the methodology of controlling adult mosquitoes in anthropic ecosystems

We will further characterize the main categories of ecosystems that integrate the multitude of habitats suitable for larval development and for sheltering adult mosquitoes. Habitats viewed as parts of ecological systems include physical space with its chemical and biological components that provide the conditions for the installation and maintenance of a population or species.

II.2.1.1. Natural aquatic ecosystems

The natural aquatic ecosystems in the cross-border area are:

Stagnant or lenticidal aquatic ecosystems

The light penetrates into these shallow waters, with vegetation and accumulations of vegetal debris on the bottom. Emerged and floating vegetation is usually well developed, and water agitation is reduced. This category includes ponds and marshes of different origins.

Ponds are stagnant, low-water and bottom-vegetated waters that can dry out in the warm season. Most spring pools in the cross-border area dry out in the summer.

The swamps appear through the mowing of lakes or ponds or some of them, and they usually have sludge in the bottom. Muddy areas are permanently or almost permanently covered with shallow water and are often invaded with perennial or reed vegetation.

Ponds and swamps usually represent habitats entirely suitable for the development of mosquito larvae.

Lakes only provide development conditions for mosquito larvae in some of their coastal areas, with deeper, less agitated water where vegetation can occur. Occasionally, on the surface of the lakes can appear vegetal plaques produced by the abundant increase of the submerged vegetation, they delimit in the surface layer of habitats favorable to the development of larvae of anopheles of the maculipennis group.

The flowing or lochal aquatic ecosystems generally offer less adequate space for mosquito larvae to develop on the banks of vegetation, with very shallow water and extremely low flow rates on meanders, dead branches, and canals.

II.2.1.2. Seminatural aquatic ecosystems

Seminatural aquatic ecosystems are, in turn, particularly favorable habitats for the development of mosquito larvae. In ponds and lakes formed by artificial dams, conditions approaching those existing in the ponds and on the shores of natural lakes occur. Irrigation and drainage and drainage channels, although with large fluctuations in water level and velocity, largely provide extremely favorable conditions for the development of larvae, usually similar to those in natural ponds.

II.2.1.3. Wetlands

Wetlands are intermediate ecological systems between terrestrial and aquatic. Groundwater permanently soaks the soil or forms a shallow layer favoring the growth of hydrophilites. These areas are extremely favorable habitats for the development of mosquito larvae. They are spread in the delta and floodplain fields such as the Danube Meadow and the river bed plains that flow into the Danube.

II.2.1.4. Artificial habitats

Artificial habitats for the development of mosquito larvae occur in anthropic ecological systems, including in rural and urban areas.

Habitats in which mosquito larvae develop, resulting from various types of human activities, are extremely diverse and numerous and can be disseminated everywhere.-

Artificial habitats occurring in connection with the operation or deterioration of some unprotected hydrotechnical facilities - in addition to dams, dams, water tanks, drains of various types;

- Habitats related to various types of construction and construction works: pits and trenches for foundations, water storage tanks and other operations on site, non-inclined ditches, and flooded basements, ornamental elements of the buildings with container purpose, planters and flowerpots without drainage; terraces without leakage; unclean streaks and clogged gutters

- Habitats of mosquito larvae linked to farming, animal husbandry, and fish farming: pits from irrigation network failures; drainage channels for irrigation; ditches and purine fossils from animal shelters; inoperative shallow water basins for juvenile fish;

- Outbreaks resulting from faults in water and sewage networks: pits on pipelines; stadiums where water stagnates; defective hydrants; channels and ditches for faecal-water runoff; basins at sewage treatment plants;

- Habitats of larvae on green spaces, parks, recreation areas, cemeteries: stormwater accumulations on the ground or in the grassy areas; persistent for more than 7 days; puddles from defects in sprinkler watering systems from artesian fountains; water puddles from public canopies with clogged leaks; shallow water ornamental pools, unchanged for 7-10 days, or empty, non-functioning basins that can accumulate rainwater; stagnant water pools during periods of non-operation; drainage drains; flooded or marshy areas with thicket on the shores of lakes or ponds with or without a shingle; flowers pots for flowers in cemeteries; broken car tires and discarded containers in which water is collected; drainage channels and drainage channels, etc

- Extensive artificial habitats in urban and rural areas where there are houses with courtyards and gardens, where birds, pigs, cattle are grown: water-containers for animals, barrels, buckets or other containers, especially with rain water for planting plants in gardens; containers and unused pots that can accumulate rainwater;

Areas and habitats of adult mosquitoes in which they carry out feeding, sheltering and breeding activities are embedded in both natural terrestrial ecosystems, including forests, hedges, meadows, as well as agro-systems such as agro-systems and

especially rural human settlements and urban. Within them can be found all the types of aquatic ecosystems described above, in which the mosquito larvae develop

Habitats housing adult mosquitoes are also very varied. In nature, they are sheltered in vegetation, in hollows, soil and rock cracks, crevices, shelters of wild animals, etc. In anthropogenic areas, they find a multitude of shelter places, virtually anywhere less lighted, with less air currents, and without too much temperature and humidity variation of any type of construction in rural or urban areas, including housing and shelters of domestic animals.

II.2.1.5. Mosquito Fauna

The investigation of the fauna of culicides in the Romania-Bulgaria cross-border area should highlight as many species as possible in this area, in order to know the distribution of vector species and discomfort species.

Knowledge of biological cycles and succession of mosquito species in Romania-Bulgaria cross-border area will guide the strategy of the entire mosquito control program in this area, establishing the spatial and temporal application of various anti-larvae and anti-adult mosquito methods and, depending on the characteristics of this fauna, it will elaborate the entire methodology of choice and application of control means.

No	Species	County							No of counties
		MH	DJ	OT	TR	GR	CL	CT	
1	*Anopheles claviger*		+	+		+	+		4
2	*Anopheles hyrcanus*	+	+		+	+		+	5
3	*Anopheles maculipennis s.l.*	+	+	+	+	+	+	+	7
4	*Anopheles plumbeus*					+			1
5	*Aedes cinereus*			+	+	+			3
6	*Aedes geminus*					+			1

7	*Aedes vexans*		+	+	+	+	+	+	6
8	*Aedes albopictus (Stegomyia albopicta)*					+			1
9	*Dahliana geniculata*	+	+		+	+	+		5
10	*Ochlerotatus annulipes*		+			+			2
11	*Ochlerotatus cantans*					+			1
12	*Ochlerotatus caspius*		+	+	+	+	+	+	6
13	*Ochlerotatus dorsalis*		+	+	+	+	+	+	6
14	*Ochlerotatus duplex*		+						1
15	*Ochlerotatus detritus*							+	1
16	*Ochlerotatus excrucians*					+			1
17	*Ochlerotatus flavescens*		+	+		+		+	4
18	*Ochlerotatus intrudens*					+		+	2
19	*Ochlerotatus leucomelas*					+		+	2
20	*Ochlerotatus pulcritarsis*	+				+			2
21	*Ochlerotatus punctor*					+			1
22	*Ochlerotatus refiki*					+			1
23	*Ochlerotatus riparius*						+		1
24	*Ochlerotatus sticticus*					+			1
25	*Culex modestus*		+	+	+	+	+	+	6
26	*Culex pipiens*	+	+	+	+	+	+	+	7
27	*Culex theileri*	+	+	+	+	+	+	+	7
28	*Culex hortensis*						+		1
29	*Culex martinii*					+			1
30	*Culex territans*			+	+	+	+	+	5
31	*Culex torrentium*							+	1
32	*Culiseta alaskaensis*							+	1
33	*Culiseta annulata*			+		+	+	+	4
34	*Culiseta longiareolata*							+	1
35	*Culiseta subochrea*							+	1

PROIECT 15.3.1.c.0 12.1

36	*Coquillettidia richiardii*		+			+	+	+	4
37	*Coquillettidia buxtoni*					+		+	2
38	*Orthopodomyia pulcripalpis*					+			1
39	*Uranotaenia unguiculata*					+		+	2
Specii/județ		6	14	12	11	31	14	21	

MH = Mehedinți, DJ = Dolj, OT = Olt, TR = Teleorman, GR = Giurgiu, CL = Călărași, CT = Constanța

III. Vision of the Strategy for risk management of insect excessive proliferation

The Strategy establishes a partnership for the joint management (Romania and Bulgaria) of the risks generated by the excessive increase in the number of culicidal insects and other arthropod vectors in the cross-border region.

The partnership focuses on sharing knowledge and coordinating the relevant actors in Romania and Bulgaria for the target cross-border area.

A basic tool of the partnership is the GIS system developed in the project implementation process. GIS collects, processes, analyzes, and displays information about:

- insect habitats;
- entomological characteristics;
- the risk level;
- information on the treatments performed.

The periodic GIS will be updated with useful information to be disseminated to the institutions and stakeholders. The system is based on a constant collaboration process of relevant actors in the field.

The partnership requires transparency and accountability as fundamental principles.

PROIECT 15 3.1 0.6
12-1

TRADUCĂTOR AUTORIZAT OLTEANU ADELINA GEORGIANA AUT NR.32172 CĂLĂRAȘI-ROMÂNIA

III.1. Strategic Principles and Objectives

III.1.1. Sustainable Development

Prevention of Emergency Situations is part of sustainable development, developed as a coordinated set of processes that allow ongoing progress on the basis of planning and mobilizing existing resources, reconciling the economic, social and environmental objectives of society in the short and long term, thanks to the implementation of strategies that are mutually supportive.

III.1.2. Complementarity of prevention and reaction

Prevention and response are complementary, process-driven and constitute a permanent activity of national and cross-border importance, planned and coordinated at organizational, financial, and logistic level, by all components of the partnership.

III.1.3. Primordiality of emergency situations prevention

Since it is generally recognized at international level that prevention is at least 8 times less expensive than the reaction to the events produced, the prevention of emergencies must be a priority activity of the Romanian-Bulgarian partnership and the members of the assistance forum.

III.1.4. Obligativity of emergency situations prevention

The task of preventing emergency situations is complex and interdependent. It involves responsibilities from citizens, local communities, economic operators and public administration authorities and is managed by the Romanian-Bulgarian partnership.

III.1.5. Identification, evaluation and hierarchy of risks

Identifying, assessing and ranking hazards are principles that underpin the planning and organization of preventive actions. In this process of identifying, assessing and ranking hazards, based on profound knowledge, the GIS system intervenes.

III.1.6. Specialization

The Romanian-Bulgarian partnership and the assistance forum ensure the identification of risks, planning and organizing the implementation of preventive measures.

III.1.7. Graduality

According to these important requirements in the field of emergency prevention and management, decisions are made on a number of levels, namely at local, regional and national levels

III.2. Specific Strategic Objectives

1. A strengthened process of cross-border risk management regarding insect proliferation through better cross-border coordination;
2. Improving the knowledge management process at cross-border level through the GIS and updating it and involving relevant actors;
3. Better cooperation of all competent institutions and stakeholders in the field of insect-related risk management.

PROIECT 15 3.1.0.0
12.1

III.2.1. Integrated Control of Insects in the Cross-Border Region, A Consolidated Process of risk management by better Cross-Border Coordination

In Romania-Bulgaria cross-border area, the control of insects and other arthropod vectors and discomfort generators through the concept of its integrated approach is a complex strategy involving the use of all appropriate methods, both technically and methodologically and organizationally, in good conditions of profitability and environmental protection with the aim of limiting or eliminating the socio-economic impact caused by the presence of excessive populations of these insects and other arthropods.

The strategy for the sustainable monitoring of risks caused by insect and other arthropods in the Romania-Bulgaria cross-border area should reduce and maintain population density at low density levels that eliminate the risk of disease transmission and ensure the well-being of the population.

In order to achieve this, the sustainable monitoring strategy includes two key directions:

- **Elaboration and implementation of the integrated mosquito control program** (as well as other insects and arthropods), which will be the technical, methodological and organizational framework for monitoring and control of the excessive mosquito populations in the Romania-Bulgaria cross-border area.
- **Development of the Romanian-Bulgarian joint institutionalized partnership for the implementation of the integrated combat program in the cross-border area Romania-Bulgaria.**

III.2.2. Improvement of the Knowledge Management Process at Cross-Border level

In conducting an integrated mosquito control program, it is necessary to permanently pursue the proper combination of the three basic components of the integrated fight, namely environmental methods, biological methods and chemical methods of control,

and to act on the permanent reduction the use of chemical insecticides and their replacement by other non-polluting methods.

Environmental planning is currently a key component of the integrated mosquito control program. This activity has two main directions:

- changing the environment through extensive landscaping works leading to the definitive elimination of some culicidal development habitats;
- handling the environment in the sense of interventions in certain habitats to make them unfit for the development of mosquito larvae.

There are locally resolvable targets through current maintenance work under the responsibility of local administrative services, economic units and the local population: the elimination of potential habitats, such as the less stretchable watercourses from faults in the water and sanitation network, gardens, ornamental basins, ditches, basements, household courtyards - water barrels, drinking water, etc.

Other objectives may come under the responsibility of the mayoralties: the deterioration of the damaged banks of the lake, the cutting of the reed, the dismantling of medium-sized marshes, the construction of pumping stations and the collecting channels of flooded land, etc.

Objectives solvable by extensive hydrotechnical works require investments that can be requested at the county level from the budget.

The importance of performing these environmental improvements and modifications is reflected in the decrease in time of the volume of chemical treatments and the accumulation of the beneficial effects of large-scale facilities that lead to the final elimination of important mosquito development habitats.

Biological methods to combat mosquitoes include the direct or indirect use of their natural enemies. Larvae fish of the species *Gambusia affinis* (Poecilidae) can be used in larger pools or lakes where they can last for many years.

The use of bacterial insecticides in Bacillus thuringiensis israelensis is beneficial because they are not toxic to human beings and aquatic fauna and can be applied in many larval habitat types using conventional chemical insecticides.

The chemical control methods, with all their inconveniences (time-limited efficacy and need for multiple treatments, mosquito resistance, fairly high cost of

operations, adverse effects on the environment), are justified due to the fact that there is not a wide enough range of biological means to cover all the control needs and sufficient material and organizational possibilities to meet the needs of combat by means of environmental planning and manipulation. In order to minimize the negative effects of the application of chemical insecticides, the approach to this application must be based on ecological bases. This involves a very thorough knowledge of the biology and ecology aspects of mosquito populations in the area where the integrated control program applies, including knowledge of the susceptibility / resistance status of these populations to insecticides (local mosquito populations will be tested by standard WHO procedures) to ensure that the application of insecticide treatments is done under optimal technical and methodological conditions, leading to maximum efficacy in minimal adverse environmental effects. Methodologies for the application of insecticidal products will also take account of environmental conditions and include appropriate equipment so that the polluting effects are minimal.

In order for the risks of environmental toxicity and pollution to be minimal, the selection of insecticides for mosquito control will take into account their risk classification based on the risk of use developed by the World Health Organization (2006). Classification of insecticides comprises 5 active substance classes or groups:

- IA = Extremely hazardous
- IB = Highly hazardous
- II = moderately hazardous
- III = Slightly dangerous
- U = Unlikely to pose a risk to normal use (= Unlikely to present acute hazard in normal use).

In mosquito control, insecticides are used in the last three groups of toxicity of active substances (II-U).

Insecticides contain their active substances in various formulations to be used in the field. The final classification of an insecticide product on the risk of use is related and depends on its formulat

PROIECT 15.3.1.6.3
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TRADUCĂTOR AUTORIZAT OLTEANU ADELINA GEORGIANA

III.3. Institutionalized partnership and its GIS tool

III.3.1. Institutionalized partnership

The Institutionalized Partnership will be materialized through a Framework Agreement between the two partners in the project specifying the following:

1. Competencies and functions
   - informing stakeholders about measures to combat insects in the cross-border area;
   - collection, analysis and dissemination of information on the insect population, its habitats, risk areas and disinfestation campaigns;
   - organizing information campaigns;
   - cooperation with all relevant and interested actors in Bulgaria and Romania on the issue of combating insects in the cross-border area;
   - Funding for partnership activities will be achieved from various sources: national budgets, sponsorships from public and private institutions, external funding, own budgets, etc.

2. Structure:
   - Surveillance body;
   - Executive Committee
   - Support Forum.

The Surveillance Body is made up of the governing structures of the two parties in the Partnership: the Danube Municipalities Association "Danube" and the "Natura Vie" Foundation. With the following competencies and responsibilities:

- cooperate with all stakeholders to meet the objectives of the institutionalized partnership and the joint strategy;

PROIECT 15.3.1.6.6
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- supervise the work of the Executive Commission, request and receive information from it;
- make decisions on the Partnership activities;
- accepts the annual partnership report;
- make decisions on updating the joint strategy on control of the insect population following a consultation process.

The Executive Committee is made up of the executive bodies of the two partner organizations. Its competencies and responsibilities are as follows:

- Coordination of joint insect risk management activities on both sides of the border (by municipalities, towns, districts and counties) in the implementation of the joint strategy;
- Maintaining and updating GIS information for use by all stakeholders;
- makes the GIS database available to all interested parties and the public free of charge;
- provides methodological support free of charge to all registered GIS users;
- Draws up annual reports on the activities of the Partnership or at the request of the Surveillance Authority.

The Support Forum is made up of representatives of all stakeholders in the field of risk management in the target area, on a voluntary basis. They become members of the forum by signing a letter of support for the partnership. Forum members have the following rights and obligations:

- has the right to be informed about all aspects of the Partnership's activities;
- to submit amendments to the Common Strategy on Insect Control;
- participates in the co-ordination process of the two sides of the Partnership;
- has the right to freely use the GIS information;
- supports the Partnership by providing up-to-date information on insect-related risk management;
- Provides methodological support to the partnership.

The Support Forum is an open body so that stakeholders can become members at any time.

PROIECT 15.3.1 c.0
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TRADUCĂTOR AUTORIZAT OLTEANU ADELINA GEORGIANA AUT.NR.32172

The partnership complies with the general legal and institutional provisions (acts, regulations, institutional protocols) as well as with the specific aspects of crisis management related to insect proliferation.

Funding and purchases of disinfestation activities are carried out within the national framework.

The partnership is funded from various sources: own budgets, public and private donors, national and transnational public health programs and better governance.

III.3.2. GIS Application for Insect Population Control

GIS - Partnership Working Tool

The main objective of the project "Development and adoption of a joint institutionalized partnership on the risk management of excessive insect proliferation affecting public health and safety in the Romania-Bulgaria cross-border region" is to improve joint risk management of excessive insect growth and public health insecurity in the region cross-border Romania-Bulgaria by developing a common institutional partnership.

The Joint Geographic Information System (GIS) for controlling the insect population is necessary because the geography and climatic characteristics of the cross-border region create the necessary environment for the proliferation of mosquitoes, ticks and other insects.

There are many water basins in the region that, combined with high humidity and high temperatures, lead to an annual increase in the population of mosquitoes, ticks and other insects. They may be carriers of several viruses and pose a threat to public health and a veterinary risk to diseases and epidemics.

Insect concentrations also have a negative effect on the economic activities of the region, especially in the agriculture and tourism sectors. Romania and Bulgaria have specific regulatory frameworks and institutional structures for insect control activities. Despite attempts to coordinate efforts in this direction, there are still no harmonized

PROIECT 15 3.1 c.3

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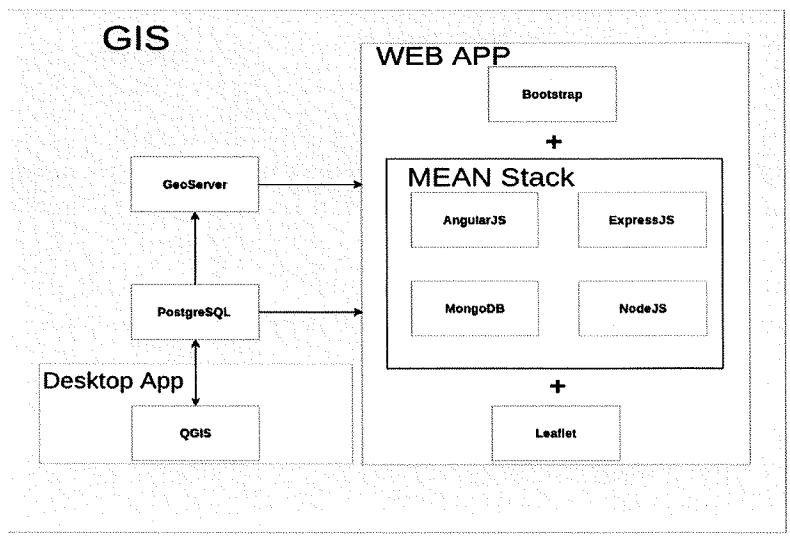
and integrated activities to prevent, mitigate and manage risks in the cross-border region.

Controlling the insect population is obviously a cross-border issue: insects spread through the state's physical borders and pose a threat to public health. Unilateral activities do not have a serious effect on the insect population.

"BuGIS" is a WebGIS product for **identifying, visualizing and presenting the characteristics of insect distribution areas, treatment areas, measures taken, and control effectiveness.** WebGIS is a geographic information system (GIS) that is entirely based on the Internet, that is - no software, except the browser, is needed to work with it.

The objective of GIS for insect control is to contribute to the creation of improved, efficient, common and sustainable coordination of insect population reduction activities in the Romania-Bulgaria cross-border region.

In fact, "BuGIS" is an interactive web map of the risk areas in the Romania-Bulgaria cross-border region, which has the standard navigation tools of all geographic information systems, the ability to make selections through different methods, to display information about areas, as well as generate reports. The architecture of the system is shown in the figure below:



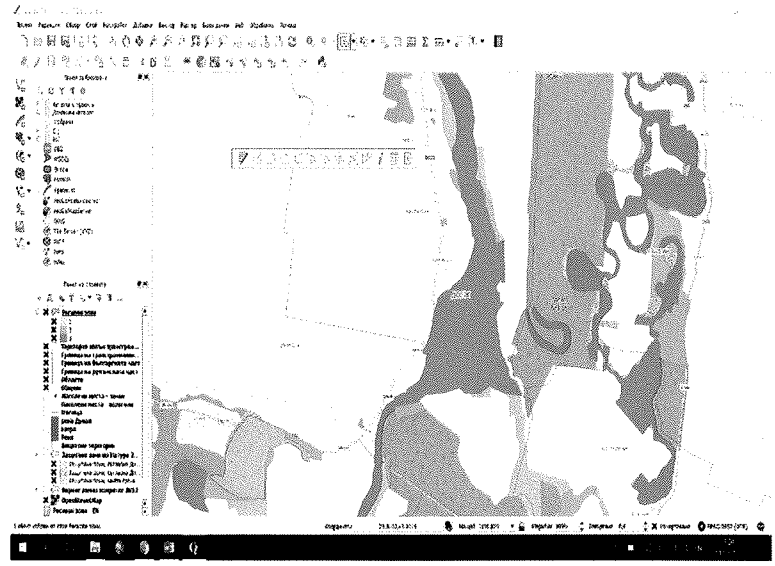
BUGIS is made up of three subsystems:

- DBMS - Database management system - PostgreSQL. In the technical proposal, the Open Source PostgreSQL platform has been selected to store and manage the project database. It was successfully tested by the company's team of experts with GeoServer,

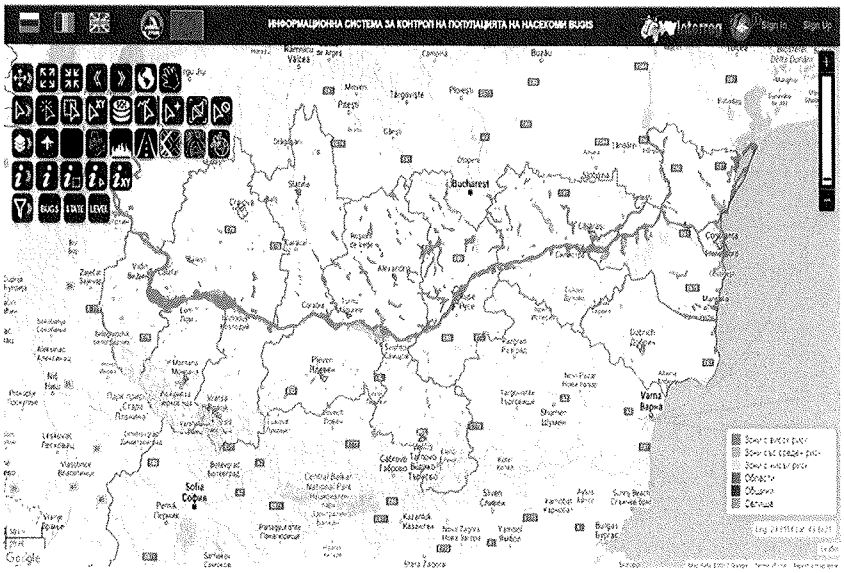
PROIECT 15.3.1.6.9
12.1

which had excellent results. It is a combination of the GIS server and the SGBD used in this project.

- GIS desktop client, which is an upgrade of GIS Open Source - QGIS. QGIS is a fully functional geographic information system (GIS) that reads, processes, and generates new geographic information. It's an open source program and its built-in functionality can be updated and modified because it supports the Python and C ++ consoles.



- WEB GIS server, which reads data about PostgreSQL risk areas and views information in the Internet environment (through the browser). The Web-based GIS server is based on AngularJS technology, often referred to as the "Angular", an open-source code for web applications. The goal is to simplify both application development and testing by providing a platform based on the Model-View-Controller architecture model, along with all components of commonly used Internet applications.



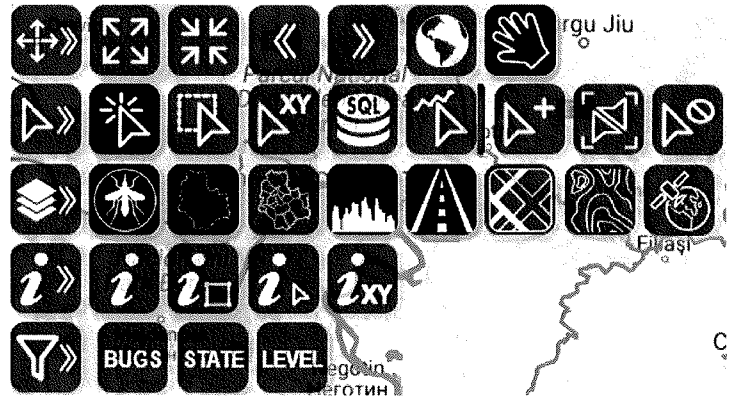
The system is available at the following Internet address: http://bugis-robg.eu. When you enter this address into your browser, the BuGIS system for insect control is open, which is accessible to all non-registered users.

PROIECT 15.3.1 12.1

Administrative staff with advanced access to service information must have accounts created with defined rights and roles approved by the system administrator. To do this, there are two options in the title bar (top) - "Log in" and "Sign Up".

BUGIS functionality (interactive map):

Through the developed GIS server features, users can view the area of the Danube municipalities, risk areas for the development of insect populations, search for information about a particular area of risk, and (if registered as a user) can see information about contracts for active treatments, as well as other important information.



The system allows you to create a report for a specific area and export it to .pdf format if this information needs to be shared. If the originally created information needs to be edited - this is a function of the GIS desktop client, through which users can create, edit, or delete risk areas and their features. All components of the system are based on the Internet, so administrations on both sides of the Danube can see the information and geographic location of risk areas in real time, coordinate the measures they take for greater efficiency

The third component - "Mobile" allows you to work directly on the ground and record areas of risk with information sent to a Danube ADRM server.

The GIS application will be updated with data by the designated representatives of the member institutions of the Partnership Forum, validated by the members of the partnership

IV. Cross-Border Coordination Measures

- Maintain a common database with open access for all stakeholders. It includes:
  - the names of the contact persons and institutions concerned,

PROIECT 15 3.1

- risk areas, owners / concessionaires;
- the evolution over time of the increase / decrease in the number of insects;
- applied disinsection treatments;
- specialized companies for disinfection treatments;
- contracts for applying treatments, etc.

- The database will be updated annually or whenever it is needed. The updating decision is based on the assessment of the annual or ad hoc report on the Partnership's activities.
- Organizing ad hoc meetings / forums for information, recommendations and joint action plans, sharing best practices, coordinating the transfer of best practices;
- Carry out joint information and dissemination campaigns for all potentially interested institutions.
- Compliance with the partnership methodology for joint cross-border disinfestation campaigns (developed in the current strategy, Annex 2);
- Developing an Early Warning Protocol by the Partnership with the Forum members;
- Elaboration of a protocol for common actions in case of epidemic threat by the Partnership with the members of the Forum;
- Conduct joint information and warning exercises.
- Exchange of information permanently.
- Coordinate fundraising for disinfestation activities.
- Joint training and specialization of stakeholders to manage such risk situations;
- Transfer of best practices at transnational level;
- Coordinate with national programs mainly with the ministries of health of the two countries.

V. Monitoring the Implementation of the Strategy

The monitoring of the strategy implementation is permanent. The Surveillance Body and the Support Forum monitor the overall implementation of the strategy. They also

participate in the evaluation of the implementation of the strategy and updates it if necessary.

For an effective monitoring activity, a system of indicators will be followed:

- Impact / measurement / source indicators

1. the number of risk areas;
2. the number of notifications / updates in GIS;

- Result indicators

1. the number of identified risk situations;

- Output indicators

1. the number of warnings issued by the Partnership;
2. the number of informed institutions about the risk situations;
3. the number of interventions following the warnings issued

VI. Technical, methodological and organizational elements of strategy development and implementation

VI.1. Delimitation of operational areas within the strategy

The implementation of an integrated control program of the culicides requires with priority the delimitation of the operational area. Operational areas must be sufficiently expanded for the effectiveness of control actions not to be annihilated by the impact of adjacent areas in those counties. Operational areas include urban and rural areas, as well as some natural habitats that are close to them with an impact on the development and maintenance of mosquito populations in these localities, precisely to eliminate this impact. Interventions in some natural habitats near the localities will take place up to a maximum of 2 km away from the localities, given that the flight distances of adult

mosquitoes do not exceed this distance under the conditions of the territory of the combat program.

VI.2. Planning and centralized coordination of all biological and environmental control operations in the cross-border area

Centralized coordination of all combat operations is essential for the adequate application of the combat program on a territory as extensive as in the cross-border area Romania-Bulgaria. This will allow for timely and optimal programming of large-scale combat actions, especially from the nearby urban areas on the two banks of the Danube. Also, centralized coordination on either side of the Danube will allow for the choice and use in optimum moments and conditions of the means of fighting and the appropriate equipment to obtain the maximum effectiveness of combat actions with minimal environmental effects. Centralized coordination will allow permanent exchange of entomological, epidemiological, methodological and efficiency information between teams on both sides of the cross-border area.

VI.3. Entomological surveillance

The entomological surveillance in space and time of the territory included in the operational area is the primary and essential component of the integrated mosquito combat program, which directly determines its applicability and effectiveness. Entomological surveillance is permanent in the operational area and is carried out in each habitat with a rhythm imposed by the duration of biological cycles of mosquito species. The objectives of entomological surveillance through the two operational elements of space and time coverage are as follows:

PROIECT 15.3.1.0.9

- Identification and mapping of habitats for the development of larvae and housing of mosquito adults throughout the operational area;
- Elaboration of standardized traceability records for each habitat;
- Rhythmical investigation of potential habitats to intercept in good time the occurrence of mosquito larvae and, implicitly, the application of adequate anti-barbarity measures;
- Identifying new potential habitats by including them in the periodic entomological control system;
- direct operative intervention by the immediate application of control measures in some habitats, usually less exetnded, where the larvae were found in the land prospecting stage, a differentiated intervention according to the type of habitats;
- Evaluation of adult mosquito presence in various places of refuge and / or during their flight activity during the evening and early night in different manmade ecosystems and proposals on application of imagocide treatments in certain places and times, if it is found that they are needed.
- The permanent presentation of the entomological situation on the field to the responsible factors in the area with proposals for the application of adequate methods of timely control;
- Involvement in the organization and application of anti-larvae and imagocide actions in different areas and moments;

VI.4. The qualitative control of the execution of anti-dildo and imagocide operations

- Time tracking of the retentive effects of some types of treatments (with BTI in some larval habitat types, imagoid indoor treatments, etc.) to determine the appropriate rate of application of the treatments in question;

- Performing aggressive tests on adult mosquitoes that allow the correlation of adult densities intermittently raised in some areas of the supervised territory with the

presence of habitats of larvae becoming active and undetected or where the necessary measures have been applied late.

- Contribute to informing and guiding the population to intervene in eliminating artificial outbreaks of mosquito larvae in their own households in both rural and urban areas;

- Permanent collection of significant bio-ecological data on mosquitoes and data on the effectiveness of applied methods and control methodologies;

- Tracking and control of mosquito mosquito dwelling;

- Annual evaluation of the application of the mosquito control program in these areas with optimization proposals.

Entomological investigations fundamentally underpin the implementation, monitoring, and evaluation of an integrated control program of vegans and discomfort and in this context the existence of entomologists becomes an essential condition.

It is advisable that the entomologists from the Romanian counties of the cross-border area should be part of the County Public Health Authorities, who are considering the vector epidemiology and how to control their emergence and spread.

In this context, it is necessary to redefine the status of the National Center for Reference to Insect Vectors in Romania, as a guidance and training center in the field of medical entomology, of the surveillance and control of diseases transmitted by the vectors.

VI.5. Integrated application of different control methods in different habitats in relation to the evolution of mosquito populations and environmental conditions

Combating mosquitoes takes place at community level, both in urban and rural areas, based on integrated combat programs, and is needed both to eliminate the risks of local

people becoming ill and to reduce or eliminate the discomfort caused by them. In certain special situations, mosquito control actions may be applied in limited areas in the vicinity of some localities.

Combating mosquitoes in localities should take into account many aspects: existing mosquito species, their biology, the ecological characteristics of their populations, their resistance to insecticides used, local environmental factors and their evolution, including the variation in climatic conditions, etc.

The essential characteristics of mosquito control programs in localities are as follows:

- Monitoring and control of mosquitoes is a continuous activity.

- Combating activities apply concurrently against larvae and mosquitoes.

- Fighting activities in a given period will be applied at the shortest possible time throughout the locality.

The Surveillance and Control is a continuous activity that must start in March-April-May and run until October-November to include all generations of vector mosquitoes and discomforts that occur in that year depending on the evolution and influence especially climatic factors. The resumption of biological cycles of culicide species in spring is highly dependent on temperature.

Global climate change, whose effects are strongly felt in recent years, generally leads to longer warmer seasons each year, in which mosquitoes occur early in the spring, develop more generations than normal during the year and with flocks. Higher temperatures also allow winter hibernation and the survival of a larger number of mosquitoes in the winter, which in the next spring resume development cycles and lead to the early emergence of high population populations.

The continuity of surveillance and mosquito control in localities is aimed at the evolution of mosquito populations during that year and the maintenance of low population densities for the presence of a minimum risk of disease transmission and discomfort or even elimination of risk.

PROIECT 15 3.1 8.0
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TRADUCĂTOR AUTORIZAT OLTEANU ADELINA GEORGIANA AUTNR.321 CĂLĂRAȘI-ROMÂNIA

In a combat program, especially in urban areas, the optimal periods of application of treatments throughout the spring - autumn are determined according to the composition and the stages present in the culicide populations, their abundance and the types of habitats of larval development and housing of mosquito adults in the area.

Treatments applied during the spring and early summer are very important because targeting several objectives:

- Fighting the spring mosquito species (Aedes and Ochlerotatus genus), with a role in initiating West Nile circulation and amplification during the pre-epidemic period, but with a discomfort role; these species mostly have a single generation a year and lay eggs that are on the ground; combat will largely eliminate the disconcerting populations of these species, diminish or even eliminate the amplification of West Nile virus and will largely prevent eggs from being deposited by these species so that in the coming spring their populations will be much lower.

- Fighting the adults of the Culex genus (West Nile vectors and discomfort) and Anopheles (malaria vectors) that came out of hibernation and lay eggs, initiating the development cycles of that year; combat will diminish the new generations of that year that will be less abundant. Also, combating Culex pipiens mosquitoes, hibernating and West Nile viruses in the winter will prevent the introduction of the virus transmission cycle into birds or humans.

- Fighting the first generation of Culex pipiens of the year (the vector transmitting the West Nile virus to humans), which may occur earlier in early spring; fighting this generation hinders the early resumption of West Nile virus transmission in humans and leads to diminishing summer populations of this species.

in rural localities, Culex pipiens species are also dominant but are often accompanied by abundant populations with overlapping generations of anopheles of the Anopheles maculipennis s.l. complex.

Fighting this season reduces the transmission of West Nile virus to man and discomfort.

PROIECT 15.3.1 c.3
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TRADUCĂTOR AUTORIZAT
OLTEANU ADELINA GEORGIANA
AUT.NR.32

The treatments that apply during the fall are aimed at decreasing the number of mosquitoes entering hibernation and implicitly resuming their development cycles from the following year to a lower level.

Applying treatments throughout the spring - autumn period is also appropriate for combating mosquitoes of the Aedes albopictus (Stegomyia albopicta), which may be present in some places in the Romania-Bulgaria cross-border area and which could be a vector for certain pathogens, including the virus Zika. Fighting actions will aim to prevent the occurrence of this species in stable populations and / or reduce those populations where they exist.

The global spread of this species, originating from the tropical forests of Southeast Asia, was carried out by the transport of worn-out tires bearing species of diapaus of the species through the trade of lucky bamboo ornamental tropical plants, but also by public transport private distances (especially from West to East Europe), and climate change is likely to spread.

Aedes albopictus places its eggs on substrates in the immediate vicinity of water, both in small natural habitats (not in large lakes and ponds), especially in artificial habitats (all containers and water accumulations linked to poorly maintained urban infrastructure) . In Europe, the species generally shows preference for urban and suburban habitats.

Larvae development may take 3-4 weeks, but only one week at high temperature. The species is polyvotin, it has several generations per year. Females live 3-4 weeks. In the autumn, they place eggs that enter the winter slide and survive at -10 ^{0}C until the following spring, in April - early May. Adults appear since mid-May, their abundance rises and reaches the highest values in the second half of the summer and autumn until October.

Aedes albopictus feeds on various animals, but its special preference is human blood. Females are aggressive usually during the day and in the outdoor environment, but also indoors. It has an important discomfort role. Its flight rate is only about 200 m. This is why large-scale dispersion is by transport, especially with TIRs and other goods vehicles

PROIECT 15 3.1 6-9
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with adult mosquitoes, or in containers (such as used tires, etc.) in which can be eggs in diapase.

Combating activities are being conducted concurrently against mosquito larvae and mosquito adults to ensure their effectiveness.

Actions to control mosquito larvae will be carried out both in their indoor and outdoor habitats, in urban and rural areas.

The vast majority of mosquito larvae development habitats in the urban area is represented by the multitude of water accumulations connected to drinking water distribution networks, sewage and waste water and district heating and water in the basements of some blocks. To this, there are water vans of various kinds in individual households with courtyards and gardens (often very rural households in some cities). The lakes, especially those for recreation, do not represent in their entire outbreak the development of mosquito larvae, but only some shore areas, usually small and with special conditions (damaged pear, where small temporary ponds, vegetation grown on shore in shallow water areas, etc.). Temporary puddles also appear on green spaces or other areas, especially in the spring, but also in other periods of the year when precipitation occurs.

Of particular importance, especially in rural and urban areas, are the very large container habitats in courtyard and garden farms, especially where animals and birds are growing.

Of the greatest importance among the anti-grassing measures are the ecological methods of environmental manipulation, for the elimination of some larvae development habitats or for their modification that are no longer favorable to their development. The use of bacterial and chemical products to combat mosquito larvae will take into account ecological requirements to mitigate negative environmental effects.

Antibiotic treatments with microbial or chemical means in human settlements made from the ground are of great importance due to the following advantages: it is applied only in habitats where there are larvae, which are narrow, strictly delimited and precisely detectable in space; consumption of insecticides is low, which means not only

low costs but also low pollution (especially if bacterial, non-polluting larvicides are used); efficacy is maximal, and adult mosquito populations that occur later are much less abundant.

A good fight against mosquito larvae leads to a significant decrease in the weight of chemical treatments against mosquito adults, until these treatments are eliminated in some areas and periods. Therefore, it is advisable that anti-larvae treatments do not miss out on mosquito control activities.

The order of priorities for applying the treatments will take into account the proportion of larval outbreaks in that territory in the development of mosquito populations and is generally the following:

- Flooded subsoils and outbreaks formed on the entire sewage and waste water outlet and district heating will be treated as a priority in the urban environment;

- Water containers from individual households with courtyards and gardens; it is efficient and essential to change the water from the containers at intervals of up to 6 - 7 days in the hot season;

- Some areas on the shores of lakes where there is vegetation. The lake's lazy water is not a good habitat for the development of mosquito larvae and is not treated.

- Temporary ballasts that occur in different areas, especially in the spring.

Antibiotic treatments will use bacterial insecticides in Bacillus thuringiensis israelensis (Bti) and B. sphaericus, which have specific action on mosquito larvae and are not harmful to other aquatic or terrestrial organisms including humans. Chironomide larvae are an exception, because BTI insecticide doses that are used to control mosquito larvae produce a 50% mortality of Chironomide larvae. These larvae represent 70-80% of the fish feed in many lakes and therefore, for the growth and maintenance of the fish, the Bati insecticides are not used in the lakes.

Bacterial insecticides, conditioned as water-dispersible products (powders, granules), are applied at doses of 125-750 g conditional preparation per hectare (depending on

PROIECT 15.3.1.6.3

clean water or loaded with organic residues, presence of vegetation etc.) and 1- 5 mg prepared / 1 liter of water to control larvae in container habitats.

The organophosphorus insecticides recommended by WHO (2006) as mosquito larvicides are chlorpyrifos, fenthion, pirimphos-methyl, temephos.

The products containing the active substance (s.a.) the organophosphorus insecticide (U class) are preferred as larvicides to other chemical insecticides because they have specific action on culicide larvae, have a DL50 of about 8600 mg a.c. / kg body weight in the oral rat and is therefore also used in drinking water without adverse effects on humans and animals in areas where it is stored in reservoirs for long periods of time. As compared to microbial insecticides or growth regulators that apply to small-stage larvae, the temefos insecticide is effective against the four larval stages of Aedes, Ochlerotatus, Culex and Anopheles. The temefos insecticide formulated as emulsifiable concentrate granules or concentrate is used in doses of 56-112 g a.i./ha and 1-2 mg / l in container drinking water. When using a dilute preparation with 1% temefos, its application rate depends on the water quality and is 10-20 kg / ha.

Insecticides that act as regulators of growth (insect growth regulator) inhibit the life cycle of the insect by interfering with the leaching process, which makes the insect unable to move to the next stage of development, it does not reach maturity and can not reproduce. Mortality occurs over a longer period of 3-10 days.

Growth regulators most commonly used as larvicides in mosquito control are diflubenzuron, methoprene and pyriproxyfen. These active substances are part of the U toxicity class.

Treatments with bacterial or chemical insecticides can be applied at intervals of 7 to 10 days, but less often if water is clean and free of vegetation or at higher doses of insecticide.

Neither larvicidal products containing carbamates nor those containing synthesis pyrethroids will be used as larvicides because they have a broad spectrum of action on non-target organisms have great potential for inducing mosquito resistance through their action on larvae and produce strong environmental pollution.

PROIECT 15 3.1

Combating adult mosquitoes is done, as well as combating larvae, both in their indoor and outdoor habitats in urban and rural areas.

he chemical methods occupy the most important place in mosquito control and their selection is directly conditioned by habits of housing and feeding of culicidal fauna, namely whether the exofile and exofage species or endophile species and endofage predominate in different habitat types, which leads when choosing indoor or outdoor insecticide treatments.

In the Romania-Bulgaria cross-border area there is a rich mosquito-like fauna with many species whose populations prefer outdoor spaces but penetrate quite a large number of different types of indoor habitats to nourish. Therefore, depending on the specific conditions in the various outdoor and indoor shelters in urban and rural areas, indoor or outdoor treatments will be applied.

Combating mosquito adults within the integrated control program has the main directions for application:

- Residual indoor treatment that is a site for mosquitoes: in basements, stairwells in blocks, animal shelters and poultry, much rarer in living quarters. These treatments are essential for the need to combat malaria vein aneurysms.

- Outdoor space treatments on vegetation, in localities along the streets including courtyards on streets, parks, etc .;

- Combined treatments (indoors and outdoors), effective at the beginning of the cold season for the control of the hibernate fauna of culicides.

- The selection of insecticides for use in combat will be based on the assessment of the sensitivity / resistance status of the local mosquito populations in the targeted territory relative to the insecticides generally recommended for combating.

Regular resistance monitoring is required in areas where countermeasures are constantly applied.

Since the mosquito resistance process is taking place against a growing number of insecticides on increasingly widespread territories, WHO recommends the use of any

type of insecticide in a particular area, including organochlorine (even if at some point it was banned) , if mosquitoes are found to remain sensitive to the insecticides. In this way, the duration of the use of existing insecticides is prolonged, as there are no new categories of substances that can be used as insecticides and in the circumstances where it is absolutely necessary at present to stop the transmission of diseases globally and to limit the human mortality .

Insecticides recommended by WHO for indoor residual spraying in mosquito control are among all four major groups of insecticides: organochlorinated (DDT), organophosphoric, carbamate and pyrethroid.

The duration of effective insecticide action used in indoor residual treatments depends on several factors, the most important being the form of conditioning of the insecticide preparation, the nature of the support to be applied, the temperature and humidity conditions of the interiors to which these treatments apply . Water dispersible powders are used to the greatest extent because they have a longer residual effect, especially on porous surfaces.

Internal residual treatments are performed with hand-held sprayers and handled.

Outdoor spatial treatments are aimed at combating adult mosquitoes with exotic tendencies and powerful exofases, which prefer outdoor habitats, especially vegetation of various types.

Spatial treatments in the external environment apply to localities only from the ground in the form of aerosols or cold fog (ULV-ultra low volume) and hot fog.

Such treatments use much smaller amounts of insecticide than coarse splashes, insecticide that is dispersed in micron droplets (micrometers = μm) with greater efficacy on mosquitoes.

Cold fog is produced with portable or motorized ULV generators. Portable generators are used on more restricted spaces or even for indoor treatments, such as those in the basements, which also target adult mosquitoes.

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In thermic fog treatments, the particle size produced by thermal aerosol generators is 1-200 μm, including insecticide drops and smoke particles that eliminate visibility, producing a dense cloud. Hot fog generators are also portable or worn on vehicles.

Ground spatial treatments in the external environment are performed against adult mosquitoes but also larvae, with equipment worn by operators or installed on motor vehicles.

Vehicle treatment on motor vehicles that travel to the streets, alleys in parks, access ways in recreational areas, etc. efficiently encompass all vegetation from the ground up to the tree tips. In residential areas, these treatments include not only the vegetation in the immediate vicinity of the dwellings but also the spaces on both sides of the streets, including the outside of the blocks and houses, their yards and gardens without entering them.

By using the equipment worn by the operators, strictly and with very high efficiency, the selected areas of smaller size, perfectly circumscribed, both larval habitats and adult shelters are treated.

The amount of insecticide product recommended in space treatments is established for each type of product, with a specific formulation, to ensure the optimal dose in the treated area and is expressed in the amount of product / ha. Take into account the amount of active substance in the product to be insured per hectare. The determination of the total amount of insecticide product to be used for spatial treatment will be made taking into account the entire area corresponding to the space in which insecticide product dispersion will occur.

The methodology for mosquito control in the urban environment involves the simultaneous application of a complex set of actions against larvae and mosquito adults. In our climate, the duration of a generation from adult to adult for Culex species, dominant in mosquito populations to be fought during the warm season, is two to three weeks. To effectively combat these mosquito populations, the application of a set of combat actions will cover a range that can sometimes reach up to the duration of a mosquito generation. Within this range, two to three to seven space treatments are

recommended for public sector vegetation and street alignments at intervals of 2 to 3 days so as to eliminate mosquitoes who continue to appear. These are adult mosquitoes from untreated larval habitats (outbreaks on particular properties, containerized artificial outbreaks, permanent outbreaks in the vicinity of the locality), and adults who migrate permanently from surrounding areas or leave indoor areas where they are not have suffered from outer space treatments. Eliminating adult mosquitoes, which continue to occur after the first space treatments, eliminates the possibility of eggs depositing them and the immediate recurrence of larvae, which, in the conditions of high summer temperatures, can reach adult stage within a range of up to 10 days and thus maintain mosquito populations if insufficient treatments were applied at one time.

Airplane treatments on human settlements are not recommended.

Airplane treatments in localities are extremely low, virtually nil, because many mosquito-housings are indoors where they are not affected by such treatments and also have no effect on larval outbreaks in subsoils, sewerage networks, small ponds, containers, which represent the majority of sites for the development of mosquito larvae in localities. On the other hand, airplane treatments are extremely polluting and have high costs.

The effectiveness of combat activities is ensured by their application, as far as possible, throughout the locality and in the shortest possible time.

Treatments applied against both larvae and adults at a given time on narrow surfaces and at longer intervals of time have very low efficiency due to reinfestation of respective areas with adult mosquitoes that appear permanently in untreated areas, locality and lay eggs.

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VI.6. Participation of the local community in the implementation and implementation of the integrated mosquito combat program

The complexity of the program of integrated control of culicides in the Romania-Bulgaria cross-border area requires the participation of the community from the respective territory to its implementation, namely the local administrative bodies, the communal households, the economic units and state and private enterprises, including the population from the respective localities. In order to ensure this participation, it is necessary to issue normative acts by the Prefectures of the respective counties to regulate through them the functions and responsibilities of the administrative and economic units, of the Local Public Health Authorities and of the population in the planning, sanitation of the territory, the application and the unfolding of the fighting actions of mosquitoes.

VI.7. Continuous application of integrated insect control program for the accumulation and consolidation of beneficial results

The continuity of the integrated culicide control program is essential and indispensable for enhancing the beneficial results of maintaining low populations of insects for the continuous adaptation of control methodologies to the evolution of environmental factors over time as well as for developing and introducing methods new alternatives with higher and non-polluting efficiency.

VI.8. Periodic epidemiological, entomological and operational evaluations

The implementation of the integrated control program of the culicides is permanently accompanied by evaluations in order to elaborate the forecasts and the measures for its future development and its optimization.

Entomological assessment aims to evaluate the way and the effectiveness of applying the integrated mosquito control methods. Both specific tests for the evaluation of the results after the application of larvicidal and imagocide treatments and "aggressiveness" tests periodically applied at representative points of the operational area to assess the general level of presence of mosquito populations will be used. Measures are being taken to optimize operational methods and methodologies for high efficiency and pollution mitigation. The entomological and operational assessment in correlation with the assessment of the environmental factors will ensure the development of prognoses regarding the evolution of mosquito populations in the area and future measures.

The epidemiological, entomological and operational evaluation of the effectiveness of the integrated mosquito control program together with the local actors responsible for program implementation in the respective counties will be organized annually and the measures for the continuation and optimization of its implementation will be established.

VII. Financial resources

The funding of larvicidal treatment should be made from national budgets for the Danube River and other rivers, lakes, marshes, etc in localities_county / regional and / or local budgets.

Financial parameters are GIS information on larvicidal_imagocide and treatments

The estimates made by the Bulgarian side for larvicidal treatment for the cross-border territory are approximately EUR 2 million. In the urban areas, the necessary amounts for treatments ranging from 0.8 - 1 Euro / person were highlighted.

From the discussions in the round tables in Romania and Bulgaria, the estimated costs of the treatments are between 0.6 - 1 Euro / person in the urban area.

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VIII. Types of alerts issued

The application of larvicidal treatments should be announced in advance (early warning) and made only after all institutions, firms and interested persons, mainly beekeepers, have been notified.

GIS may include that information or, in collaboration with the mayoralties and, identify beekeepers and be alerted by regular SMS on the imminence of such treatments. In this case, a campaign to promote the GIS system and the mobile phone application among bee breeders can also be launched.

GIS can also be a tool for working out specific treatments for protected territories: parks, reserves.

The support materials underlying the elaboration of this Strategy are:

- Annex 1.1 (mosquitoes);
- Annex 1.2 (ticks);
- Annex 1.3 (phlebotomi);
- Annex 1.4 (Integrated Combating Program
- Annex 2 - Answers from national and local authorities received;
- Annex 3 - Conclusions resulting from the organization of Roundtables in Romania and Bulgaria;
- Annex 4 - Strategy Bibliography;
- Annex 5 - Romania and Bulgaria database;
- Annex 6 - Methodology;
- Annex 7 - Coordinated Plan for the Joint Institutionalized Partnership
- Annex 8 - Action Plan and Financial Plan

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S.C. **Global Management Arte** S.R.L.

București, November 2017