MediLabSecure Situation Analysis on integrated surveillance (MeSA) Study

REPORT on SITE VISIT TO SERBIA

(4-8 July 2016)

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Acknowledgement

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Stakeholders involved in the Study (Debriefing Meeting, Batut PHI- Belgrade, 7 July 2016)

1. BACKGROUND

This report describes the Situation Analysis on integrated surveillance conducted in Serbia in the framework of the MediLabSecure Project (the MeSA Study).

MediLabSecure [1] aims at increasing the health security in the Mediterranean and Black Sea Regions by enhancing and strengthening the preparedness to common health threats. The activities focus on emerging viruses with vector transmission.

The MeSA Study has been designed and implemented by the ISS Team (Maria Grazia Dente, Flavia Riccardo and Silvia Declich) that is leading the WP5-Public Health Working Group of MediLabSecure [2].

Public health activities aim at reinforcing preparedness of the MediLabSecure Network by investigating and improving the standard methods of surveillance of arboviral diseases towards *integrated surveillance, integrated risk assessment and early case detection* in the framework of *One Health*. The strategies adopted rely also on the experience and lessons learned gained with the implementation of EpiSouth and EpiSouth Plus Projects [3, 4].

For this Study, the definition of One Health Surveillance provided by K.D.C. Stärk et al. [5] has been adopted: "*One Health Surveillance consists of the systematic collection, validation, analysis, interpretation of data and dissemination of information collected on humans, animals and the environment to inform decisions for more effective, evidence- and system-based health interventions*".

One Health surveillance should lead to faster disease detection, more efficient disease control and tangible financial savings when formally compared against separated surveillance streams [5, 6].

While there seems to be consensus about the value of One Health in published studies, there is an evident lack of metrics and associated methods to estimate One Health benefits in a systematic way [7].

The MeSA study can support the evaluation of the One Health benefits. It is the end-point of a study process, in the framework of MediLabSecure project, that identified common criteria to consistently describe and compare how arbovirus surveillance integration occurs in countries,

document the impact of the One Health strategy in a national context and assess the level of integration between relevant sectors/disciplines.

The above-mentioned study process had a stepwise approach as per the following scheme:

- Scoping Review – Step 1
- Survey with Medilabsecure members – Step 2
- Situation analysis (MeSA Study) – Step 3

The description of the studies related to the first two steps (Scoping Review, Survey with Medilabsecure members) are available in other documents [8, 9] .

The results of these studies will be reported and discussed in the ***Strategic document on integrated surveillance and risk assessment of arbovirosis in Mediterranean and Black Sea Regions*** (including Network's recommendations on future actions aimed at strengthening preparedness and response in the framework of One Health).

2. THE MESA STUDY

The MediLabSecure Situation analysis on integrated surveillance of arboviruses in the Mediterranean and Black Sea Region is a qualitative situational analysis study involving the human, animal and entomology sectors of vector borne disease surveillance in three countries of the Mediterranean and Black sea region participating to the MediLabSecure Project.

General Objective

- Contribute to the integration of laboratory/clinical human, animal and entomological surveillance of arboviruses in the Mediterranean and Black Sea region and encourage inter-sectoral collaboration.

Specific objectives

- Describe how the collection, analysis and dissemination/exchange of information is organized within and between human, animal and entomological surveillance of arboviruses in three countries of the MediLabSecure network,

- Identify formal procedures, informal practices and legal constraints for integrated surveillance and inter-sectoral collaboration in these three countries,
- Discuss main challenges and success stories in establishing a functional inter-sectoral collaboration and integration of surveillance between the human, animal and entomological sectors in these three countries.

The Study is structured in four phases:

1. Selection: selection of three countries to involve in the study ("participating countries");
2. Country Portfolios: development of study tools and collation for each country, in advance of the site visit, of available data/documents to build a country portfolio including a specific checklist;
3. Site Visits: conduction of a site visit in each participating country to investigate processes, procedures and performance in the field of arbovirus surveillance integration between human, animal and entomological sectors in the framework of One Health;
4. Reporting: preparation of a country report for each visited country and distillation of main findings in a strategic document on inter-sectoral integration in the field of arbovirus surveillance.

For further details on the study design please refer to the Annex I- Study Design

3. THE MESA STUDY IN SERBIA: WEST NILE VIRUS (WNV) SURVEILLANCE ACROSS THE HUMAN, VETERINARY AND ENTOMOLOGICAL SECTORS

The MeSA Study in Serbia developed on the following steps:

i) First feedback on the experience of Serbia in intersectorial surveillance of West Nile Virus (WNV) from the MedilabSecure Survey 2014 [8]
ii) Consultations during the MediLabSecure Mid Term Meeting, December 2015 [10]
iii) Agreement to participate in the MediLabSecure MeSA Study, February 2016
iv) Preparation of Study Portfolio and tools (including stakeholders table), April-June 2016
v) Site Visit to Serbia, 4-8 July 2016
vi) Preparation of the Report, August-September 2016

During the visit the following activities have been performed:

a. Present the country situation
b. Visit all stakeholders involved in West Nile Virus surveillance (at least one per each sector: human virology, animal virology, medical entomology, public health) and explore the effectiveness of the surveillance process and communication mechanisms in place between the sectors
c. Debriefing meeting with all the stakeholders involved to discuss and consolidate the information, data, procedures, lessons learned etc., collected through the documentation provided and through the interviews conducted during the visit.

For further details on investigation team, duration and scope of the activities, etc. refer to Annex II - Portfolio of Serbia and its annexes.

4. THE ORGANIZATION OF THE SERBIAN SURVEILLANCE SYSTEM

The Serbian Health system is decentralized, and the accountability for health institutions is shared among their founders – the Government, the Ministry of Health (MoH), the Province of Vojvodina, the City of Belgrade, and local municipalities.

The municipality is the basic unit of local government in Serbia. Municipalities are geographical subdivisions of the national territory. In rural areas, a municipality may include both towns and the surrounding countryside. Belgrade and three other large cities, Novi Sad, Nis and Kragujevac, have the status of cities. There are two autonomous provinces, Vojvodina and Kosovo and a region under direct control, Central Serbia.

The main responsibilities of municipalities are currently for infrastructure services such as heating, water and sanitation, local transport and maintenance of physical assets. Increasing responsibility for delivery of public sector services are being transferred to municipalities and service providing institutions. As a result, Government's ability to deliver public services will increasingly depend on the performance of municipalities [11].

Serbia is divided in 24 Districts: Institutes of Public Health are available in each of the District while the Regional Veterinary Institutions (12 in total, 2 Scientific and 10 Specialized – regional Institutes), may cover from one to several Districts (for example Kraljevo institute covers 4 Districts, Belgrade covers 1, Pancevo covers 1 etc.).

In fact Serbia is, according to veterinary authorities, divided in 12 epizootiology regions, each leds by one veterinary institute. Epizootiology regions have nothing to do with Districts which are administrative divisions. Epizootiology regions are determined by geography, climate etc.
The surveillance system has the first ring of the chain at district level with direct reporting to the Batut Institute for the human surveillance and to Veterinary Directorate for the Veterinary and Entomological surveillance.
Batut Institute reports to the MoH and the Regional Veterinary Institutions to the Veterinary Directorate/Ministry of Agriculture.
With reference to Veterinary surveillance, the sero-surveillance of sentinel animals (horses and poultry in 2014 and only horses in 2015) are under the supervision of all 12 veterinary Institutes.

The direct surveillance of virus presence in mosquitoes and wild birds are divided, so that the seven districts of the Province of Vojvodina, in the north of the Country, are under the supervision of Scientific Veterinary Institute Novi Sad, the Central Serbia Districts (five) under the Institute of Veterinary Medicine of Serbia (Belgrade) and the other twelve Central Serbian districts (parts of the central and south part of the country) are under the supervision of the Specialized Veterinary Institute Kraljevo.
Data are electronically transferred from district to national level.

5. THE HISTORY OF WNV TRANMISSION IN SERBIA AND EVOLUTION OF THE SURVEILLANCE SYSTEMS AND THEIR INTEGRATION

The WNV surveillance system developed in Serbia after the first outbreak in humans in August 2012 is described in detail in the scientific articles of Petrović T. et al. [12] and Petric D. et al. [13].
See for details BOX 1

BOX 1.

First serological investigation of WNV infection presence in human population in Serbia was conducted in 1972 and antibodies against WNV were found in 2.6% - 4.7% of human sera (Bordjoški et al., 1972). In another study, antibodies against WNV were detected, depending on location, in 1 to 8% of tested human sera in Serbia (Vesenjak-Hirjan et al., 1991). After a gap of many years, more recent serological examinations show presence of anti-WNV IgG antibodies in 18 out of 451 (3.99%) human collected from 2005 to 2010 in Vojvodina province with yearly rates varying between 1.97% and 6.04% (Petrić et al., 2012).

Except this data, as to our knowledge, no clinical manifestation of disease was ever reported in Serbia until 2012. In August 2012, an outbreak of WNV infection in humans was reported for the first time ever in Serbia (EpiSouth Weekly Epi Bulletin - N°232 and N°240, 2012; ECDC, 2012), being the first time that WNV infections in the country have been associated with clinical symptoms.

EpiSouth Weekly Epi Bulletin - N°232 -

http://www.episouthnetwork.org/sites/default/files/bulletin_file/eweb_232_30_08_12.pdf

Location: Serbia	Event: West Nile	Comments
As of 18 October 2012, a total of 64 West Nile fever cases among which 40 confirmed were reported in Serbia (cf. ECDC). 72% of this total number of cases was reported in Beograd district. **Map 1. Areas affected by West Nile in 2012, Serbia, 2012**  		• It is the first year Serbia is reporting WNV cases. The first cases were reported in August (cf. eWEB n° 232). • This high number of cases in a newly affected country illustrates the dynamic of WNV circulation in the Balkan area this year. • WNV surveillance for humans and equine is implemented in Serbia (cf. Note on 2010 & 2011 seasons WNV circulation in EpiSouth countries).

EpiSouth Weekly Epi Bulletin - N°240 -

http://www.episouthnetwork.org/sites/default/files/bulletin_file/eweb_240_25_10_12.pdf

As of November 30, 2012, a total of 71 West Nile fever cases were reported, among which 42 were clinically and laboratory confirmed, and in 9 cases resulted fatal (lethality of 12.7%). All the cases were detected in central and northern parts of the country, 72% of them in the Beograd district (ECDC, 2012; Obrenovic et al., 2013; Popovic et al., 2013).

This epidemic continued, and became even more severe during 2013. As of November 2nd, 2013, a total of 303 West Nile fever cases were reported, among which 202 were clinically and laboratory confirmed, and 103 were classified as probable cases".

WNV Surveillance Annual Plan

Plans for WNV surveillance have been drafted since 2013 by the Ministry of Health (human surveillance) and by the Ministry of Agriculture (animals/vector surveillance), but officially released and funded from April 2014. So far, these plans were released with distinct official communications (for further details see Fig 1. and Annex III).

In 2016 the Ministry of Agriculture did not release the Plan due to other emerging priorities (lumpy skin disease) and lack of funds.

The 2016 surveillance Plan for human cases has been released with identical procedures for endemic and not endemic areas.

The Torlak Institute (human virology), the Batut Institute (human epidemiology) and the MoH have jointly prepared the 2016 Plan.

Surveillance of human cases started in 2012 based on ECDC WNVD case definition.[1]

WNVD started to be a notifiable disease in Serbia in 2016 (under the law on protection of the population against communicable diseases, Official Gazette of the RS no 15/2016), with notification due within 24 h from laboratory confirmation.

Enhanced Surveillance is triggered by the first human WNV case detected in the area.

Enhanced Surveillance is activated 24 h after the identification of a cluster of WNV human cases in the same area.

Enhanced surveillance includes active case finding around each confirmed case, re-issuing awareness messages to clinicians in all county hospitals on how to recognise the clinical presentation of neuroinvasive WNV infection, and ensuring that reporting and sending of samples was done in a timely manner.

An Entomological Surveillance system reporting to the MoH was started in 2013 with a Programme financed by the MoH and the Beograd Municipality in Beograd and other urban areas in Serbia. This activity developed in the context of the vector control programme (see 5.b).

[1] http://ecdc.europa.eu/en/healthtopics/west_nile_fever/eu-case-definition/pages/eu-case-definition.aspx

Novi Sad University-based entomological surveillance started in 2005

The Veterinary Directorate of the Ministry of Agriculture and Environmental Protection launched and funded the national WNV monitoring program, Veterinary plus Entomological surveillance, starting from April 2014. The Program encompassed the entire territory of the Republic of Serbia and was conducted by specialized academic veterinary institutes and field veterinary service in close collaboration with qualified entomologists and ornithologists.

"The principal objective of the monitoring – surveillance program is early detection of WNV in monitored regions, timely reporting of the virus presence and activation of human health service institutions and local authorities aimed at establishing the control measures - eradication of mosquitoes, informing the local community and taking all relevant preventive measures for human health protection" [12].

In 2014 the veterinary and entomological integrated surveillance program was based on the monitoring of IgG negative horses and poultry and detection of their seroconversion. In 2015 the surveillance was based on monitoring of anti-WNV IgM antibodies in blood sera of sentinel horses (indirect surveillance) performed continuously and periodically during the most intensive mosquito activity (May – September), as well as on monitoring the presence of the virus in natural hosts and vectors: wild birds and mosquitoes (direct surveillance).

Direct surveillance *is performed through periodical and continuous testing of pooled mosquitoes samples collected at two-week intervals during peak mosquito season (May – September) and samples of wild birds (tissues of dead birds and throat swabs of captured live susceptible bird species). The number of samples is estimated according to the anticipated risk rate in particular regions.*

As reported in Annex III, the Surveillance plan provides for active and passive surveillance.

Active surveillance includes:

- serological testing of sentinel horses (ELISA WNV IgM Ab test)
- testing on virus presence in mosquito vectors (RT-PCR)
- testing on virus presence in samples of found dead / alive captured susceptible wild birds (RT-PCR) .

Passive surveillance includes:

- ❖ serological testing (pared sera samples) and testing of virus presence in samples of horses with clinical signs of neurological disorders.

The active and passive surveillance encompassed all municipalities in the Republic of Serbia with distinction by endemicity areas: distribution of sampling points is determined based on risk assessment of exposure to WNV (see Fig 1).

The veterinary surveillance programs in 2014 and 2015, that also included the entomological surveillance, were based at districts level (regarding the number of sampling location and number of samples that should be collected per districts of high or low WNV risk).

National WNV monitoring program in Serbia

➢Based on the existing knowledge on presence and circulation of WNV, Districts (NUTS3) in Serbia were, regarding the risk of WNV infection divided into Counties of higher and Counties of lower risk for WNV infection:

Higher risk Districts	Lower risk Districts
Severno-bački okrug	Severno-banatski okrug
Zapadno-bački okrug	Mačvanski okrug
Južno-bački okrug	Braničevski okrug
Srednje-banatski okrug	Pomoravski okrug
Južno-banatski okrug	Borski okrug
Sremski okrug	Zaječarski okrug
Grad Beograd	Zlatiborski okrug
Kolubarski okrug	Moravički okrug
Podunavski okrug	Rasinski okrug
Šumadijski okrug	Nišavski okrug
Raški okrug	Toplički okrug
	Pirotski okrug
	Jablanički okrug
	Pčinjski okrug

Source: Petrovic et al. 2014 [10]

Fig 1. Counties in Serbia as per high and low WNV risk

Ongoing Surveillance-Monitoring Measures in 2016

As of 2016 the following measures were being implemented:

- Human cases surveillance with Plan delivered by the MoH
- Routinely Monitoring of vector pools and control measures or/and on the basis of suspected WNV in a patient within MoH programme (traps are placed in the relevant sites).

Vector Control

Vector control activities are decentralized to Municipalities therefore, as anticipated in chapter 4, the quality of vector control depends on the performance of municipalities[2].

For example, of the 44 Municipalities of the Province of Vojvodina less than 10 are presently running vector control activities. Municipalities act independently from the National Level and without national guidance and financial support. Municipalities are not obliged to report to Institutions or Ministries at National level.

The vector control is often, therefore, not a systematic action coherent and fed by the monitoring outcomes because monitoring and control are implemented by different entities with scarce coordination between them.

The Institute for Biocides and Medical Ecology, contracted by the Municipality and the MoH, reported that the situation is different in Belgrade and in selected urban areas in Serbia where monitoring and control of mosquitoes is conducted on a daily basis. If positive mosquitoes are detected in field samples, the same evening mosquito control measures are conducted (ULV cold and thermal fogging).

[2] Mosquito control, as well as other DDD measures (disinsection, disinfection, deratisation) are under the auspices of the municipalities, without a regional/national plan providing guidelines for actions. Due to the specific socio-economic and political situation, each municipality may decide independently if/when/how it activates vector control programmes.

5.A INSTITUTIONS INVOLVED IN WNV SURVEILLANCE IN SERBIA MET DURING THE SITE VISIT [3]

Ministry of Health - http://www.zdravlje.gov.rs/
Ministry of Agriculture and Environmental Protection - http://www.eko.minpolj.gov.rs/en/
Institute of Public Health of Serbia "Dr Milan Jovanović Batut" (Batut Institute) http://www.batut.org.rs/index.php?lang=2
Institute of Virology, Vaccines and Sera Torlak - National Reference Laboratory for ARBO viruses and hemorrhagic fevers **Torlak Institute)** - http://www.torlakinstitut.com/en/home/index/Home
Institute for Biocides and Medical Ecology
Institute of Veterinary Medicine of Serbia Virology Department - http://nivs.rs/category/referentne-laboratorije/
Scientific Veterinary Institute „Novi Sad" http://niv.ns.ac.rs/?lang=en
Faculty of Agriculture, University of Novi Sad Laboratory for Medical and Veterinary Entomology https://www.uns.ac.rs/index.php/en/laboratories/faculty-of-agriculture
Clinical of Infectious Disease of Human

Establishment of an intersectorial Committee

The WNV outbreaks stimulated the establishment of an intersectorial Committee in 2016 (which includes representatives of all the sectors involved in the WNV Surveillance and Response) on the basis of a law promulgated by the MoH in 2014.

The aim of the Committee is to enhance and share early warning of WNV circulation in animals and mosquitoes to the Human and Animal Public Health sectors in order to issue alerts and trigger needed action.

The Committee met two times a month during previous transmission seasons, in 2016 (up to July when this document has been drafted) once in March.

The intersectorial Committee is under the coordination of the Batut Institute and started to meet also for other emerging infections (e.g. in 2016 for Zika virus).

[3] For details on the Institutes involved, see related websites, portfolio and presentations in annex IV.

5.B ANALYSIS OF SURVEILLANCE PROCESSES (INTRA/INTER SECTORIAL)

The analysis has been done on the surveillance processes implemented when the surveillance of WNV is in place in the different sectors. At the moment of the visit (July 2016), the veterinary and entomological surveillance for WNV was not in place, so the analysis of the processes refers to the year 2014 and 2015.

However, the Entomological Surveillance system reporting to the MoH, started in 2013 with a Programme financed by the MoH, was still in place although with some limitations.

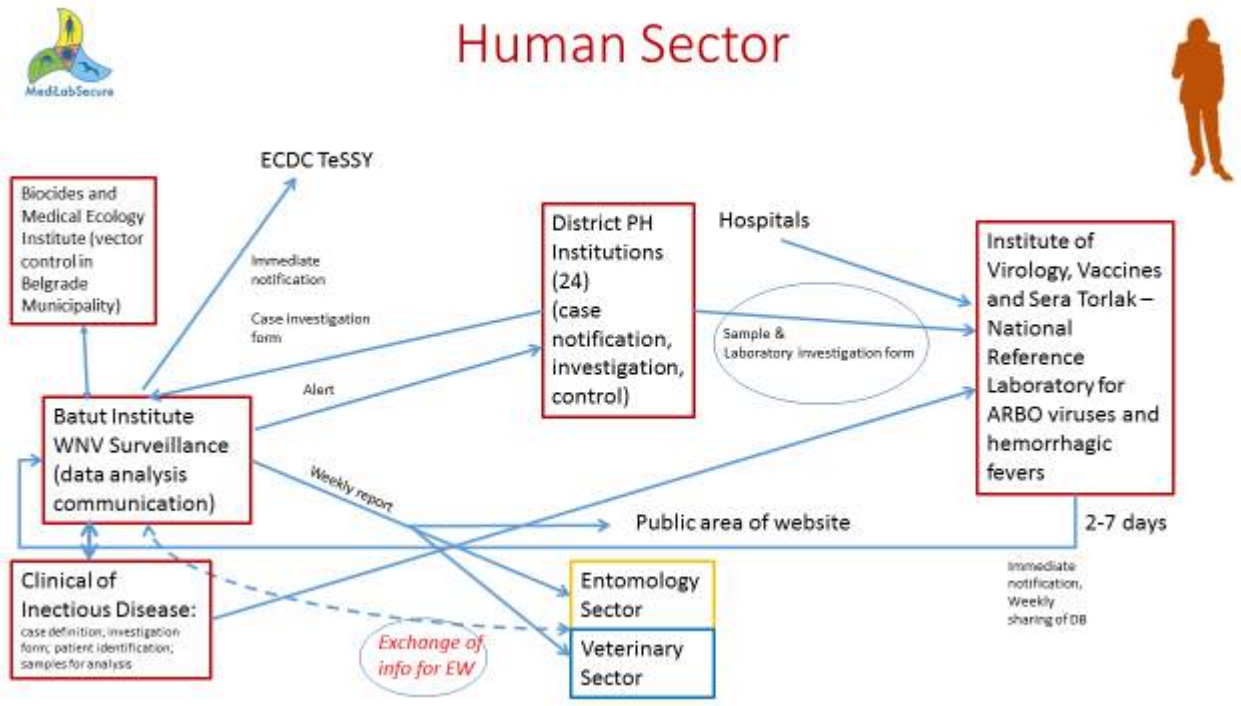

FIG.2 – Data and actions flow between actors involved in WNV human surveillance

Continuous line: consolidated process

Dashed line: process to be consolidated

The Human Surveillance Sector was described through interviews conducted at the MoH, Batut Institute, Torlak Institute and integrated with documentation and comments provided during the debriefing meeting at Batut Institute.

Responsibility for human WNV surveillance is of each healthcare facility in the country and, in case of outbreaks, of district IPHs.

National investigation forms are prepared by the Batut Institute (case investigation form) and the Torlak Institute (laboratory investigation form).

Approximately 170 *epidemiologists* of District IPHs are involved in collecting and transmitting WNV surveillance data.

Epidemiologists of district IPHs (24) collect data with face-to-face interviews and surveillance is case-based.

Laboratory Confirmation of human cases of WNV is conducted with **s**erological analysis of sera and Cerebrospinal Fluid Analysis (CSF) at the Reference Laboratory for ARBO viruses and hemorrhagic fevers in Institute Torlak in Belgrade (5 people in case of emergency, 1 on routine).

Surveillance data are transmitted electronically from district to national level, and the Batut Istitute coordinates data collection, analysis, communication and response. The central level can send early warnings to district levels if relevant information is provided by other sectors and reports internationally through the European TESSy surveillance platform.

Inter sectorial processes, as schematically reported in FIG.2, involve the Entomological and Veterinary sectors that are kept informed on human surveillance by weekly reports. Likewise reports and meetings enable the health sector to be provided information relevant for early warning from the other sectors. Exchange of information for Early Warning between the human sector and the entomological and veterinary sectors is not a consolidated process.

5.B.2 VETERINARY SECTOR

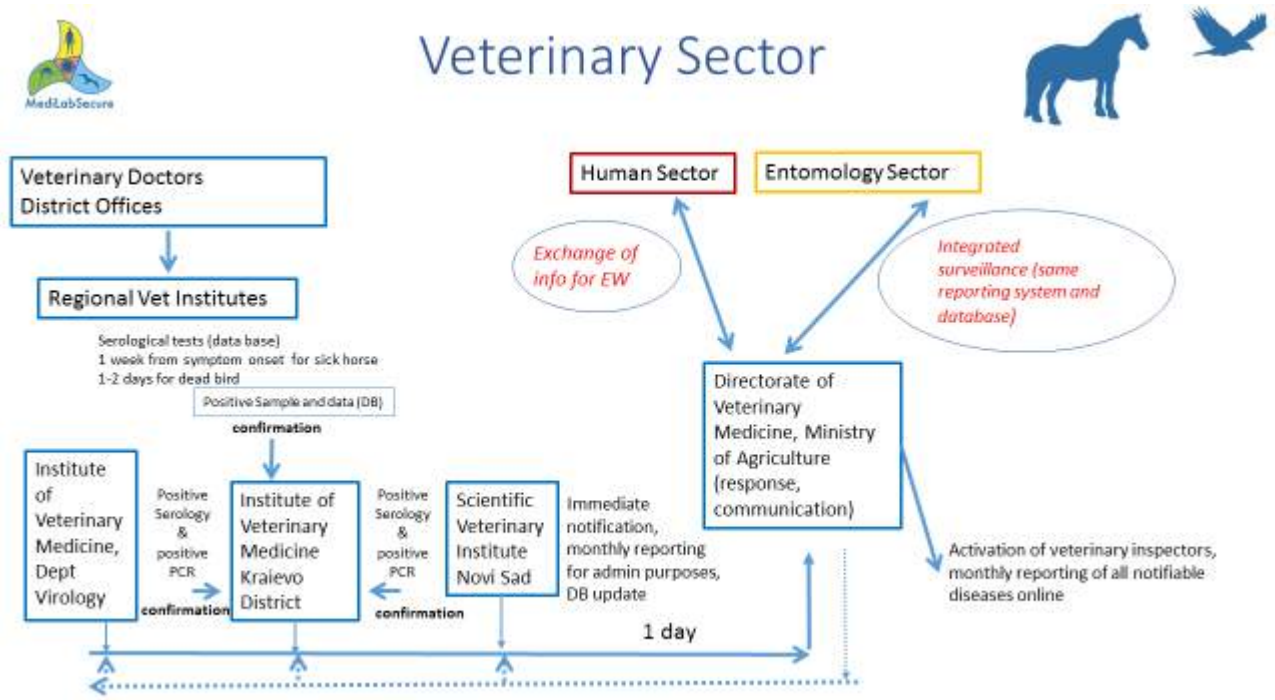

FIG. 3 – Data and actions flow between actors involved in WNV veterinary surveillance

Continuous line: consolidated process

Dashed line: process to be consolidated

The Veterinary Surveillance Sector was described through interviews conducted at the Institute of Veterinary Medicine of Belgrade, Dept. of Virology, and integrated with documentation and comments provided during the debriefing meeting at Batut Institute.

Three veterinary doctors and three technicians of the Institute of Veterinary Medicine, Dept Virology work in the mammal section while 2 veterinary doctors and 1 technician work in the birds section.

As already mentioned, Serbia is, according to veterinary authorities, divided in 12 epizootiology regions, each led by one veterinary institute. Epizootiology regions are determined by geography, climate etc. A network of 12 regional veterinary Institutions is presently active.

All anti-WNV antibody positive blood samples found positive by each of the 11 of 12 Veterinary Institutes included in serosurveillance, as well as all RT-PCR WNV positive samples of wild birds or mosquitoes found by Veterinary Institutes in Novi Sad and Belgrade are sent for the confirmation of the results to the Specialized Veterinary Institute Kraljevo, acting as a national reference laboratory for WNV.

Within one day, notification of confirmed cases is due to the MoA.

Inter sectorial collaboration with the Entomological sector, as schematically reported in FIG.3, is ensured through institutional collaboration mechanisms. The human sector provided information relevant for early warning purposes through an unconsolidated process as described above.

5.B.3 ENTOMOLOGY SECTOR

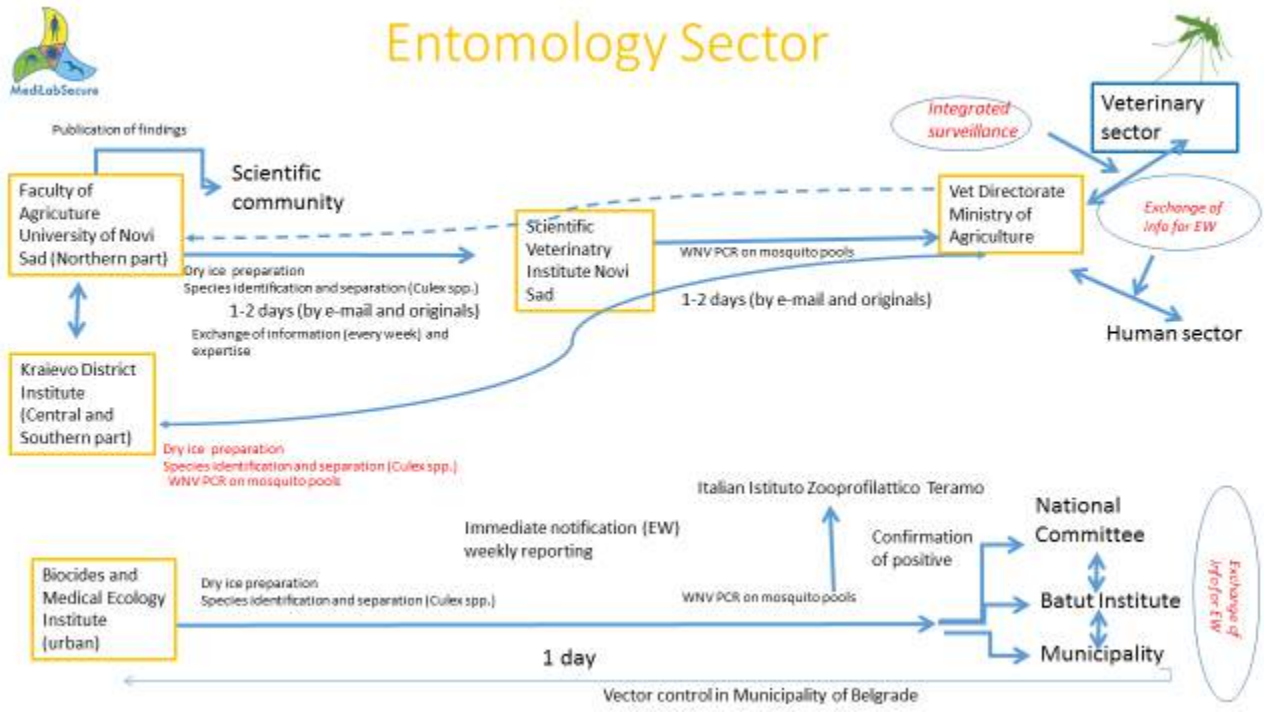

FIG.4 – Data and actions flow between actors involved in WNV entomological surveillance

Continuous line: consolidated process

Dashed line: process to be consolidated

The Entomology Sector was described through interviews conducted at the Faculty of Agriculture University of Novi Sad, the Biocides and Medical Ecology Institute, and integrated with documentation and comments provided during the debriefing meeting at Batut Institute.

The Faculty of Agriculture, University of Novi Sad Laboratory for Medical and Veterinary Entomology (LME) is staffed with a medical entomology team of 10 people, including WNV expert, and started research and studies on entomological surveillance of WNV since 2005. The aim was to search for the evidence of WNV circulation in order to elevate alert of public health officials. The Laboratory is implementing research for the scientific community and species identification and separation for the Scientific Veterinary Institute of Novi Sad. In 2014 and 2015 LME was indirectly involved (subcontracted by Scientific Veterinary Institute of Novi Sad) in Ministry of Agriculture National WNV surveillance programme and in both years provided biweekly sampling, cold chain identification, pooling and delivery of mosquito vectors from 64 fixed sampling stations covering Vojvodina Province only.

The public Institute of Biocides and Medical Ecology (56 staff in total, 20 devoted to WNV) started entomological surveillance in 2013, initially within 30 cities, and now in 26 cities, across the country. Each year the target cities are identified on the basis of the previous year's epidemiology and on the resources provided by the Ministry of Health.

As previously reported, vector control in Serbia is under the responsibility of Municipalities. The Institute of Biocides and Medical Ecology is contracted by the Belgrade Municipality to implement vector control activities in its territory. The surveillance activities held monitor and guide vector control activities in Belgrade municipality.

In order to boost capacity, especially for sample confirmation and evaluation, the Institute of Biocides and Medical Ecology set up an ongoing collaboration with the Italian Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "Giuseppe Caporale" in Teramo.

When asked, no overlapping was described with the entomological surveillance carried out by the Institutions operating under the Veterinary Directorate under the MoA because only urban areas are targeted by this surveillance and the only vectors considered are mosquitos.

Both the Laboratory for Medical and Veterinary Entomology of University of Novi Sad and the public Institute of Biocides and Medical Ecology have an institutional database for entomology. These two systems are not connected.

Areas to strengthen mentioned by participants were the feedback flow of information from the MoA to the Scientific Institute of Novi Sad and then to the Laboratory for Medical and Veterinary Entomology of University of Novi Sad to enhance coordination and collaboration between all the institutions involved in the surveillance process.

Regarding intra-sector processes, in the case of the Entomological sector, two different processes were identified, one reporting to the MoH (through the public Institute of Biocides and Medical Ecology) and the other to the MoA (through the regional veterinary institutes).

Inter sectorial collaborations are ensured with the Veterinary sector through institutional collaboration mechanisms (Fig. 4).

The human sector provided information relevant for early warning purposes through an unconsolidated process as described above.

6. DISCUSSION

It appears that, although entomological monitoring activities for WNV date back to 2005 in Vojvodina province (northern Serbia) with a programme supported by the Ministry of Education ans Scienece and MoA, the first human case of WNVD in 2012 triggered institutional and operative measures towards a well-structured WNV surveillance system.

The establishment of a “multisectorial Committee”, under the officially recognized coordination of the Batut Institute, provided several insights.

It suggests the implementation of an intersectorally coordinated surveillance and response system and a possible opportunity to harmonize activities and programmes to increase efficiency [14].

It provides a formally established environment for the exchange of information and a way to strengthen existing informal contacts (telephone calls, e-mails) that can favour information exchange for early warning purposes between sectors.
Finally, the intersectorial Committee has the potential to inter-sectorially manage also other emergencies, as was recently proved by the summoning of the Committee in 2016 to discuss the recent Zika virus emergency.

The elaboration of surveillance plans released annually shows the effort of identifying targets, schedules, protocols and resources. Unfortunately, when resources are insufficient due to other priorities, the plans might not be released.

Opportunities were identified for strengthening integration procedures between the human (MoH) and the veterinary/entomological (MoA) sectors. As described, the MoH and the MoA seem to communicate mainly for early warning purposes, while the Entomological and Veterinary sectors, being both under the MoA, are experimenting integration practices like a joint surveillance plan, a common real time Data Base and an integrated network active in the field. However, the entomological sector described difficulties in linking surveillance findings with vector control actions.

The flow described for the Biocides and Medical Ecology Institute, which is supported by the MoH, was different. This Institute reports to the Regional Institute for Public Health, to Batut Institute and to the MoH, and is involved in the preparation of the MoH WNV Plan for Human surveillance. It has set up an entomological monitoring data base (not connected to Ministry of Health) and is directly in charge of vector control actions in Belgrade due to the original mandate of the Institute itself and its contract with the Municipality of the capital.

Feedback mechanisms from the Ministries to the Institutions which provide data and info were considered weak in some cases especially for information related to response/public health actions implemented. It was suggested to extend the participation to the intersectoral Committee also to representatives of Institutions not presently involved in the Committee.

More in general, some stakeholders ask for a central guidance (Ministries plus district authorities) which can coordinate and harmonize some critical actions like vector control activities at Municipality level (not regularly implemented), communication and public awareness campaigns.

Challenges in establishing a cross-sectorial system include sustainability (financial, human resources), need for standardization of methods (detection, response), need for joint reporting and interoperable Data-bases, need for calculation and interpretation of commonly understood and chosen indicators across sectors and within sectors, need for a strong central coordinating authority for each sector with clear roles and responsibilities.
These challenges are also preventing the evaluation of the surveillance plans which have not been evaluated so far (cost-effectiveness; impact of control measures).

7. CONCLUSIONS

Serbia has been experimenting intersectorial surveillance integration for WNV disease, both with intra-sectorial and inter-sectorial collaboration processes, for several years.

The analysis reported in the previous chapters are based on the information collected during the interviews, guided by the study's check list (see in annex II of the Portfolio), with key stakeholders working at the Institutions involved in WNV surveillance in Serbia.
The information, data, procedures, lessons learned etc. collected were preliminary elaborated during the site visit by the ISS team and presented and consolidated during the debriefing meeting, with all the relevant stakeholders, held in the last day of the mission (7 July) at the Batut Institute (see annex V).

In order to assess and document the level of integration between sectors, we identified possible criteria [8], proposed on the basis of an existing operational protocol and procedures [14].

The current levels where inter sectorial integration of WNV surveillance has been implemented in Serbia, in accordance with the identified criteria, is reported in Table 1.

Table 1. Levels of intersectorial WNV surveillance integration, Serbia, 2016

Level of integration	**Sublevels of integration**	**The WNV surveillance in Serbia**
Policy and institutional level	Policy level	1. Legislation issued (2014) by the Ministry of Health has created an **intersectorial Committee** in order to share information across sectors to recognize early circulation of WNV and make decisions (coordination/communication role of the PH sector) 2. National and district level **projects** supported financially by the Ministry of Agriculture and by the Ministry of Health have sustained intersectorial integration of entomological with veterinary and human surveillance of WNV. 3. Unique reporting system legislation for entomological and veterinary surveillance.
	Institutional level	Presence of ***formal*** institutional collaboration mechanisms within sectors (e.g. bilateral agreements in place for the entomological surveillance in Vojvodina) and of ***informal*** collaboration mechanisms (across sectors)
Data collection and analysis level	Interoperability mechanisms at data collection level	Data sharing is in place within sectors with distinct databases. Unique web-based database across all administrative level exists for veterinary surveillance since 2013
	Interoperability mechanisms at data analysis level	
Dissemination level		Information and weekly reports are shared across sectors Each institution might deliver information to the public autonomously.

The main criteria related to integration in place, seem to be fulfilled in the Serbian surveillance system.

Considering that, as anticipated in Background, the One Health surveillance should lead to faster disease detection, more efficient disease control and tangible financial savings when formally compared against separated surveillance streams [5,6], further studies are needed to

evaluate the impact of these surveillance plans to systematically quantify the costs and benefits of this integration .

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Annexes

Annex I

MediLabSecure

Situation analysis on integrated surveillance of arboviruses in the Mediterranean and Black Sea Region

MeSA Study Design

The MeSA Study was designed by Flavia Riccardo (ISS), Maria Grazia Dente (ISS) and Silvia Declich (ISS).

MediLabSecure is a continuation of the “EpiSouth plus” project (2010-2013). The project is funded by the European Union DEVCO/EuropeAid (Contract Number: IFS/2013/330 961). The Project is led by the Institut Pasteur and counselled by an Advisory Board composed by international experts.

CONTENTS

Sommario

1. Introduction

1.1 THE MEDILABSECURE PROJECT

Countries of the Mediterranean and Black Sea regions have common sea borders and, as a result, share common public health issues and threats. MediLabSecure is a European project (2014-2017) that aims at consolidating a Public Health and Laboratory Network on emerging zoonotic vector borne viruses.

It represents a cluster for awareness, risk assessment, monitoring and control of these vector borne diseases. This cluster pursues the interaction of four sub-networks, one laboratory network for human health, one laboratory network for animal health, one laboratory network for entomology and one network for public health reinforcement. The MediLabSecure network includes partner countries around the Mediterranean and Black Sea Regions (19 non-EU countries).

1.1.1 General objectives

- Create a framework for collaboration to improve surveillance and monitoring of emerging vector borne viral diseases (arboviruses)
- Provide training in participating countries to increase the communicable disease control in the Mediterranean and Black Sea region.
- Promote knowledge development and transfer of biosafety best laboratory practices

1.1.2 Specific objectives

Prevent spread of viruses and concerned vectors (mosquitoes):

- Prevent outbreaks of zoonotic viruses with an existing identified or potential risk in the region (West Nile, Dengue, Chikungunya, Yellow Fever, Rift valley fever, …)
- Improve integrated surveillance (animal, human, entomological)
- Provide risk assessment of the different emerging viruses (transmission, spread, human impact…)
- Recommend and implement public health measures for control where possible

For more information, visit http://www.medilabsecure.com/project.html

1.1.3 WP5- Public Health

Public health activities will reinforce the laboratories' consortium by investigating and improving where possible the standard methods of surveillance towards integrated surveillance, risk assessment and early case detection. The harmonization of methods for epidemiological surveillance in the three areas of human and animal virology and medical entomology will facilitate data exchange and data management, which ultimately will improve prevention and control.

In particular, the WP5 aims at assessing the current national situations in terms of **integrated surveillance**: which kind of links/procedures exists in the countries involved between the animal virology, human virology and medical entomology entities and the central national surveillance system.

These links/procedures will be verified and described through a national situation analysis (MeSA Study) to be carried out in a pool of three countries. The identified gaps and needs will inform the other WPs and the identified relevant case studies and lessons learned will be shared with all the countries involved in order to enhance inter-sectoral integration of surveillance.

The design of this study is based also on the experiences gathered during the conduction of the EpiSouth Plus National Situation Analysis of coordination of surveillance between Points of Entry and National Health Systems [1].

1.2 OBJECTIVES OF THE MESA STUDY

The MediLabSecure Situation analysis on integrated surveillance of arboviruses in the Mediterranean and Black Sea Region (MeSA Study) is a qualitative situational analysis study involving human, animal and entomology sectors of vector borne disease surveillance in three countries of the Mediterranean and Black sea region participating to the MediLabSecure Project.

1.2.1 General Objective

The goal of The MeSA study is to:

> Contribute to the integration of laboratory/clinical human, animal and entomological surveillance of arboviruses in the Mediterranean and Black Sea region and encourage inter-sectoral collaboration.

1.2.2 Specific objectives

1. Describe how the collection, analysis and dissemination/exchange of information is organized within and between human, animal and entomological surveillance of arboviruses in three countries of the MediLabSecure network,
2. Identify formal procedures, informal practices and legal constraints for integrated surveillance and inter-sectoral collaboration in these three countries,
3. Discuss main challenges and success stories in establishing a functional inter-sectoral collaboration and integration of surveillance between the human, animal and entomological sectors in these three countries.

1.3 MESA SITUATION ANALYSIS INVESTIGATORS

The national situation analysis will be guided and performed by a team of investigators (hereby Situation Analysis investigators) comprising MediLabSecure Focal Points of participating countries, the WP5 leaders and subject matter experts. The PH Focal Points of participating countries will participate in all the study phases.

1.4 PHASES OF THE MESA STUDY

The MeSA study is structured in four phases:

1. **Selection**: Selection of three countries to involve in the study (hereby called “participating countries”).

2. **Country Portfolios:** Development of study tools and collation for each country, in advance of the site visit, of available data/documents to build a country portfolio including specific scenarios/check lists.

3. **Site Visits:** Conduction of a site visit in each participating country to investigate processes, procedures and performance in the field of arbovirus surveillance integration between human, animal and entomological sectors in the framework of One Health.

4. **Reporting:** Preparation of a country report for each visited country and distillation of main findings in a strategic document on inter-sectoral integration in the field of arbovirus surveillance.

2. Relevant background information

2.1 SURVEY ON THE LEVEL OF INTEGRATION BETWEEN THE ANIMAL VIROLOGY, HUMAN VIROLOGY AND MEDICAL ENTOMOLOGY ENTITIES WITH THE CENTRAL NATIONAL SURVEILLANCE

In order to assess and document the level of integration between the animal virology, human virology and medical entomology entities with the central national surveillance system we identified criteria, reported in table 1., proposed on the basis of existing operational protocols and procedures [2, 3, 4] and assessed with a scoping literature review [5].

Table 1 – Proposed criteria to describe existing levels of integration between human/animal/entomological surveillance for a specific exposure

Level of integration	Sublevels of integration	Criteria
Policy and institutional level	Policy level	1. Existence of a National policy addressing integrated surveillance for this specific exposure 2. Existence of a policy addressing integrated surveillance for this specific exposure at subnational level
	Institutional level	3. Existence of agreements among the institutions involved in human/animal/entomological surveillance for the specific exposure, 4. Existence of a coordination mechanisms among the institutions involved, 5. Existence of identified focal points for each of human/animal/entomological surveillance for the specific exposure
Data collection and analysis level	Interoperability mechanisms at data collection level	6. Existence of integrated data collection tools 7. Existence of activation mechanisms of human surveillance based on signals from animal/entomological surveillance 8. Other interoperability mechanisms at data collection level

	Interoperability mechanisms at data analysis level	9. Presence of DB exchange/merging/other mechanisms to facilitate joint analysis among sectors. 10. Performance of joint/integrated data analysis among the different surveillance sectors 11. Other interoperability mechanisms at data analysis level
Dissemination level	-	12. Existence of joint result dissemination mechanisms (e.g. bulletins, reports, papers, media reports, websites …)

On the basis of the three critical levels reported in the table, we designed a survey targeting all the contact points of the project that could explore:

1) the existence of a national policy addressing integrated surveillance;

2) the existence of coordination mechanisms among the institutions involved;

3) the existence of integrated data collection tools and

4) the existence of joint result dissemination mechanisms such as bulletins, reports, papers, media reports and/or websites.

We then assessed the level of surveillance integration in the 19 countries of the project splitting them in three regions (Table 2.).

Table 2 - Countries and regions involved

Balkans	Black Sea	North Africa and Middle East
Albania	Armenia	Algeria
Bosnia and Herzegovina	Georgia	Egypt
Kosovo	Moldova	Jordan
Montenegro	Ukraine	Lebanon
Serbia		Libya
The Former Yugoslav Republic of Macedonia		Morocco
Turkey		Palestine
		Tunisia

We performed a frequency analysis for all categorical variables, and the proportions of responses were calculated on the basis of the number or respondents for each question.

Fifty-six contact points (CP) from laboratories (animal virology, human virology and medical entomology) and 19 contact points (CP) from Public Health Institutes (PHI)/Ministries of Health (MoH) (human epidemiology) from the 19 countries were invited to participate in the survey between December 2014 and July 2015.

We obtained responses from 51 laboratories (51/56; 91%) and 12 PHI/MoH (12/19; 63%), of whom: 14 were from the Black Sea, 26 from North Africa and the Middle East and 23 from the Balkans.

Human virology laboratories (19/63; 30%) were the most represented, followed by animal virology laboratories (18/63; 29%), medical entomology laboratories (14/63; 22%), and human epidemiology experts (12/63; 19%).

2.1.1 Main findings of interest for the MeSA Study:

Thirty-four responders (34/63; 54%), of 17 countries, reported the availability of a ***National policy addressing integrated surveillance*** in their countries. When considering the result by sub-regions we found national policies to be available for 57% (8/14) of the Black Sea respondents, 62% (16/26) of North Africa and Middle East respondents and 43% (10/23) of Balkan responders.

Positive replies were given by 50% (9/18) of all animal virology respondents, 42% (8/19) of human virology respondents, 50% (7/14) of medical entomology respondents and 83% (10/12) of human epidemiology respondents.

Thirty-one respondents (49%), of 16 countries, reported the ***existence of coordination mechanisms*** among the institutions involved, of whom 57% (8/14) of the Black Sea respondents, 54% (14/26) of North Africa and Middle East respondents and 39% (9/23) of Balkan respondents. Positive replies were given by 56% (10/18) of all animal virology respondents, 47% (9/19) of human virology respondents, 29% (4/14) of medical entomology respondents and 67% (8/12) of human epidemiology respondents.

Integration mechanisms in data collection were reported by 29% (18/63) of all respondents, of 11 countries. This response was positive among 29% (4/14) of all the Black Sea respondents, 27% (7/26) of North Africa and Middle East respondents and 30% (7/23) of Balkan respondents. Positive replies were given by 11% (2/18) of all animal virology respondents, 32% (6/19) of human virology respondents, 21% (3/14) of medical entomology respondents and 58% (7/12) of human epidemiology respondents.

Thirty-four respondents (34/63; 54%), of 16 out of 19 countries, reported the availability of ***joint results dissemination mechanisms*** in their countries. This response was positive among 43% (6/14) of all the Black Sea respondents, 69% (18/26) of North Africa and Middle East respondents and 43% (10/23) of Balkan respondents. Positive replies were given by 44% (8/18) of all animal virology respondents, 58% (11/19) of human virology respondents, 57% (8/14) of medical entomology respondents and 58% (7/12) of human epidemiology respondents.

Table 3 – Inter-sectoral integration reported by region

				N Respondents reporting integration

Level of integration	Sublevels of integration	Number of countries reporting integration (N 19)	Number of respondents reporting integration (N 63)	Balkans (N 23)	Black Sea (N 14)	NA & ME (N 26)
Policy and institutional level	Policy level	17	54% (34)	43% (10)	57% (8)	62% (16)
	Institutional level	16	49% (31)	39% (9)	57% (8)	54% (14)
Data collection and analysis level	-	11	29% (18)	30% (7)	29% (4)	27% (7)
Dissemination level	-	16	54% (34)	43% (10)	43% (6)	69% (18)

For further details on the study, see [6]

2.2 EXERCISE ON WEST NILE VIRUS RISK ASSESSMENT DURING THE MEDILABSECURE MID-TERM MEETING

During the mid-term Meeting of the MediLabSecure Project (15-17 December 2015), the Multisectorial Exercise on Risk Assessment was organised and conducted. This exercise was designed to foster small group discussion on surveillance integration in the framework of One Health, on the status of West Nile Virus surveillance in the region also in relation to what proposed in the ECDC tool and on the applicability of the ECDC tool in a non EU context (report available at http://www.medilabsecure.com/documents/site/report_midterm_meeting_web.pdf).

During this exercise, each country table (including participants from the same country and different professional sectors) conducted a SWOT analysis on the basis of a predefined template looking at:

- Strengths in the country in relation to surveillance in place and the risk level assessed.
- Weaknesses in the country in relation to surveillance in place and the risk level assessed.
- Opportunities in the use of the ECDC tool in their context
- Challenges in using the tool in their context.

Findings were then discussed in the whole group and summarized in a single subregional SWOT output that was included in the last restitution slide.

Recurring strengths that were mentioned in relation to WNV surveillance included:

- The existence of consolidated surveillance systems for WNV infection including entomological surveillance, animal surveillance and human surveillance,
- Existing laboratory capacity and expertise, and
- In some countries, the existence of multisectorial collaboration mechanisms across disciplines was also mentioned.

The most recurring mentioned weaknesses were:

- The need to strengthen intersectorial collaboration,
- The need to strengthen laboratory capacity for differential diagnosis and confirmation of WNV, and
- The need to strengthen surveillance systems (e.g. through active surveillance).

Some countries reported that WNV is not considered a priority for public health. These participants highlighted a lack of awareness of WNV among authorities/physicians/general public and of political commitment in supporting targeted preparedness activities.

3. MeSA phase 1: Selection

The MeSA study aims to analyse success stories in integration of arboviral disease surveillance across the human, animal and entomological sectors. To this end, the selection builds on the findings of the survey conducted by the MediLabSecure project, as well as on country discussions held during the Midterm project Meeting (15-17 December 2015).

Coordination complexity among stakeholders involved in surveillance activities across the human, animal and entomological sectors both in laboratories and in the National Surveillance System could vary according to the size of the country and its type of health system.

What is seen in large countries and a more federal organization with many intermediate levels of competency, may not reflect the situation in smaller settings where functions are aggregated with fewer levels of competence and where the same professionals cumulate many functions and have more chances of interacting routinely. These considerations will also be taken into account in the selection phase.

For this reason enrolment criteria are designed to select three countries with reported experience in inter-sectoral integrated surveillance, that reflect the demographic, geographical and governmental diversity of the Mediterranean and Black Sea Region (Box 1).

The success of the MeSA study will depend also on the commitment of the MediLabSecure PH Focal Points of participating countries. In fact, these Focal Points will be charged of organizing the site visits in their Ministry of Health and in other relevant Ministries and Institutions, of planning all internal travel and of organizing meetings with the most appropriate actors and informants. For this reason, we drafted terms of reference (Annex1) that were discussed in a dedicated side meeting of Mid Term project meeting.

This allow countries through the PH Focal Points to be aware of the amount of work required before deciding whether or not to agree to participate in the study.

Candidate countries will be identified for each group based on their relevant national know-how. The selection process will be aimed at identifying a rose of candidate countries with experiences and lessons learned that, if shared, could be useful to network participants in strengthening integration of surveillance in the framework of One Health.

3.1 THE SELECTION PROCESS

Based on the objectives of the MeSA study pre-selection criteria were identified (Box 1).

BOX 1: NATIONAL SITUATION ANALYSIS PRE SELECTION CRITERIA FOR COUNTRY PARTICIPATION

- The three countries should reflect the diversity Region (i.e. large/small countries, centralized/decentralized countries, countries of Balkans/Middle East & North Africa/ Black Sea)
- The level of integration of surveillance in the selected country is known to be high (according to the survey)
- The PH Focal Point considers the sharing of lessons learned and experiences matured nationally to be useful for the network
- There is internal national capacity to meet the study's terms of reference requirements

During the Mid Term MediLabSecure project meeting, the WP5 held a side meeting in which the MeSA study objectives, process and selection criteria were discussed with members of the PH network of the project.

On the basis of the background knowledge gathered through the survey, initial expressions of interest are being collected from candidate countries. Countries expressing interest were further contacted and invited to participate in the study.

4. MeSA phase 2: Development of a Country Portfolio

With the objective of providing the investigators in advance of each site visit with a document containing key information on the country that would be visited and tools to guide discussions, a country specific portfolio will be assembled. This will include details on the visit duration, aims and agenda as well as a stakeholder table and checklist for each environment to be visited . The national SWOT analysis performed during the exercise on West Nile Virus risk assessment held during the MediLabSecure mid-term meeting will also be used to enrich the country portfolio (see 2.2).

All the investigators involved in the MeSA study will discuss and jointly develop the study tools. These will include:

1. a stakeholder table, and
2. a comprehensive checklist

4.1 IDENTIFICATION OF IN-COUNTRY PARTICIPANTS TO INVOLVE IN THE STUDY AND DEVELOPMENT OF STAKEHOLDER TABLES

Each Participating Country's Public Health Focal Point will be in charge of identifying and involving concerned actors and informants that could provide information and insights on the processes, procedures and performance of integration of laboratory/clinical human, animal and entomological surveillance of arboviruses in his/her country.

To aid this process, stakeholder tables will be developed in agreement with all the investigators, one for each sector studied.

All participating countries will be asked to involve, among others, the following informants:

- At least one actor in charge of the chosen disease surveillance in each sector to be visited as appropriate (e.g. human virology laboratory, animal virology laboratory, human public health, veterinary public health, entomological surveillance),
- Relevant national, intermediate and/or local level operators of the surveillance system of the chosen disease.

4.2 THE SITUATION ANALYSIS CHECKLIST

A semi structured check list will be developed to guide interviews with actors and informants during the site visit.

This tool will be developed by the investigators in advance and circulated ahead of the site-visit to informants to enable them to understand better the scope of the study and the type of information that would be requested.

The aim of the checklist is to provide a guide to follow in analysing the procedures and processes in place for integration/coordination of laboratory/clinical human, animal and entomological surveillance of arboviruses.

The checklist will be developed in English. In countries where English is not a used language, Public Health Focal Points will be in charge of explaining and, if needed, translating the checklist in advance of the visit to facilitate the work of the investigators.

The checklist might be structured in two separate sections directed specifically either to national actors involved in surveillance or to intermediate/local administrative levels (if appropriate).

5. MeSA phase 3: Site visits

The MediLabSecure project foresees site visits of the MeSA study to take place **between July and December 2016**. Selected participating countries will be asked to define, at their earliest convenience, the week in which to plan the situation analysis.

During each visit, the members of the MeSA study investigation team will be asked to:

- Visit the office in charge of national human surveillance of the selected arbovirus (MoH, central level) meeting with key informants and conduct a briefing,
- Visit the office in charge of national human laboratory, veterinary Public Health and lab, and entomological surveillance, as appropriate, of the arbovirus (central level) meeting with key informants,
- Visit, if possible, key informants across sectors in charge of the surveillance of the selected arbovirus at intermediate/local administrative levels,
- Discuss a real life events with key informants in each sector to explore the procedures, processes and performance of two way communication between laboratory/veterinary/entomological sectors and the NHS on aspects related to the surveillance of the selected arbovirus,
- Conduct a debriefing meeting with all the stakeholders involved to discuss and consolidate the information, data, procedures, lessons learned etc., collected through the documentation provided and through the interviews conducted during the visit.

The country portfolio and the checklist will be used to guide discussions.

The Public Health Focal Point of each participating country will be in charge of organizing the site visits in the Ministry of Health and in all relevant Sectors, of planning all internal travel and of organizing meetings with the most appropriate actors and informants.

6. Reporting

After each site visit a country report will be developed in collaboration with all the investigators involved.

The surveillance processes and their inter and intra sectoral connections will be mapped with the support of OrgLab (University of Cassino), using the Business Process Modelling Notation (BPMN) methodology, and customized colour coding for each sector.

Business Process Modeling (BPM) is a representational framework designed to visually "describe how businesses conduct their operations" and typically involve "graphical depictions of at least the activities, events/states, and control flow logic that constitute a business process" (Curtis et al., 1992). A process is defined as a set of activities executed in a predefined, sequential or parallel, order by a pre-determined number of organizational actors or entities sharing the collective goal of reaching organizational objectives (Chinosi and Trombetta, 2012). The term "business process modeling" and its related representation methodologies are not necessarily limited to the business environment but can be used in any scenario in which organizations are structured in a complex net of tasks and their interactions. In fact, BPM was developed for those processes that are so complex and distributed (as in the case of infectious diseases identification, early warning and response), that require a standardized and refined representation system to be effectively transmitted and clearly understood by a broad variety of individuals and units. BPM methods have been increasingly in vogue among analysts and organizational specialists, used both to create AS-IS representations of current practices, aiming at knowledge transfer, as well as to serve as an analytical tool to improve the efficiency or effectiveness of the analysed processes (TO-BE).

After a revision phase, the report will be shared with the MediLabSecure Coordination Team and cleared for publication in the MediLabSecure Website.

All the activities performed by WP5, including the results of the MeSA Study, will be the knowledge basis upon which this team will elaborate a "Strategic Document" that will analyse findings from a Mediterranean and Black Sea regional perspective.

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Annex II

MediLabSecure Situation Analysis on integrated surveillance (MeSA) Study

PORTFOLIO FOR INVESTIGATORS

SITE VISIT TO

SERBIA

(4-8 July 2016)

CONTENTS

DURATION AND SCOPE OF ACTIVITIES

Duration of the site visit in Serbia will be of 3 days plus 2 for travels: from ***4 to 8 July 2016***.

During the visit it will be necessary to perform the following activities:

a. Present the country situation

b. Visit all stakeholders involved in West Nile Virus surveillance (at least one per each sector : human virology, animal virology, medical entomology, public health) and exploring the effectiveness of the surveillance process and communication mechanisms in place between the sectors

c. Debriefing meeting with all the stakeholders involved to discuss and consolidate the information, data, procedures, lessons learned etc., collected through the documentation provided and through the interviews conducted during the visit . The performance of the study tools will be also discussed.

CONFIRMED CO-INVESTIGATORS PARTICIPATING IN THE SITE VISIT

Istituto Superiore di Sanità: Dr Maria Grazia Dente and Dr Flavia Riccardo;

Institute of Public Health of Serbia: Dr Dragan Ilic, Dr Mitra Drakulovic, Dr Milena Vasic ;

Institute of Virology, Vaccines and Sera Torlak National Reference Laboratory for Arboviruses: Dr Vesna Kovacevic-Jovanovic;

Institute of Veterinary Medicine of Serbia Virology Department: Dr. Vesna Milicevic;

Faculty of Agriculture, University of Novi Sad Laboratory for Medical and Veterinary Entomology: Prof. Dušan PETRIC.

PROGRAMME (SEE AGENDA IN ANNEX I)

BACKGROUND INFORMATION

THE SERBIAN HEALTH SYSTEM AND WNV SURVEILLANCE

Is the health system in Serbia centralized or de-centralized?

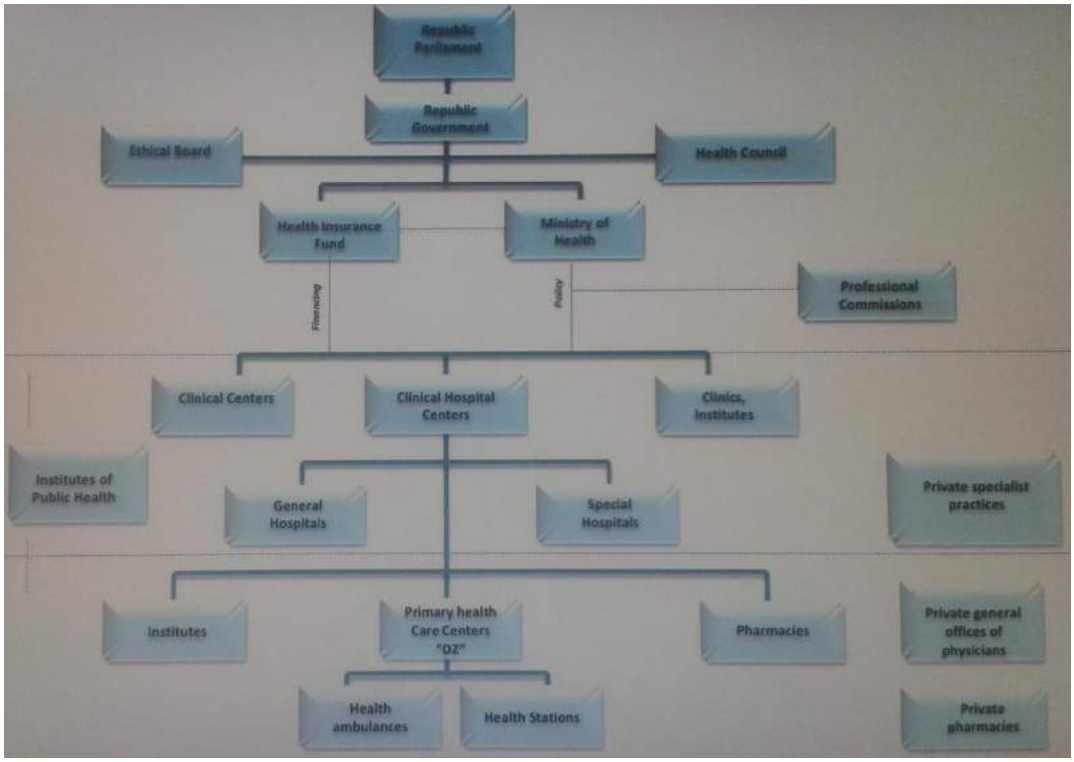
Health system in Serbia is decentralized, and the accountability for health institutions is shared among their founders – the Government, the Ministry of Health, the Province of Vojvodina, the City of Belgrade, and local municipalities. Their role is to ensure the functioning of health institutions and provision of adequate health services to the population.

What are the main administrative levels of the health care system? Could you please include an organigram of the relevant actors?

Health care for the population is directly provided through the network of health care institutions and depends on the level of organisational and operational development. In general, there are three levels of health care: primary, secondary and tertiary.

Health care at the primary level is provided by state-owned primary health centres (158), which cover the territory of one or more municipalities or towns. Primary health care in primary health centres is publicly provided by a chosen doctor who is either a medical doctor or a specialist in general medicine, or specialist in occupational medicine; specialist in paediatrics; specialist in gynaecology; and dentist (Article 98 of the Act on Health Care). The general practitioner can refer the patient to the specialist at primary and secondary level of health care (hospitals). Each patient can get needed treatment in one of 40 general or 37 special hospitals in Serbia. It might be outpatient treatment (medical check-up in the clinic) or inpatient treatment.
The tertiary level of health care has the highest specialized personnel and technological equipment and provides quality diagnostic and treatment. Thus, this level cooperates closely with the secondary level by providing technical assistance and support; engage in research and activities of medical education (Clinic, Institute, Clinical Hospital Centre, Clinical Centre).

Figure 1. Organizational structure of the health care system in Serbia



Bjegovic-Mikanovic V. Governance and management of health care institutions in Serbia: An overview of recent developments (Review article). SEEJPH 2016, posted: 17 February 2016. DOI 10.4119/UNIBI/SEEJPH-2016- 94

1. HUMAN WNV SURVEILLANCE PROCEDURES

When was WNV first detected in Serbia?

- In 2012

Is WNV disease a notifiable disease in Serbia? (please mention relevant legal references and currently used case definitions)

- Yes, according to the *Law on protection of population against communicable diseases*, („Official Gazette of the RS“, no 15/2016), 2008 EU Case definition.

How and where is laboratory confirmation of human cases of WNV conducted?

- Serological analysis of sera and Cerebrospinal Fluid Analysis (CSF) in Reference Laboratory for Arboviral Diseases “Torlak” in Belgrade, Serbia.

Who has responsibility for human WNV surveillance and who for response in case of outbreaks?

- Responsibility for human WNV surveillance have all healthcare facilities, and in case of outbreaks district IPHs.

Could you please describe the WNV surveillance system?

- **How many staff are involved in collecting and transmitting WNV surveillance data?**
    - Approximately 170 ***epidemiologists*** of District IPHs

- **What are the data sources?**
    - Case report forms prepared by National coordinator for WNV surveillance.
- **How are the data collected (forms, number of variables, individual and/or aggregated, paper and/or electronic …?**
    - Epidemiologists of district IPHs collect data face to face interviews.
    - Surveillance is case-based.
- **How is data analysis conducted?**
    - Descriptive method,
    - Analytical method.
- **How are data transmitted out. To whom, in what format?**
    - Electronically from district to national level.
- Was the WNV surveillance system evaluated?
- If so, Is it possible to share a copy of this evaluation with the investigator team?
    - No
- **Is data shared with other sectors (animal health entomology)? For what purpose (early warning, surveillance …).**
    - Yes, for early warning
    - Not with Laboratory for Medical and Veterinary entomology which is involved in Ministry of Agriculture, Veterinary Directorate integrated (mosquito, horse, bird) WNV surveillance.
- **Is feedback received from other sectors? In what format: Informal communication, regular official reports, Other (specify)**
    - Yes, regular official reports.

Can official documents pertaining human WNV surveillance procedures be made available to the team during the site visit? Yes

2. ACTORS FROM OTHER SECTORS

What institution is in charge for **animal virology and veterinary public health**?

Ministry of Agriculture and environmental protection - Veterinary Directorate.

Is a veterinary surveillance system in place for WNV?

Yes

Could you please describe the veterinary WNV surveillance system? (target species, active/passive surveillance etc.)

All relevant details about surveillance program in Serbia are available at this link:

http://niv.ns.ac.rs/wp-content/uploads/2014/12/Petrovic-Tamas.pdf

- **How many staff are involved in collecting and transmitting WNV surveillance data?**

All institutions of veterinary system of Republic Serbia (veterinary stations, veterinary institutes, veterinary inspections, veterinary directorate, and also, Faculty of Agriculture, Novi Sad, Institute for nature coneservation of Serbia, NGOs , etc.

- **What are the data sources?**
- **How are the data collected (forms, number of variables, individual and/or aggregated, paper and/or electronic …?,**
- **How is data analysis conducted?**
- **How are data transmitted out. To whom, in what format?**
- **Was the veterinary WNV surveillance system evaluated? Is it possible to share a copy of this evaluation with the investigator team?**
- **Is data shared with other sectors (human health/ entomology)? For what purpose (early warning, surveillance …)**
- **Is feedback received from other sectors? In what format: Informal communication, regular official reports, Other (specify)**

All these data are available at:

http://niv.ns.ac.rs/wp-content/uploads/2014/12/Petrovic-Tamas.pdf

Can official documents pertaining veterinary WNV surveillance procedures be made available to the team during the site visit? Yes

What institution is in charge for **medical entomology**?

Institute for Biocides and Medical Ecology, Belgrade, Serbia

Since 2013 to present within Project funded by the Ministry of Health "Detection of WNV in mosquito population in the territory of the Republic of Serbia", and within the Monitoring program of mosquitoes on the territory of Belgrade funded by Secretariat for Environmental Protection and Secretariat for Health Care Belgrade City Administration

Is mosquito surveillance and monitoring system in place for WNV vectors (distribution of potential vectors/ identification of infected mosquito pools…)? If so could you describe the systems in place?

The program of monitoring and control of the mosquito cover all major cities in the territory of the Republic of Serbia. Specialized mosquito traps (BG Sentinel) with dry ice as an attractant are placed on sites in urban areas where there are conditions for the development of mosquitoes. If the Institute of Public Health of Serbia give us information on suspected WNV in a patient, on the basis of medical history taken and movement of potentially diseased, traps are placed in these sites. The traps are placed in the afternoon and collected the following morning. Samples of mosquitoes are transported on dry ice at - 80^0C transported to entomological laboratory of Institute for Biocides and Medical Ecology.

In entomological laboratory on cold plate performs counting and determination of species of mosquitoes, as well as the separation of the samples for the detection of WNV. Detection of WNV in the population of mosquitoes on RT PCR is performed with commercial kits. Results obtained on the following day and the results in form of official report are sent to Regional Institute for Public Health, Institute of Public Health of Serbia and Ministry of Health.

In Belgrade monitoring and control of mosquitoes is conducting on a daily basis. If we detect positive mosquitoes in field samples same evening mosquito control measures are conducted (ULV cold and thermal fogging).

Could you please describe the veterinary WNV surveillance system? (target species, active/passive surveillance etc.)

- **How many staff is involved in collecting, identifying mosquito pools?**

On mosquito, surveillance and monitoring of WNV in Institute for Biocides and Medical Ecology are employed:

- 3 Doctor of Veterinary Medicine;
- 1 PhD Specialist in Epidemiology, 1 Specialists in Microbiology and Parasitology, 1 Resident in Epidemiology, 1 Resident in Microbiology and Parasitology, 2 Doctor of Medicine;
- 1 PhD Biologist, 2 Biologist;
- 4 Plant Protection Engineer;
- 1 Geographyst;
- 5 Professional Sanitary Ecological Engineer.

- **Do you have maps of distribution of potential WNV vectors in your country?**

  Yes, Institute for Biocides and Medical Ecology implemented GIS-CadCorp SIS 8.0 in all monitoring and surveillance processes. All results obtained from the field and laboratory are stored in SQSL sever and all that data can be showed on digital map within different layers. Collected data are: GPS coordinates of localities where traps were placed, PCR laboratory data and mosquitos per trap number.

- **Do you monitor PCR WNV positivity in mosquito pools?**

  Yes, after determination of mosquito species from field samples, mosquito pools are made and tested at RT PCR. Institute for Biocides and Medical Ecology have data since 2012 when first mosquitoes were tested on WNV till today, as well as Scientific Veterinary institute "Novi Sad".

- **How are the data collected?**

  The data from entomological laboratory and from PCR collect project manager and he creates official report which is sent to Regional Institute for Public Health, Institute of Public Health of Serbia and Ministry of Health.

- **How are data transmitted out? To whom, in what format?**

  Data are transmitted out as official report via e mail and in paper to Regional Institute for Public Health, Institute of Public Health of Serbia and Ministry of Health.

- **Is data shared with other sectors (human health/ animal health)? For what purpose (early warning, surveillance …)**

  Yes, data is shared with Regional Institute for Public Health, Institute of Public Health of Serbia and Ministry of Health in order to take adequate mosquito control measures.

  In Vojvodina, data are shared with animal sector (Scientific Veterinary Institute "Novi Sad") officially and with Institute of Public Health of Vojvodina Province for early warning. The entomological surveillance system is not connected to Ministry of Health.

- **Is feedback received from other sectors? In what format: Informal communication, regular official reports, Other (specify)**

Yes, when we receive information about infected patient we are collecting mosquito from surrounding area.

From animal sector (Scientific Veterinary Institute "Novi Sad"), informal immediately after screening of mosquito samples is finished (mail with the results of analysis) and formal by forwarding official report to Veterinary Directorate.

From human sector informal notification about human cases are received

Can official documents pertaining entomological WNV surveillance procedures be made available to the team during the site visit? Yes

3. POLICY/INSTITUTIONAL LEVEL INTERSECTORAL AGREEMENTS

Are there formal collaboration mechanisms between the animal virology and veterinary public health and the human sector (ministerial decree, legislation or other formal documents that impact WNV surveillance?

☐ YES

☐ NO

Yes

Are there formal collaboration mechanisms between the medical entomology sector and the human sector (ministerial decree, legislation or other formal documents that impact WNV surveillance?

☐ YES
☐ NO

Yes

Are there Memorandum of understandings or other formal agreements between the institutions involved in WNV surveillance from the human, animal and entomological sectors?

☐ YES
☐ NO

Yes

Are there informal agreements of collaboration between the mentioned institutions?

☐ YES
☐ NO

Yes

4. INTERSECTORAL COLLABORATION AT DATA COLLECTION/ANALYSIS LEVEL

Is there interoperability between data collection mechanisms of human surveillance, animal surveillance and medical entomology monitoring for WNV?

☐ YES
☐ NO

Yes

Is there interoperability between data analysis mechanisms of human surveillance, animal surveillance and medical entomology monitoring for WNV?

☐ YES
☐ NO

Yes

Is regular exchange of information occurring across sectors involved in WNV surveillance regardless of full interoperability of the data collection and analysis systems?

☐ YES
☐ NO

Yes

5. INTERSECTORAL COLLABORATION AT DATA DISSEMINATION LEVEL

Are WNV joint surveillance reports issued that include data on human surveillance, animal surveillance and medical entomology monitoring?

☐ YES
☐ NO

No

Ministry of Health most probably reports human cases for whole territory of Serbia and their program of entomological surveillance which covers limited area, traps are most densely situated around Belgrade – if I remember well their presentation from the beginning of this year.

Ministry of Agriculture, Veterinary Directorate issues reports on animal and mosquito surveillance. Entomological surveillance is completely developed in Vojvodina and still developing in the rest of Serbia.

Is there a two way communication in place between public health and other sectors involved in WNV surveillance?

☐ YES

☐ NO

Yes

6. CONCRETE EXAMPLES

When were WNV outbreaks described in Serbia?

- In 2013 (human)
- Yes in Vojvodina where human and animal sectors and medical entomology are collaborating on WNV early detection projects within the One Health paradigm since 2005 (first positive horse detected 2009, mosquito 2010 in Vojvodina).

Could these real life experiences be used to describe the intersectoral collaboration mechanisms in place during the site visit?

- Intersectoral collaboration mechanisms could not be explained yet.

If so, we would kindly ask you to describe the outbreaks and provide any publication you deem relevant in allowing the investigators to prepare in advance of the visit on the topic.

- Paper about WNV outbreak occurred in Serbia will be submitted for publication in Jun.
- **Short description of WNV infection outbreak in Serbia in 2013**.

  Overall 303 cases of WNV infections were reported in 2013. Of those 247 were classified as WNND and 56 were considered as Non-WNND cases. Encephalitis/meningoencephalitis was the most prominent clinical syndrome followed by meningitis among WNND. Large proportion of patients had underlying medical condition accounted for159 out of 247 (64.4%). The most common was hypertension. Case fatality rate in WNND group was 13.0%. All cases occured within 18 weeks time interval from Jun 25th to November 2nd, 2013. The outbreak peaked 3rd week of August. By 2nd November 247 laboratory diagnosed cases of WNND were reported to National IPH. Cases were reported from 15 out of 25 Serbian districts. The overall attack rate in the country was 3.44 per 100.000 population. Attack rates (ARs) increased progressively with age and males were more affected compared to females. Statistical difference was not found between ARs in rural and urban areas.

- As a separate attachments you will find following publications:

Lupulovic, D., Martin-Acebes, M. A., Lazic, S., Alonso-Padilla, J., Blazquez, A. B., Escribano-Romero, E., … Saiz, J. C. (2011). First serological evidence of west nile virus activity in horses in serbia. *Vector Borne Zoonotic Dis*, *11*(9), 1303–1305. http://doi.org/10.1089/vbz.2010.0249 [doi]

Petric D, Hrnjakovic-Cvjetkovic I, Radovanov J, Cvjetkovic D, Jerant-Patic V, Milosevic V, et al. West Nile virus surveillance in humans and mosquitoes and detection of cell fusing agent virus in Vojvodina province (Serbia). HealthMed. 2012;6(2):462-8.

Petrovi??, T., Bl??zquez, A. B., Lupulovi??, D., Lazi??, G., Escribano-Romero, E., Fabijan, D., … Saiz, J. C. (2013). Monitoring West Nile virus (WNV) infection in wild birds in Serbia during 2012: First isolation and characterisation of WNV strains from Serbia. *Eurosurveillance*, *18*(44), 1–8.

Petrovi??, T., Lazi??, S., Lupulovi??, D., Lazi??, G., Bugarski, D., Vidanovi??, D., … Petri??, D. (2014). Serological study on WNV presence in horses in Vojvodina after the human outbreak in Serbia in 2012. *Archives of Biological Sciences*, *66*(2), 473–481. http://doi.org/10.2298/ABS1402473P

Tamaš Petrović1, Dušan Petrić2, Ivana Hrnjakovic Cvjetkovic3, Diana Lupulović1, Aleksandra Ignjatovic Cupina2, Vesna Milosevic3, Marija Zgomba2, Sava Lazić1, Juan-Carlos Saiz4 . Update on the epidemiology of WN virus in Serbia. EpiSouth bulletin.

DEBRIEFING MEETING WITH ALL THE STAKEHOLDERS INVOLVED

The site visit will involve all sectors responsible for WNV surveillance.

The information, data, procedures, lessons learned etc., collected through the documentation provided and through the interviews conducted during the visit with all the stakeholders involved, will be discussed and consolidated during a meeting to be organized in the last day with all the stakeholders.

STAKEHOLDER TABLE (AS PER INSTITUTION TO BE VISITED) – ADD PLEASE ROWS AS NEEDED

Name	position	Role in the surveillance process	Note
Institute of Public Health of Serbia			
Associate Professor Dragan Ilic, MD, PhD	Director		
Mitra Drakulovic, MD, PhD	Department for Epidemiological Surveillance		
Ivana Kelic, MD	Center for Microbiology		
Dragana Plavsa, MD	Center for Diseases Prevention and Control, MediPiet fellow		
Milunka Milinkovic, MD	Center for Diseases Prevention and Control, MediPiet fellow		
Associate Professor Milena	Department for		

Vasic, DMD, PhD	International Cooperation and Project Management		
Ministry of Health			
Vesna Knjeginjic, MD	Assistant Minister for Public Health		
Associate Professor Zoran Mihailovic, MD, PhD	Assistant Minister for Public Health		
Zoran Panajotovic, MD			
Borka Stojkovic			
Institute of Virology, Vaccines and Sera Torlak National Reference Laboratory for Arboviruses			
Jelena Protic, MD			
Institute for Biocides and Medical Ecology			
Dragana Despot, MD			
Institute of Veterinary Medicine, Novi Sad			
Tamas Petrovic, PhD			
Institute of Veterinary Medicine of Serbia Virology Department			
Miso Kolarevic			
Milanko Sekler, PhD			
Faculty of Agriculture, University of Novi Sad Laboratory for Medical and Veterinary Entomology			
Professor Dusan Petric, PhD			
Professor Dusan Petric, PhD			

CHECKLIST

It will facilitate the interviews and the meetings with the aim of collecting, sharing and discussing relevant aspects of the surveillance system in place in the Country.

MedilabSecure

WP5 - Public Health

The MediLabSecure Situation analysis on integrated surveillance of arboviruses in the Mediterranean and Black Sea Region (MeSA Study)

Check List for the site visit

28 June 2016

Checklist's Rationale:

- Consistency with the objectives of the Study (see study design)
- Consistency with the approaches and criteria adopted during the implementation of WP5 (including the Lit Review and Survey)
- Present Focus: WNV
- The same checklist for all the sectors (human virology, animal virology, entomology, human public health) involved

- **Filled in during the meeting with:** _____
- **Medilabsecure contact point:** **YES** **NO**
- **Sector:** _____
- **Institution:**_____
- **Country:** _____
- **Starting of the WNV surveillance in the Country**: (Serbia – April 2014 WNV surveillance animals & vectors; Human? _____

1. Level of integration: Policy and Institutional

i. **Is the Aim** of WNV **integrated** surveillance in your Country stated somewhere? : YES NO
   a. **If YES:** stated where?

ii. Is a ***National steering committee*** in place ? YES NO

a. If YES
   i. Role: _____
   ii. Members: _____
   iii. frequency of ordinary meetings: _____
   iv. reasons for extraordinary meetings: _____
   v. ways of communication between members: _____
   vi. ……..

iii. Is a ***National coordinating unit*** in place ? YES NO

a. If YES
   i. Role: _____
   ii. Members: _____
   iii. frequency of ordinary meetings: _____
   iv. reasons for extraordinary meetings: _____
   v. ways of communication between members: _____
   vi. ……..

iv. Is there a ***coordinated plan for distribution of human resources*** dedicated to surveillance among the different sectors? YES NO

v. Is a **plan** for WNV Integrated surveillance available? YES NO

If YES, is it prepared on annual basis? YES NO

If YES, is the 2016 plan available? (to be provided if available) YES NO

vi. Are **types and targets** of surveillance identified in the plan? YES NO

vii. Are Endemic and not-endemic areas identified ? YES NO

2. Level of integration: Data collection and analysis

Endemic area

- Surveillance of migratory birds belonging to the target species YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Surveillance in rural poultry farms and outdoor YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Surveillance through the use of sentinel groups of animals YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Entomological Surveillance YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Surveillance of human cases YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the epi surveillance (institution, Dept. etc):_____

Who is in charge for the lab surveillance (institution, Dept. etc):_____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

Surveillance in all the areas of the Country? YES NO

If YES:

- Clinical surveillance in equidae YES NO
  - Seasonal
  - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Serological sampling surveillance in equidae YES NO
  - Seasonal
  - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Surveillance of wild birds' carcasses YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- Serological Surveillance on sample of animals YES NO
    - Seasonal
    - Permanent

If YES:

Who is in charge for the surveillance (institution, Dept. etc): _____

who does the analysis (institution, Dept. etc): _____

to whom the confirmed cases are reported (institution/s, Dept/s. etc) : _____

timing : _____

way/s: _____

- **<u>Early Warning – Risk Assessment-Response-Communication</u>**

Is there any early warning system, which actives human health measures based on animal and /or entomological surveillance? YES NO

If YES, can you describe your role (organizer, participant, etc.) in the process as per the table below? Is the procedure formally developed and available? YES NO

Steps of the Process	**EW**	**Risk assessment**	**Response/Public Health Actions**	**Risk Communication**
How does the process start? or What event triggers the process to start?				
You provide info to (Institution/s; Dept/s)				
Type of info				
how soon/periodicity				
Info are provided to you by (Institution/s; Dept/s)				
Type of info				
how soon/periodicity				
Multisectorial meetings (periodicity)				
report exchange (periodicity)				

- Please describe the most recent early warning case and provide available documents

- **<u>USE of data for PUBLIC HEALTH ACTIONS</u>**

Is a national database available for surveillance data? YES NO

If YES, is this database including all the surveillance data (animal, entomological, human) YES NO

If NO, which kind of database are available?

Are they accessible to other sectors involved in the surveillance? YES NO

If YES,

- specify the sector/s: _____
- type of access: ☐ consultation ☐ data management ☐ .....

3. Level of integration: Dissemination

Is a communication dept. /officer available? YES NO

If YES, is this connected/coordinated with the other relevant sectors? YES NO

Is a National bulletin/newsletter jointly prepared by all the relevant sectors available?

YES NO

If YES:

Frequency:_____

Target/s: _____

Is a dedicated website jointly managed by all the relevant sectors available? YES NO

Is the Evaluation of the integrated WNV plan performed? YES NO

If YES, is this available? YES NO

Consulted Documents:

- WHO Monitoring and evaluation indicators for integrated vector management WHO, 2012 ISBN 978 92 4 150402 7
- Popović N, Milošević B, Urošević A, Poluga J, Lavadinović L, Nedelijković J, Jevtović D, Dulović O. Outbreak of West Nile virus infection among humans in Serbia, August to October 2012 . Euro Surveill. 013;18(43):pii=20613. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20613
- Petrović T, Blazquez AB, Lupulović D, Lazić G, Escribano-Romero E, Fabijan D, Kapetanov M, Lazić S, Saiz JC. Monitoring West Nile virus (WNV) infection in wild birds in Serbia during 2012: first isolation and characterisation of WNV strains from Serbia. Euro Surveill. 2013;18(44):pii=20622. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20622
- WHO-FAO-OIE **Four-Way Linking Project for Assessing Health Risks at the Human-Animal Interface, 2013**
- **EpiSouth eweb_232_30_08_12-Serbia WNV - http://www.episouthnetwork.org/sites/default/files/bulletin_file/eweb_232_30_08_12.pdf**
- **EpiSouth eweb_240_25_10_12 -Serbia WNV http://www.episouthnetwork.org/sites/default/files/bulletin_file/eweb_240_25_10_12.pdf**
- WEST NILE VIRUS CIRCULATION IN THE EPISOUTH COUNTRIES AND NEIGHBOURING AREAS SEASONS 2010, 2011 AND 2012 *Update 20th June 2013* *http://www.episouthnetwork.org/sites/default/files/bulletin_file/west_nile_virus_circulation_in_the_episouth_countries_and_neighbouring_areas_2010_2011_and_2012_seasons.pdf*
- Arhiv veterinarske medicine, Vol. 7, No. 2, 29 - 45, 2014 Petrović T. et al.: West Nile virus SURVEILLANCE PROGRAM IN SERBIA
- Dusan Petric1, Ivana Hrnjakovic Cvjetkovic2, Jelena Radovanov2, Dejan Cvjetkovic3, Vera Jerant Patic2, Vesna Milosevic 2, Kovacevic Gordana2, Marija Zgomba1, Aleksandra Ignjatovic Cupina1, Aleksandra Konjevic1, Marinkovic Dusan1, Mª Paz Sánchez-Seco4 *West nile virus surveillance in humans and mosquitoes and detection of cell fusing agent virus in Vojvodina province (Serbia)* HealthMED - Volume 6 / Number 2 / 2012
- Simona Forcella, Nasr El-din El Tantawy, Jobre Yilma, Amira AbdelNabi2,Filip Claes, Gwenaelle Dauphin & Elizabeth Mumford *The development of a four-way linking framework in Egypt: an example of the FAO, OIE and WHO joint activities to facilitate national risk assessment*. Veterinaria Italiana 2015, **51** (1), 45-50. doi: 10.12834/VetIt.220.680.1
- Ministero della Salute Italiano-DIREZIONE GENERALE DELLA PREVENZIONE SANITARIA (Ufficio V – Prevenzione delle malattie trasmissibili e profilassi internazionale) e DIREZIONE GENERALE DELLA SANITÀ ANIMALE E DEI FARMACI VETERINARI (Ufficio III – Sanità animale e gest. oper. Centro Naz. di lotta ed emergenza contro le malattie animali e unità centrale di crisi) Piano Nazionale di sorveglianza e risposta alle arbovirosi trasmesse da zanzare (Aedes sp.) con particolare riferimento a virus Chikungunya, Dengue e virus Zika - 2016.

Annex III

Annex III – WNV Surveillance Plan

	High-risk regions/ Counties	Lower-risk regions/ Counties
1. Testing of sentinel animals (domestic poultry and horses) aimed at early detection of WNV circulation		
Surveillance of sentinel poultry on rural households – poultry hatched in current year (backyard poultry)	Serological testing at the authorized institute in the period May-September from 10 settlements / County; 5 samples / settlement from et least one household according to described schedule. 6 samplings (1 in May; 1 in June; 2 in July; 1 in August – by middle; 1 in September (until 15 Sept)	Serological testing at the authorized institute in the period June-September from 6 settlements / County; 5 samples / settlement from et least one household according to described schedule. 4 samplings (1 in June; 1 in July; 1 in August – by middle; 1 in September (until 15 Sept)
Surveillance of sentinel horses	Serological testing of 50 sentinel horses in the authorized institute, sampling from minimum 3 localities per County. Sampling and blood testing of same horses to be performed three times (in three occasions) (June-July-August)	Serological testing of 30 sentinel horses in the authorized institute, sampling from min 3 localities per County. Sampling and blood testing of same horses to be performed three times (in three occasions) (June-July-August)
2. Testing aimed at early detection of WNV in natural reservoirs and vectors		
Virus surveillance	Application of RT-PCR	RT-PCR or real time RTPCR

in wild birds	or real time RT-PCR methodology for testing samples of dead susceptible bird species throughout the year, or up to 100 samples of purposely hunted birds or live captured susceptible bird species per County during the period May - October	methodology for samples of up to 50 dead birds (WNV-susceptible species) per County during the period May - October
Virus surveillance in vectors - mosquitoes (Culex pipiens)	Collecting mosquitoes at 2-week intervals in the period May-September at 10 localities within the County and testing the virus presence by RTPCR or real time RT-PCR methodology (7 samplings in the period from end May to the fi rst half of September)	Collecting mosquitoes at monthly intervals in the period May-September at 5 localities per County and testing the virus presence by RT-PCR or real time RT-PCR methodology (5 samplings once a month in the period from second half May to the fi rst half of September)

Annex IV

Annex IV –List of participants

Institute of Public Health of Serbia "Dr Milan Jovanović Batut"
7 July 2016

No.	Participant	Institution	Mail
1	Dr Vesna Knjeginic	Ministry of Health	vesna.knjeginic@zdravlje.gov.rs
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Annex V

"3rd Conference on Neglected Vectors and Vector-Borne Diseases (EURNEGVEC)"

RESULTS OF WNV MONITORING PROGRAME FOR 2015 IN SERBIA

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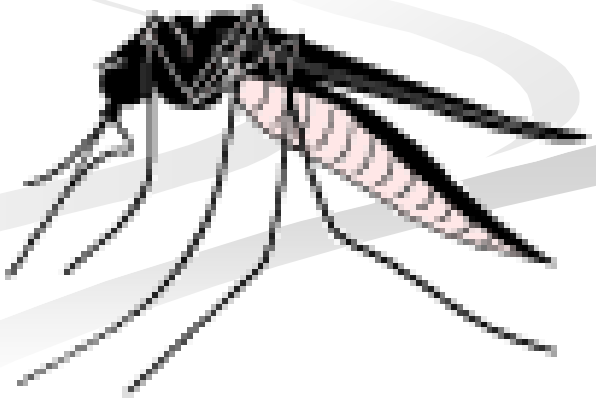
Zaragoza

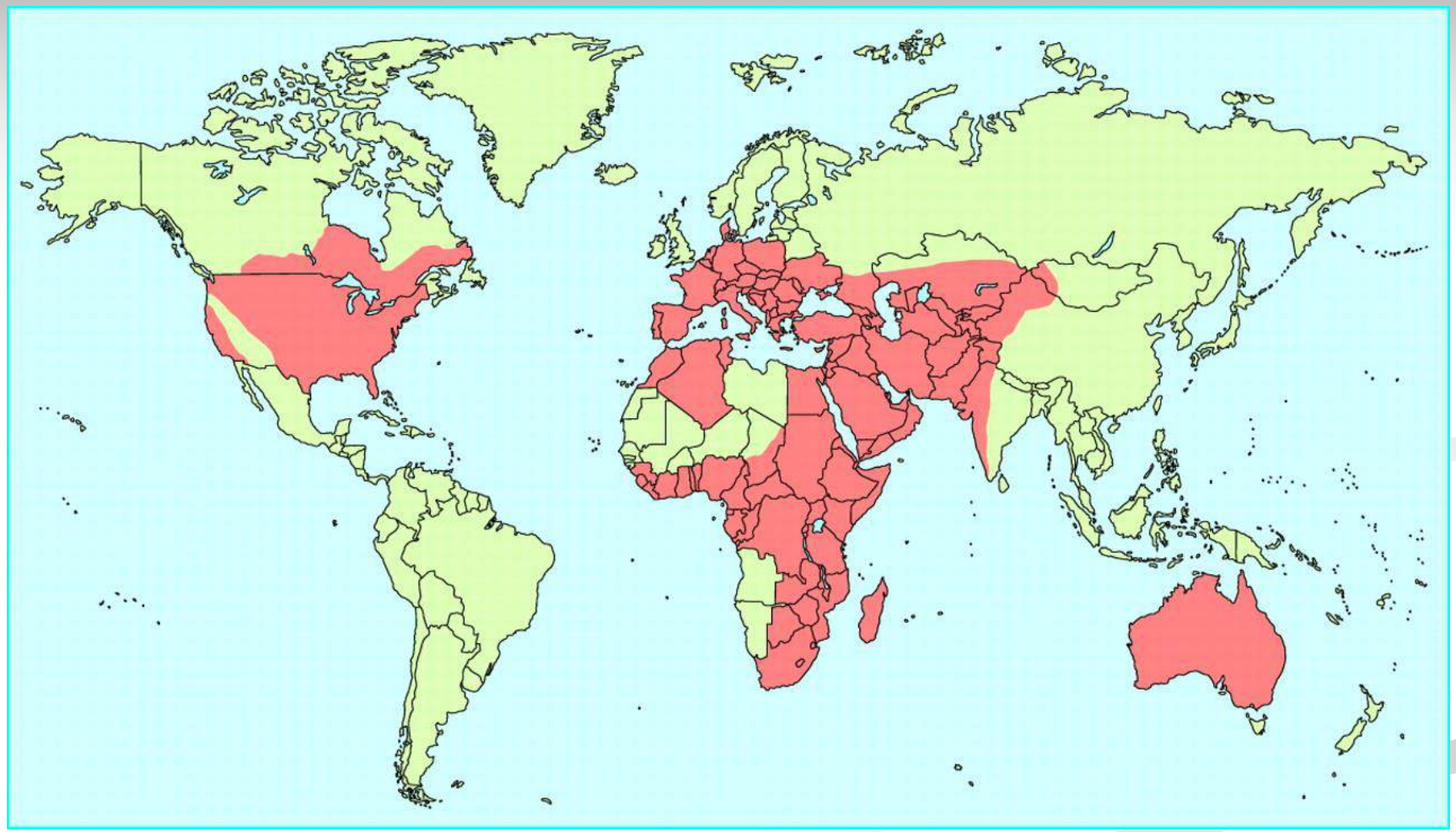
May 23 – 26th, 2016

Introduction

- West Nile virus (WNV) is a neurovirulent mosquito-transmissible *Flavivirus* with zoonotic potential.
- Infection is maintained in nature in an enzootic transmission cycle between avian hosts and ornithophilic mosquito vectors
- Virus occasionally infects other vertebrates, including humans and horses, in which it may cause sporadic disease outbreaks that may result fatal



Global Distribution of WNV



WNV situation in Serbia

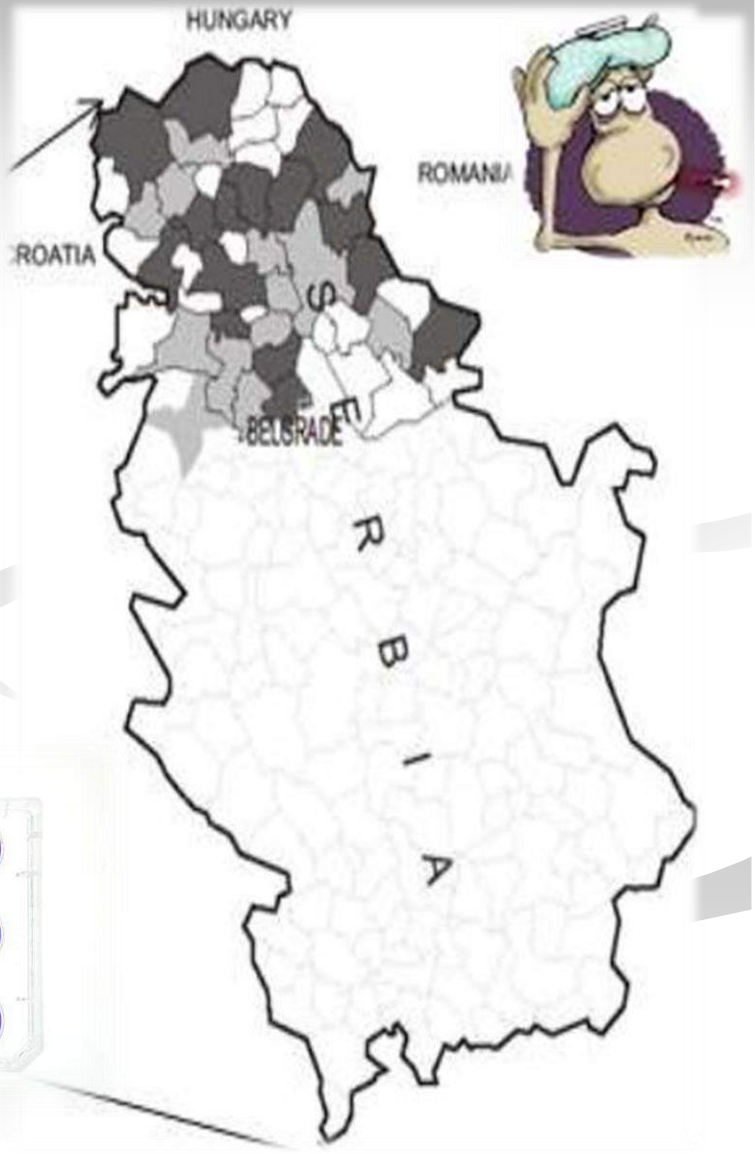
- 1972 - antibodies against WNV were found in 2.6%-4.7% of human sera samples in Vojvodina province (Bordjoski et al., 1972).

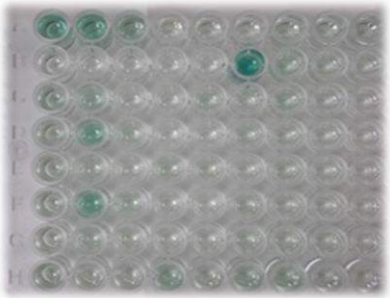
- 1991 – WNV seroprevalence in human population in the former Yugoslavia: 1-3% in Croatia, 1% in Bosnia and Herzegovina and Kosovo, 1% in Montenegro, and 1-8% in Serbia (Vesenjak-Hirjan et al., 1991).

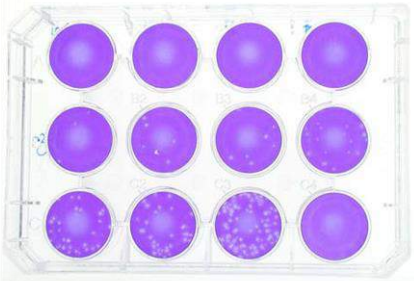
- 2005 – 2010 – average WNV seroprevalence in human population in the Vojvodina province was 3.99% (18/451) (Petrić et al., 2012)

Serological studies on WNV infection presence in horses in Serbia (2009 – 2013)

Year of sampling	No tested horses	Percent of positives
2009 - 2010	349	**12 %**
2010 - 2011	252	**28.6 %**
2012	130	**49.2 %**
2013	96	**46.9 %**

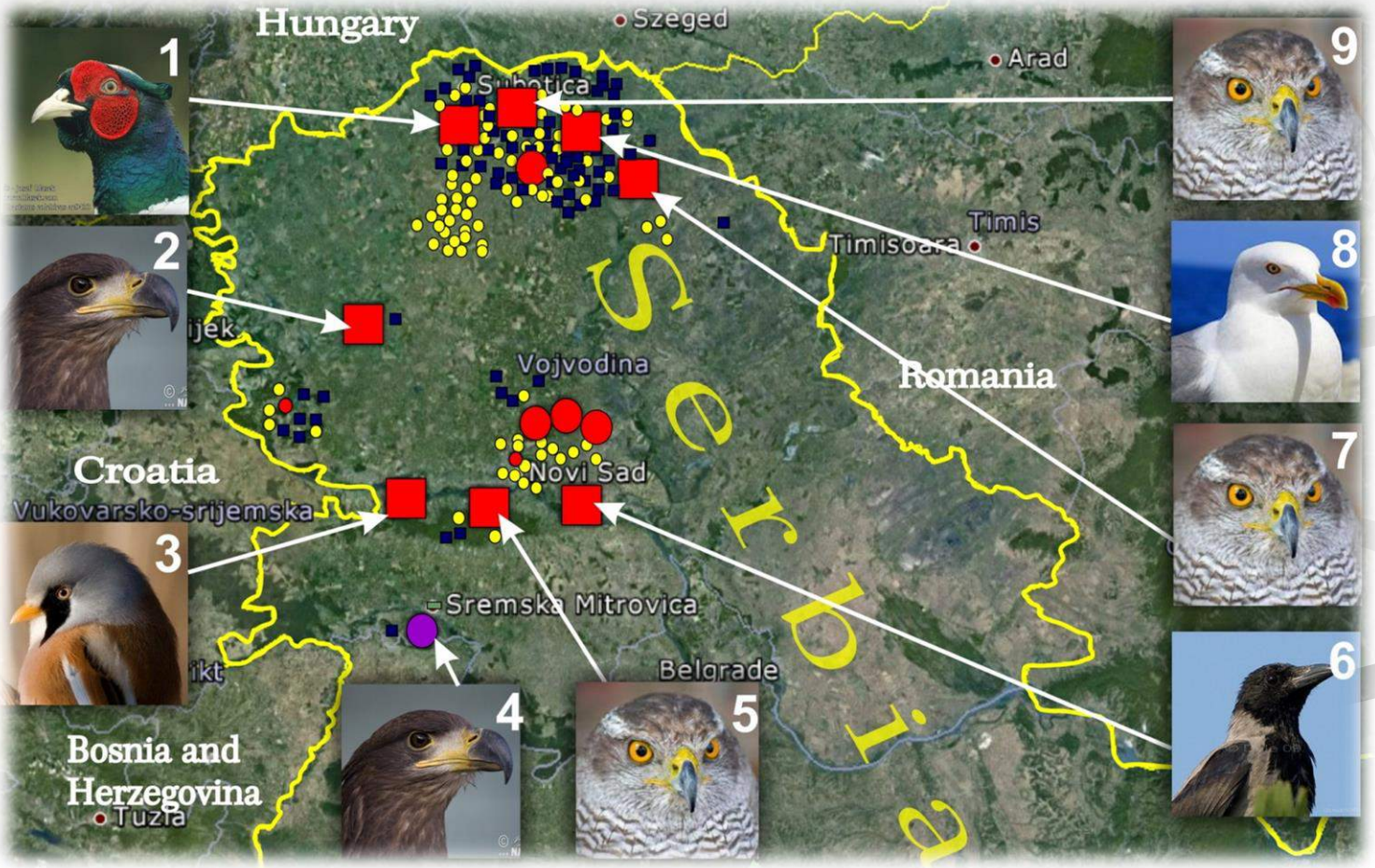




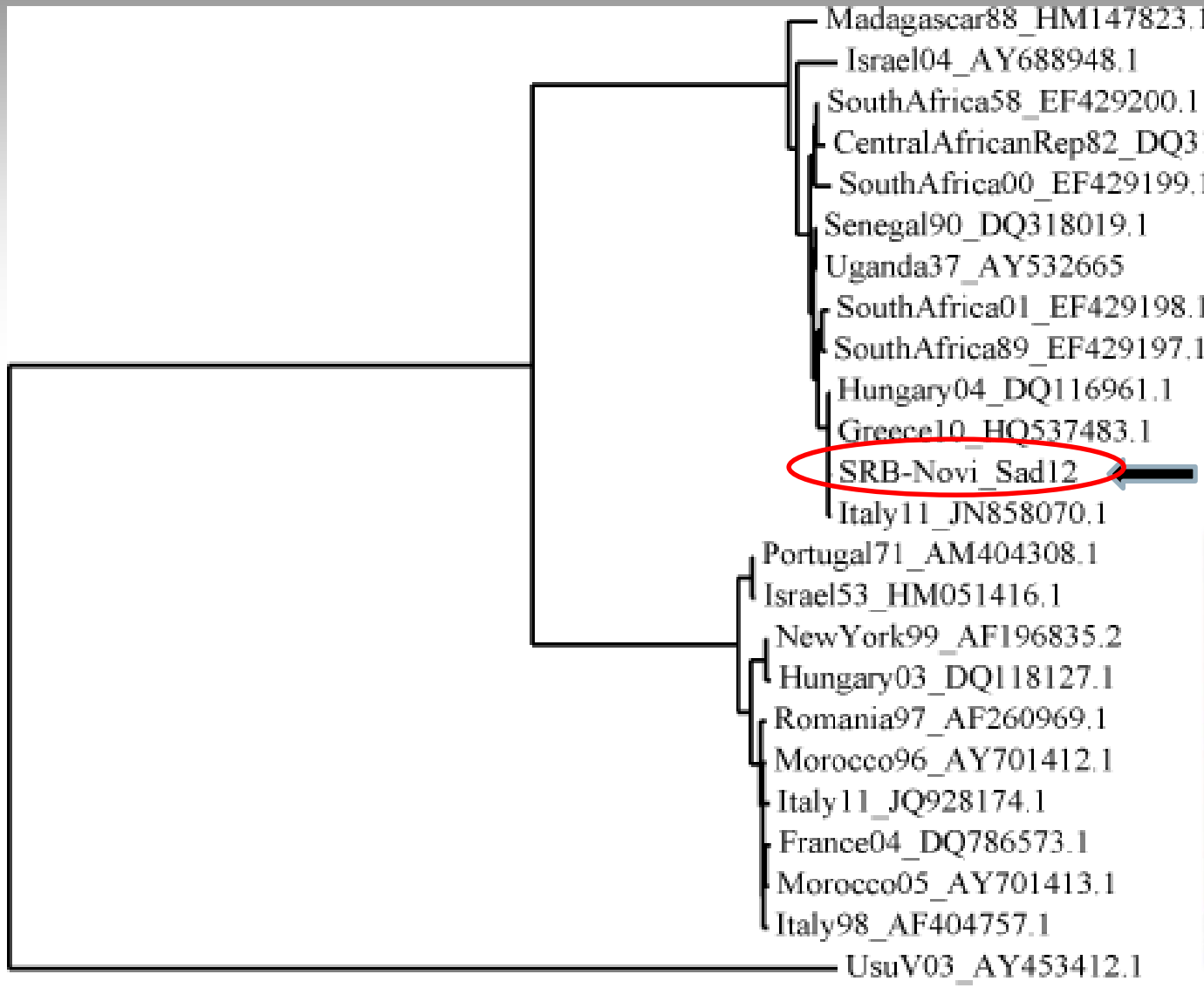


WNV- presence in wild birds in Serbia (2012)

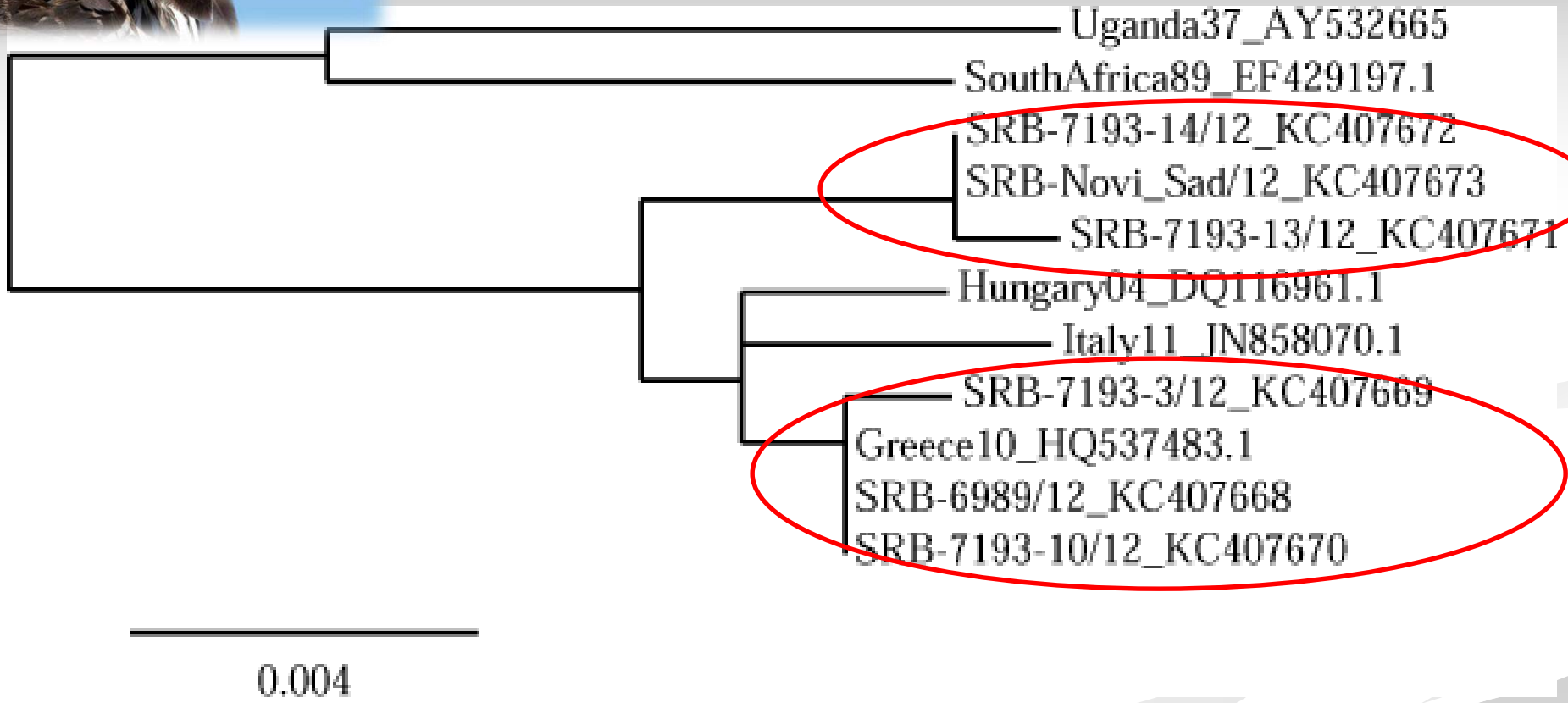
No of tested	Order	Family	*Birds Species*	WNV ELISA	WNV PRNT	WNV RT-PCR
134	15	28	46 species	7/92 (7.6%)	5/92 (5.4%)	9/82 (9.8%)



WNV- presence in wild birds in Serbia (2012)

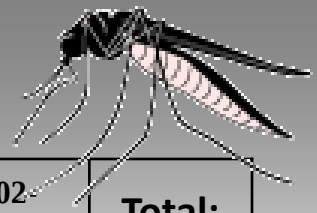


WNV- presence in wild birds in Serbia (2012)



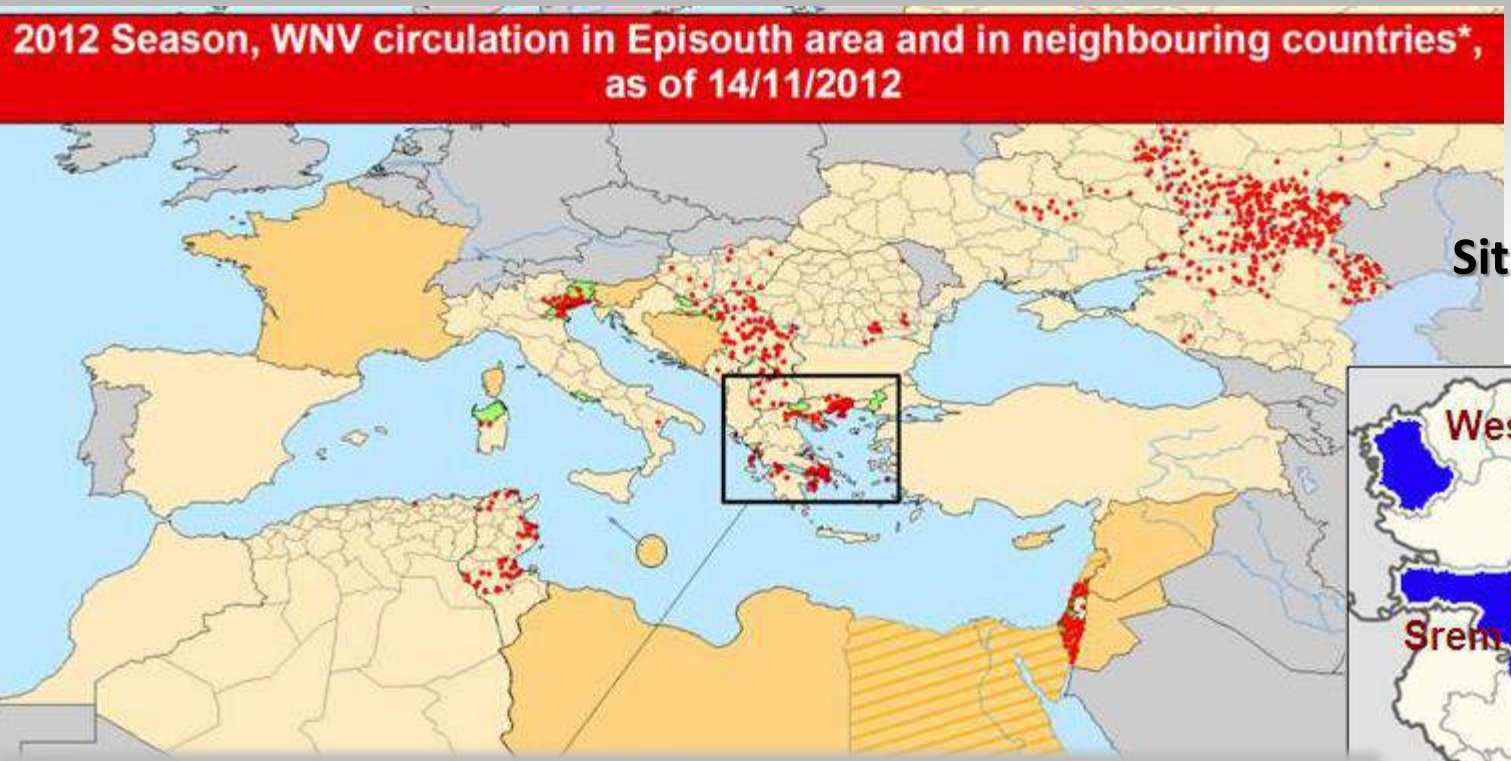
Phylogenetic analysis of partial E region sequence of WNV isolates suggests existence of at least two WNV linage 2 clusters in Serbia, in close relationship with isolates responsible for epidemics in Greece, Hungary and Italy

Results of mosquito testing – WNV positive/ tested samples, by time and sampling location (July – October 2013)



Sampling location	17-18.07.13.	19-20.07.13.	23-24.07.13	25-26.07.13.	30-31.07.13.	28-29.08.13.	06-07.09.13.	13-14.09.13.	02-03.10.13.	Total:
Čenej		0/38		0/10	0/9	**1/7**	**2/4**	**2/2**		**3/70**
Novi Sad		0/7		0/5	0/5	**1/5**	**2/6**	0/6		**3/34**
Sadovi		0/6		0/3	**1/4**	0/4	**1/1**	0/1		**2/19**
Batrovci		0/5		0/6		0/6	**1/6**	0/3		**1/26**
Bečej			**1/22**							**1/22**
Novi Bečej			**4/32**							**4/32**
Kelebija							0/4			**0/4**
Zobnatica							0/5			**0/5**
Fantast							**3/7**			**3/7**
Karađorđevo									0/1	**0/1**
Vršac									0/3	**0/3**
Hrtkovci						0/2	**1/1**	0/1		**1/4**
Kuzmin						**2/3**	**1/2**	**2/2**		**5/7**
Glogonj	0/5									**0/5**
Jabuka	**1/12**									**1/12**
Pančevo	**1/34**								0/1	**1/35**
Kačarevo	0/5									**0/5**
Alibunar	**1/4**									**1/4**
Banatsko Novo Selo	0/4									**0/4**
Vladimirovac	0/7									**0/7**
Total: 20	**3/71**	**0/56**	**5/54**	**0/24**	**1/18**	**4/27**	**11/36**	**4/15**	**0/5**	**28/306**

Reported human WNV cases in EU and surrounding countries during 2012 (ECDC)



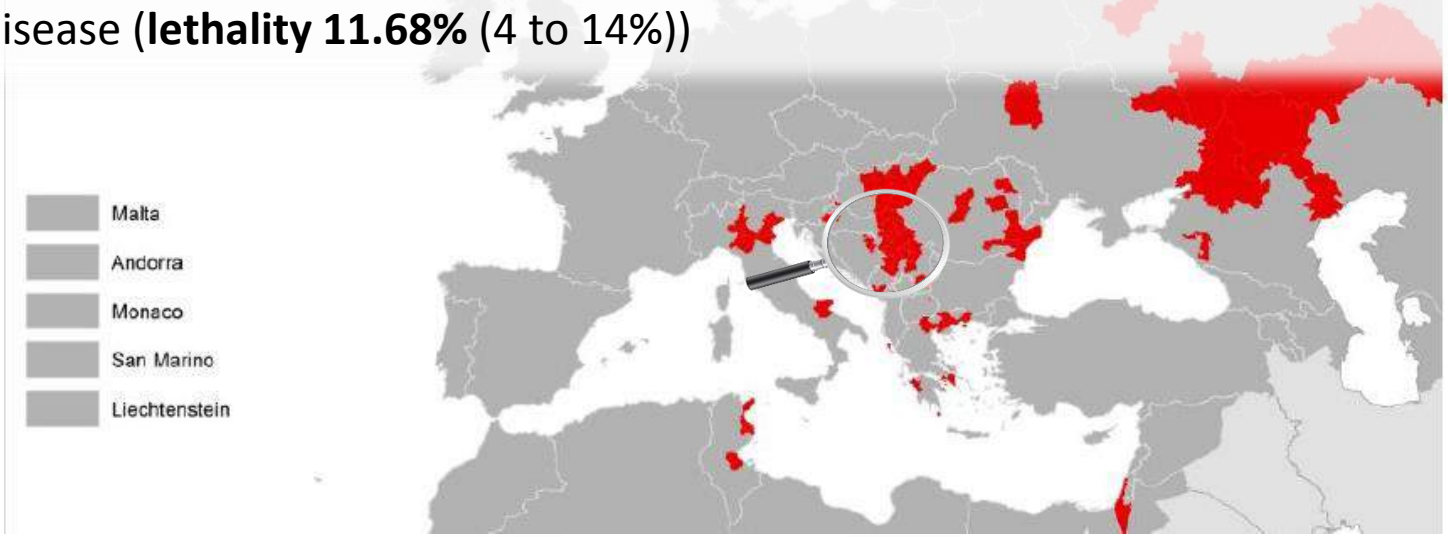
Situation October 2012

- **71 human case** was registered in Serbia in season 2012. (14. nov.).
- 81.7% patients was older then 50 years
- Most of the human cases was from the territory of **Belgrade (74.6%), South Banat (8.5%) and Srem County (7%).**
- **9 dead cases** was directly connected to WNV infection (**lethality of 12.7%)**

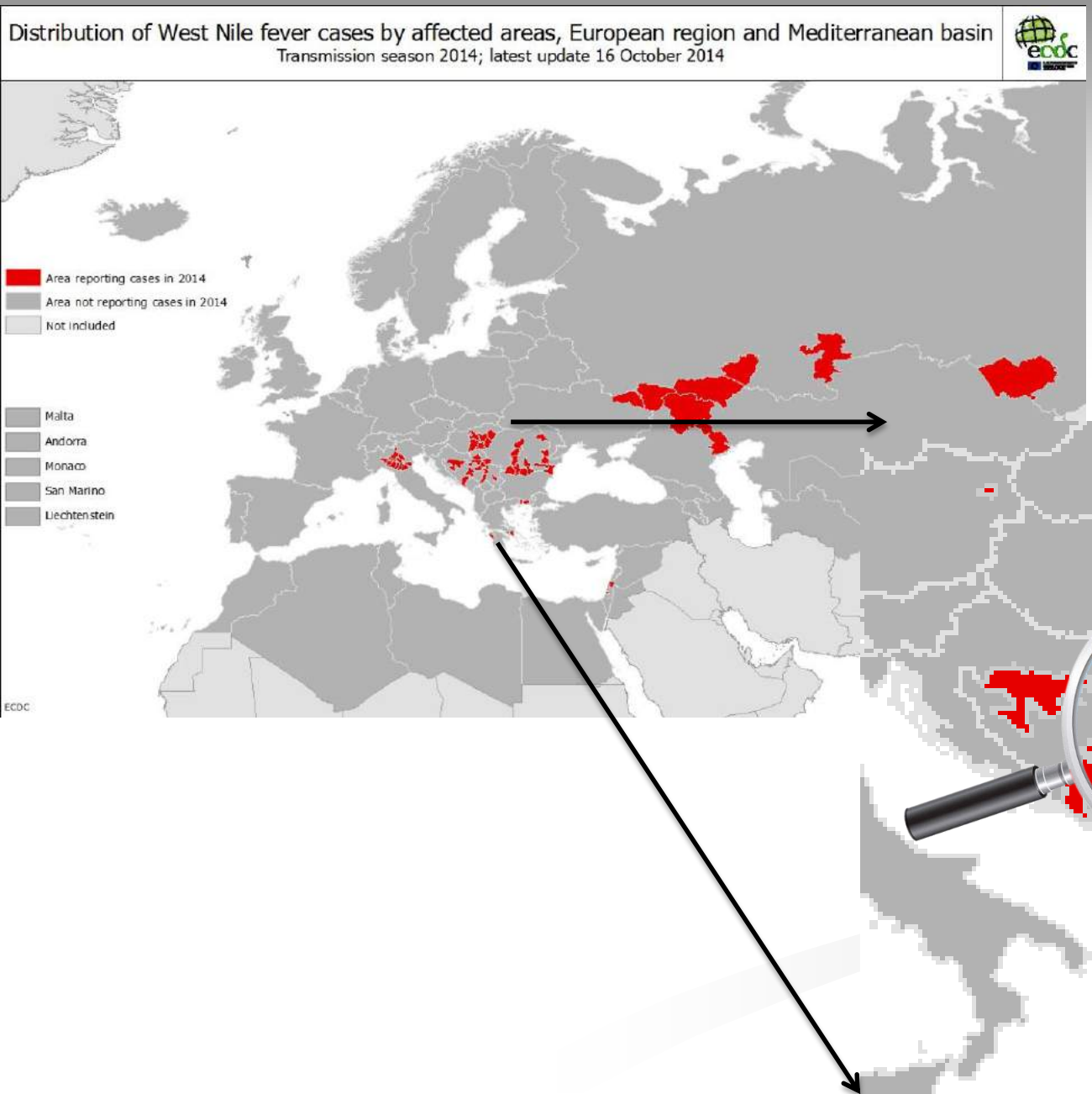
Reported human WNV cases in EU and surrounding countries in 2013 (ECDC)

Presence of WNV infection in Serbian human population in 2013 (Batut- 23.10.2013)

- **302 laboratory confirmed** human cases of WNV infection
- **243 persons had clinical symptoms** of meningitis, encephalitis or meningoencephalitis
- Out of 302 lab confirmed infections, 253 persons were older then 50 years (183 with chronicle diseases)
- **35 dead cases** were registered, all of them were older than 50 years and with some other chronicle disease (**lethality 11.68%** (4 to 14%))



Reported human cases of WNV infection in Serbia in 2014 (ECDC)

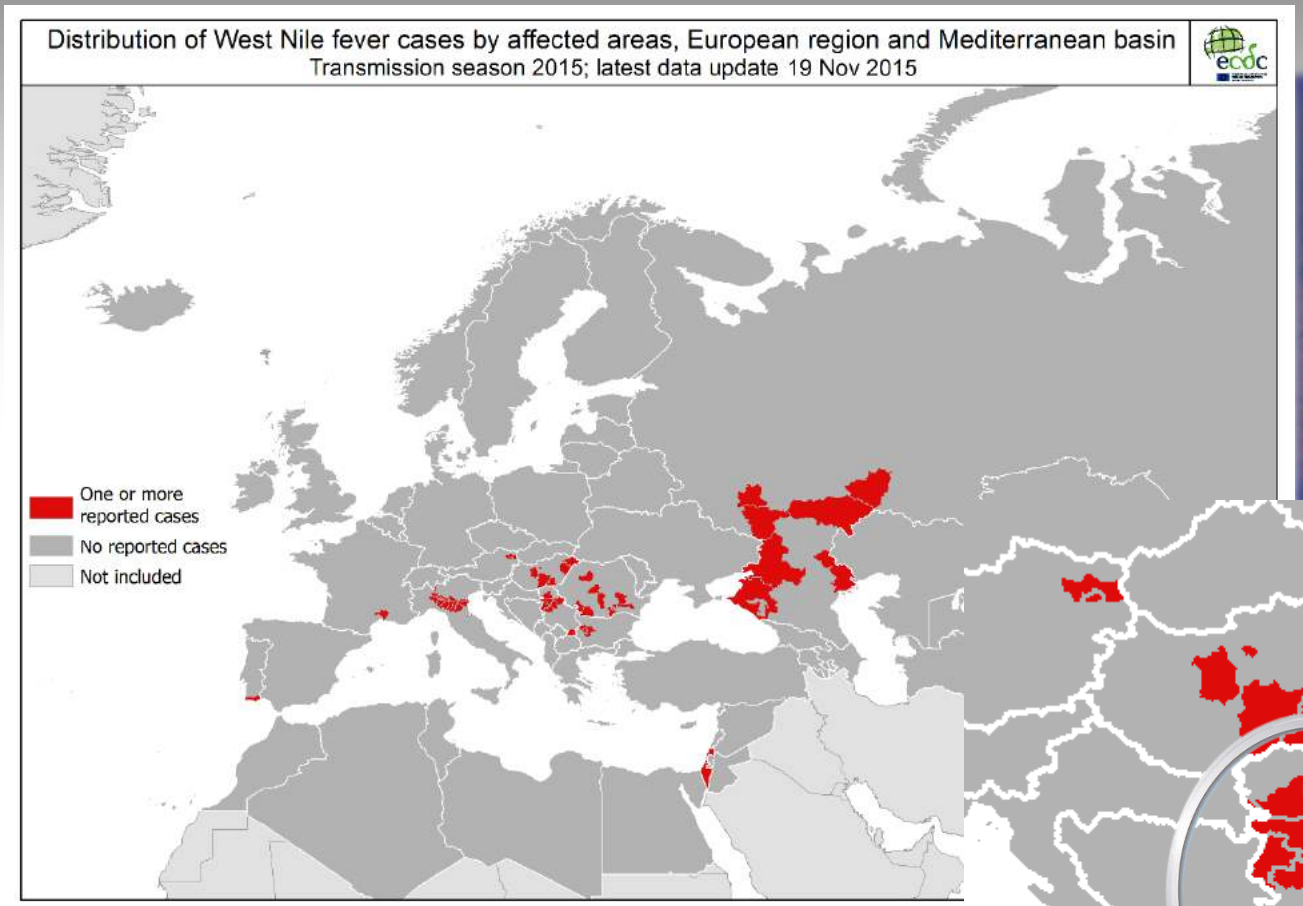


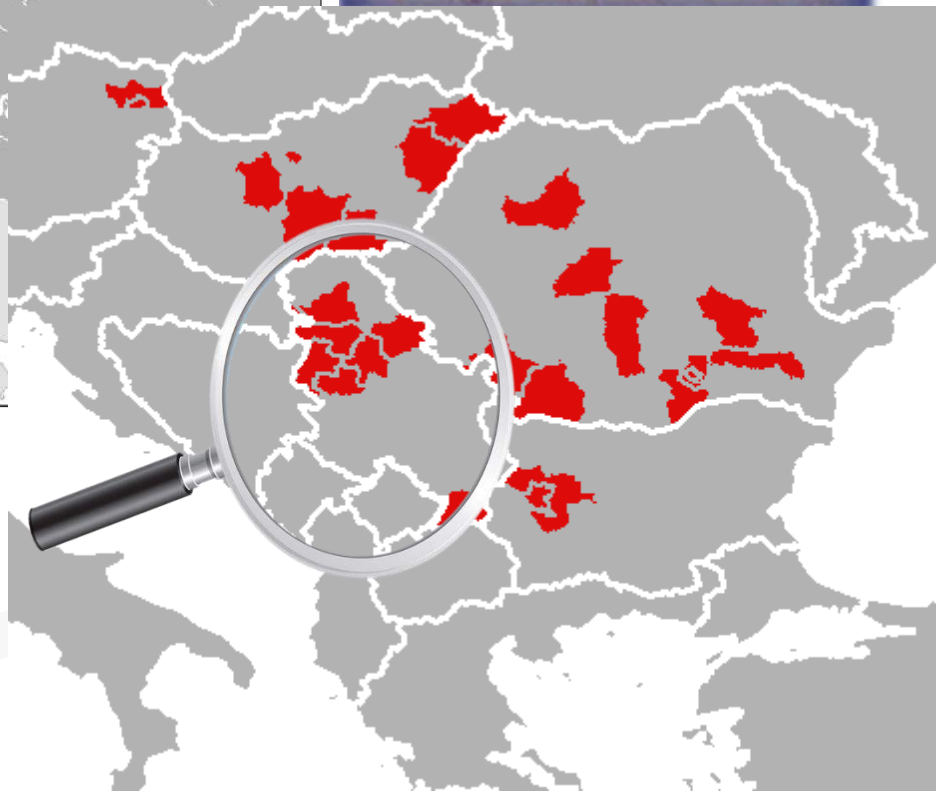
Reported human cases of WNV infection in Serbia in 2014 (ECDC)

Cumulative number of West Nile fever cases, by affected area, as of 20/11/2014 (210 cases - 163 human cases have been reported in the Europe and 47 cases in neighboring countries (Rusia, Israel, Palestina)

Country	No by country	Area	First case reported	Number of cases	
Serbia	76	**Grad Beograd**	17/07/2014	**35**	**25**
Latalitet	**9 (12%)**	**Juzno-backi district**	17/07/2014	**5**	**3**
		Juzno-banatski district	29/08/2014	**19**	**16**
		Kolubarski district	22/08/2014	**4**	**3**
		Nisavski district	17/07/2014	1	0
		Podunavski district	29/08/2014	**4**	**3**
		Raski district	10/09/2014	1	0
		Sremski district	22/08/2014	**6**	**5**
		Sumadijski district	02/10/2014	1	1

Reported human cases of WNV infection in Serbia in 2015 (ECDC)





Reported human cases of WNV infection in Serbia in 2015 (ECDC)

Cumulative number of West Nile fever cases, by affected area, as of 19/11/2015 (301 cases – 108 in EU countries + 193 in surrounding countries (including Serbia)

Region	First case reported day/month	Cases current time period	Cases current season	Confirmed cases current season	Population
Serbia - Sremski	05/10	.	1	1	.
Serbia - Pcinjski	05/10	.	1	1	.
Serbia - Macvanski	02/11	.	1	1	.
Serbia – Kolubarski	02/11	.	1	1	.
Serbia - Juzno-banatski	10/08	.	7	7	.
Serbia - Juzno-backi	05/10	.	2	2	.
Serbia - Grad Beograd	14/09	.	15	15	.
TOTAL		-	28	28	.

National WNV monitoring program in Serbia

- The WNV monitoring / surveillance program established by Veterinary Directorate MAEP was active from spring (June) 2014.

- The main aim of the program – early detection of WNV presence in the environment targeted to the application of timely control measures - the control of vectors (mosquitoes) and prevention of disease outbreaks (epidemics) in humans and animals

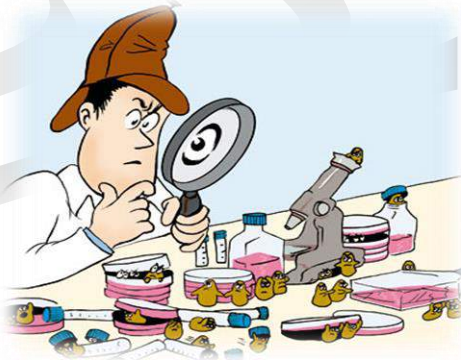
- Surveillance program is based on monitoring of anti-WNV IgM antibodies in blood sera of sentinel horses, as well as on monitoring the presence of the virus in natural hosts and vectors (wild birds and mosquitoes)

National WNV monitoring program in Serbia

- **Active surveillance was conducted**:
  - ❖ serological testing of sentinel horses (ELISA WNV IgM Ab test)
  - ❖ testing on virus presence in mosquito vectors (RT-PCR),
  - ❖ testing on virus presence in samples of found dead / alive captured susceptible wild birds (RT-PCR).

- **Passive surveillance** – serological testing (pared sera samples) and testing of virus presence in samples of horses with clinical signs of neurological disorders.

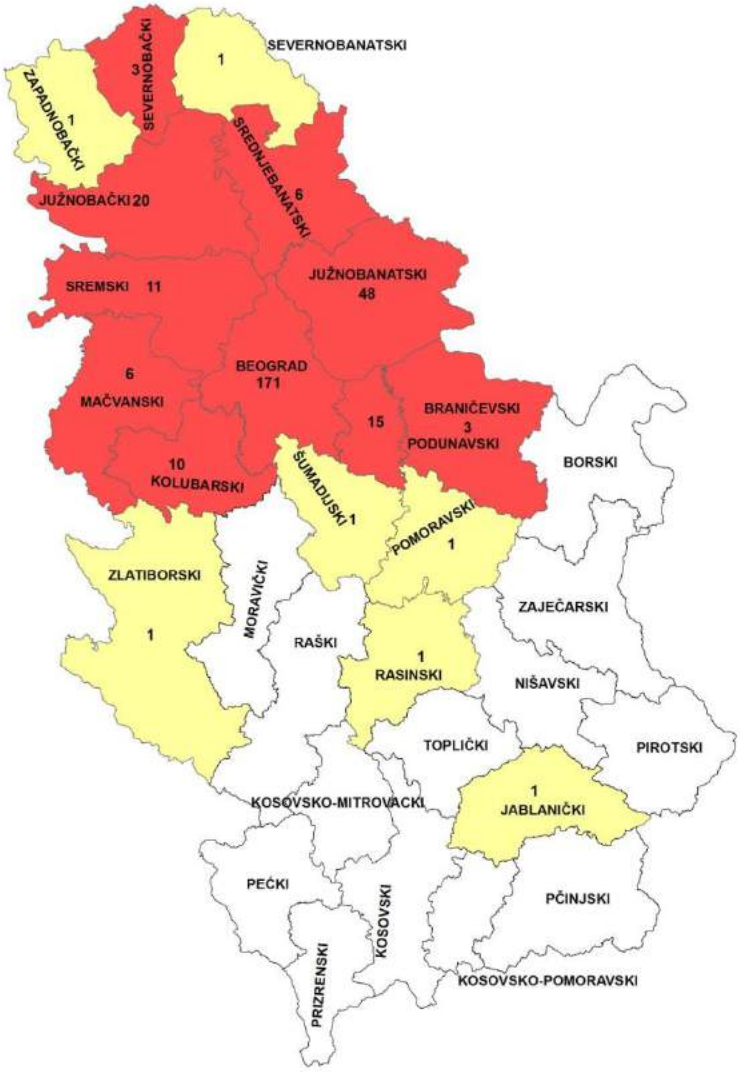
- By active and passive surveillance all municipalities in the Republic of Serbia were covered, distribution of sampling points is determined based on risk assessment of exposure to WNV.



National WNV monitoring program in Serbia

➢Based on the existing knowledge on presence and circulation of WNV, Districts (NUTS3) in Serbia were, regarding the risk of WNV infection divided into Counties of higher and Counties of lower risk for WNV infection:

Higher risk Districts	Lower risk Districts
Severno-bački okrug	Severno-banatski okrug
Zapadno-bački okrug	Mačvanski okrug
Južno-bački okrug	Braničevski okrug
Srednje-banatski okrug	Pomoravski okrug
Južno-banatski okrug	Borski okrug
Sremski okrug	Zaječarski okrug
Grad Beograd	Zlatiborski okrug
Kolubarski okrug	Moravički okrug
Podunavski okrug	Rasinski okrug
Šumadijski okrug	Nišavski okrug
Raški okrug	Toplički okrug
	Pirotski okrug
	Jablanički okrug
	Pčinjski okrug



National WNV monitoring program in Serbia

Active surveillance:

Serological testing of sentinel horses

- Surveillance in higher risk districts:
  - serological testing four time per year (June-July-August-September),
  - 50 sentinel horses sampled from at least 10 localities per District
- Surveillance in lower risk Districts :
  - serological testing four time per year (June-July-August-September),
  - 30 sentinel horses sampled from at least 7 localities per District

National WNV monitoring program in Serbia

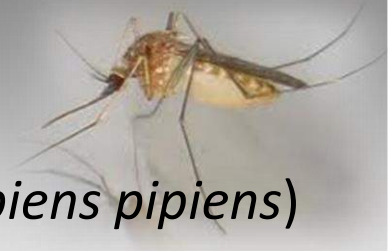
Active surveillance:

Surveillance of WNV presence in wild birds

- **Surveillance in higher risk Districts**:
  - ❖ testing by *RT-PCR* or *real time RT-PCR* methodology
  - ❖ in tissue samples of found dead suspect wild birds during the whole year, or
  - ❖ in samples of up to 100 planned hunted or live captured susceptible wild birds during May - October

- **Surveillance in lower risk Districts**:
  - ❖ testing by *RT-PCR* or *real time RT-PCR* methodology
  - ❖ in tissue samples of up to 50 found dead susceptible wild birds during period May - October

National WNV monitoring program in Serbia



Active surveillance:

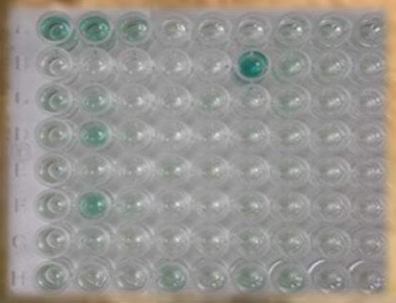
Surveillance of WNV presence in vector mosquitoes (*Culex pipiens pipiens*)

- **Surveillance in higher risk Districts** :
  - testing by *RT-PCR* or *real time RT-PCR* methodology
  - sampling of mosquitoes every 2 weeks in period June - September
  - at 10 localities distributed throughout the whole territory of the Districts
  - 7 samplings

- **Surveillance in lower risk areas/counties** :
  - testing by *RT-PCR* or *real time RT-PCR* methodology
  - sampling of mosquitoes once per month in period June - September
  - at 5 localities distributed throughout the whole territory of the District
  - 5 samplings

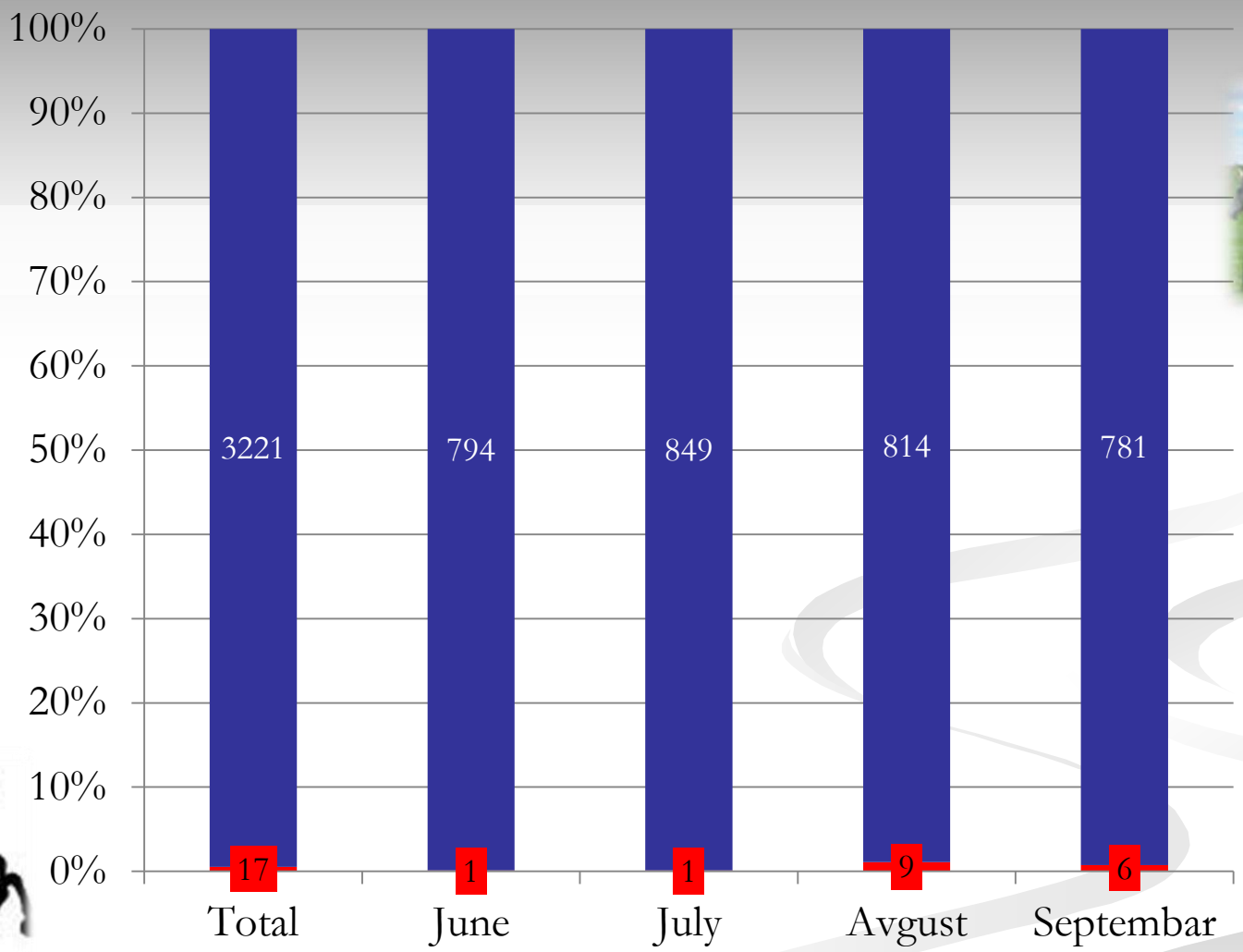
Results of WNV surveillance in sentinel horses (2015)

- In total, **3238** blood sera tested from 25 Districts(Jun-September)
- Positive serology results (IgM antibodies) found in **17 samples (animals) (0.53%)** (in June 0.13%, in July 0.12%, in August 1.11%, in September 0.77% of tested horses)
- Out of 25 Districts in Serbia, positive horses were detected in: 1 in June, 1 in July, 5 in August and 4 districts in September
- First positive serology result was detected in Belgrade area in June 2015



Results of WNV surveillance in sentinel horses (2015)

Horses:

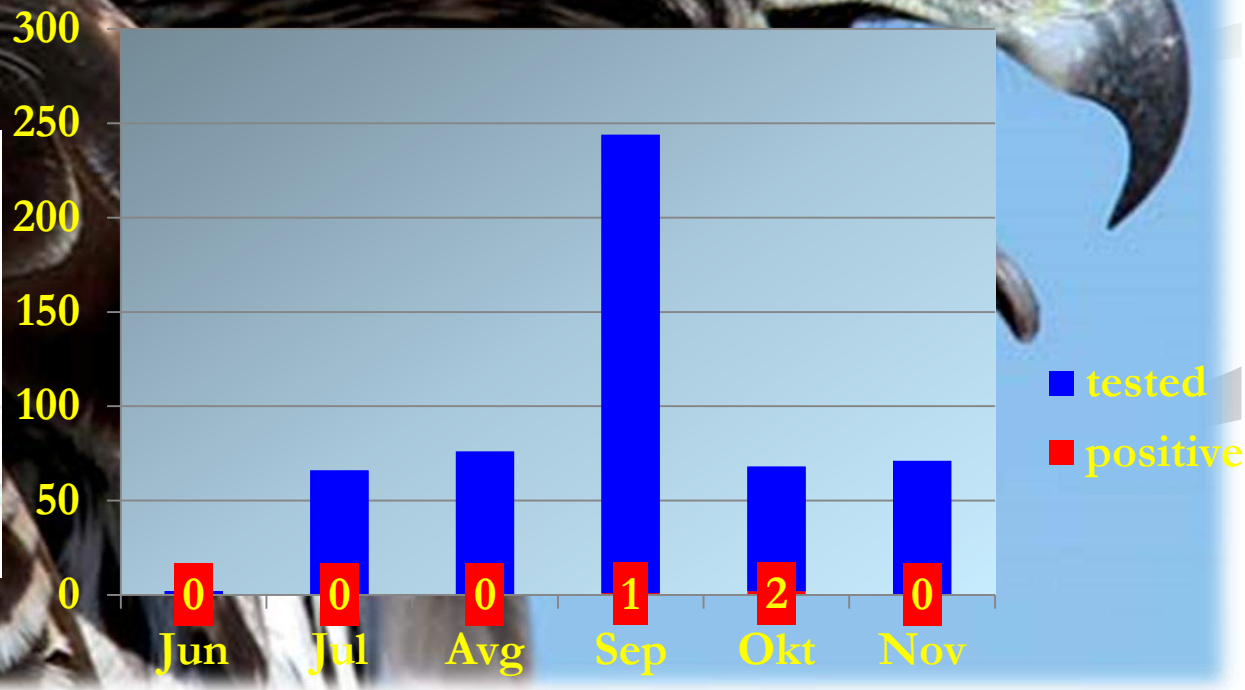


	Total	June	July	Aug	Sept
Tested	3238	794	849	814	781
Positive	17	1	1	9	6

Results of WNV surveillance in wild birds (2015)

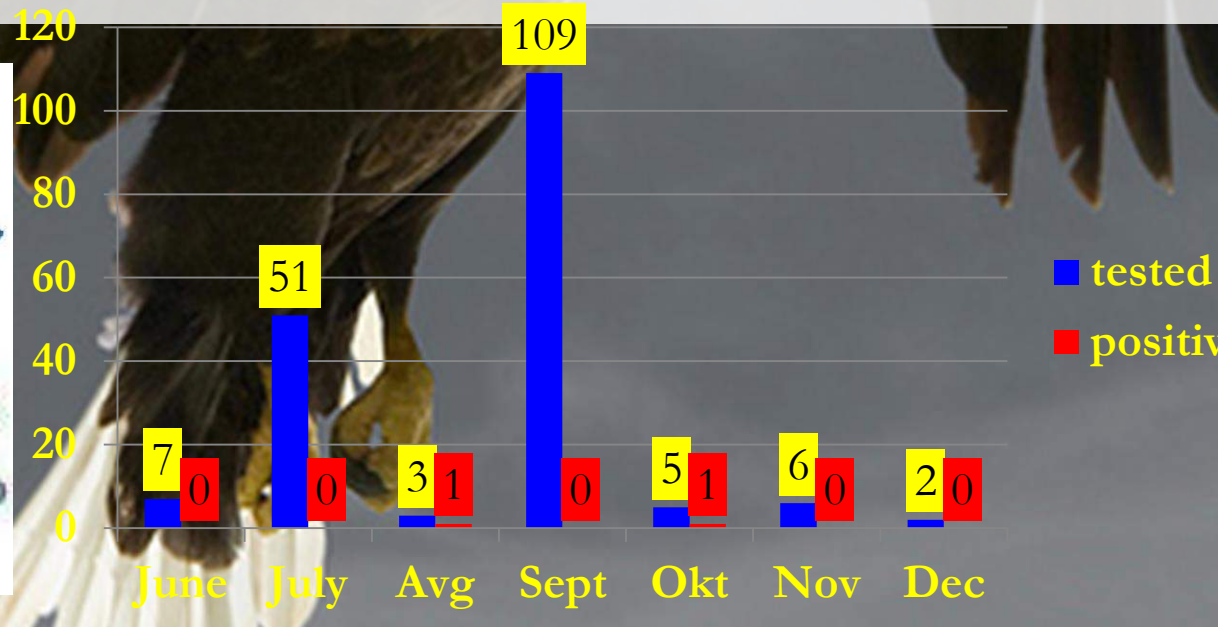
Live wild birds swabs:

- swab samples of **524** birds was tested (June – Nov. 2015)
- WNV positive samples (3) were found in Middle Banat District (Hen harrier) in September and Belgrade city area in October (2 birds)

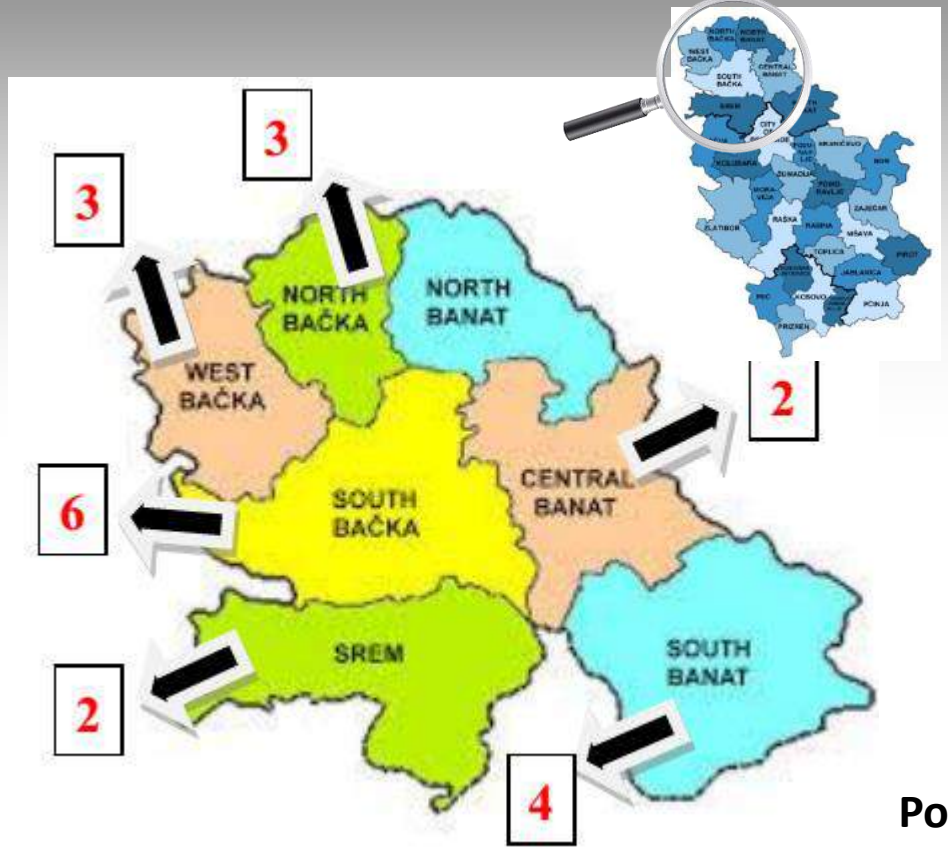


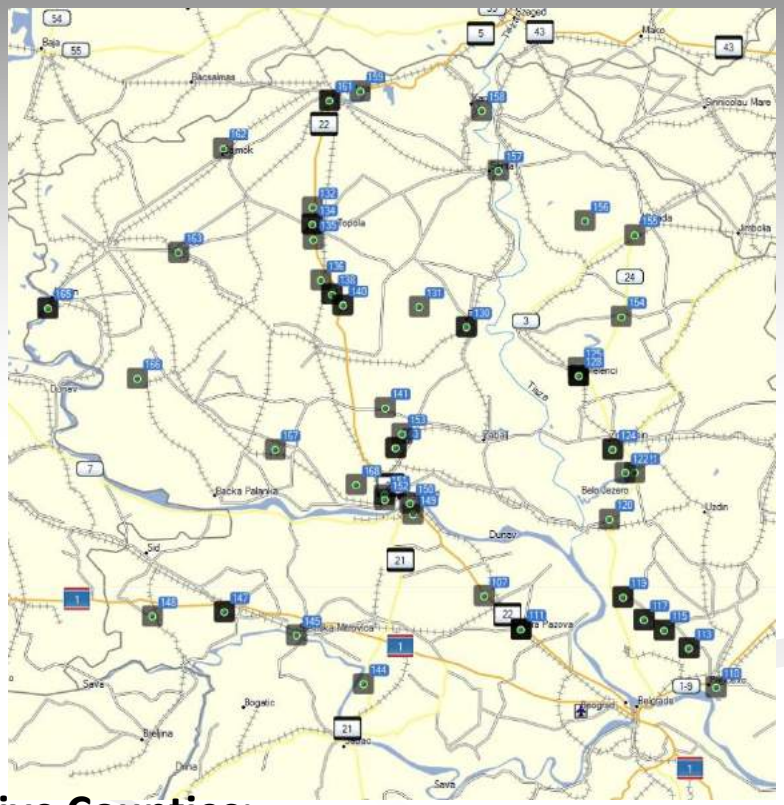
Wild birds (found dead/shot) samples:

- 183 tissues samples of dead and 13 samples of shot wild birds ware tested (June - December)
- 2 virus positive samples of found dead w/b were detected: Hooded crow in Novi Sad (14/08/2015) and Carrion crow in Pančevo (08/10/2015); and 3 virus positive European magpie were detected in WestBačka coun.(11/09/15)
- Tested wild birds: Hooded and Carrion crow, Red-footed Falcon, European magpie, Rook, Falcon, Goshawk, Hen harrier, cormorant....
- Inconsistent sampling distribution was observed



Results of mosquito testing (June – September 2015)

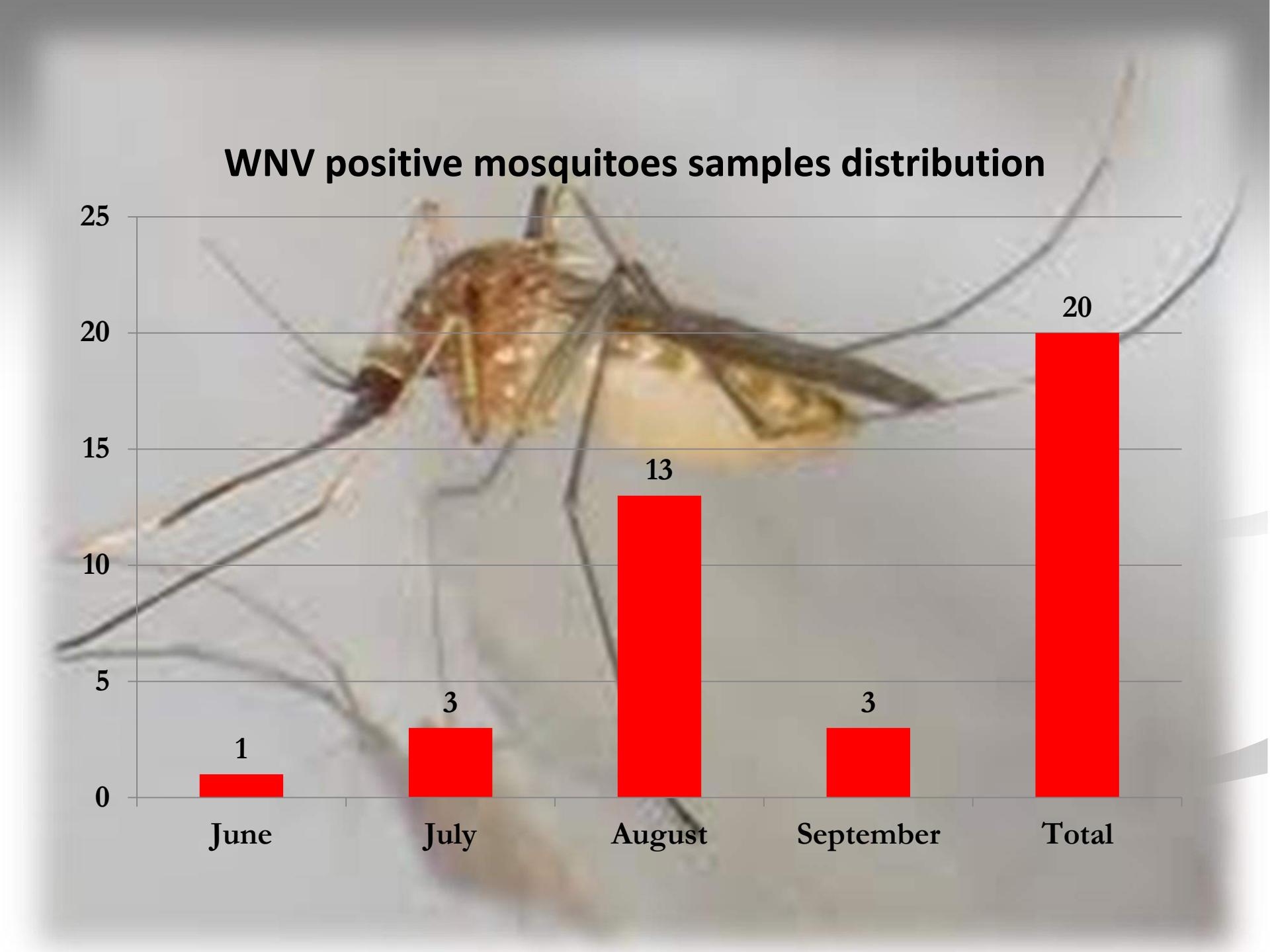




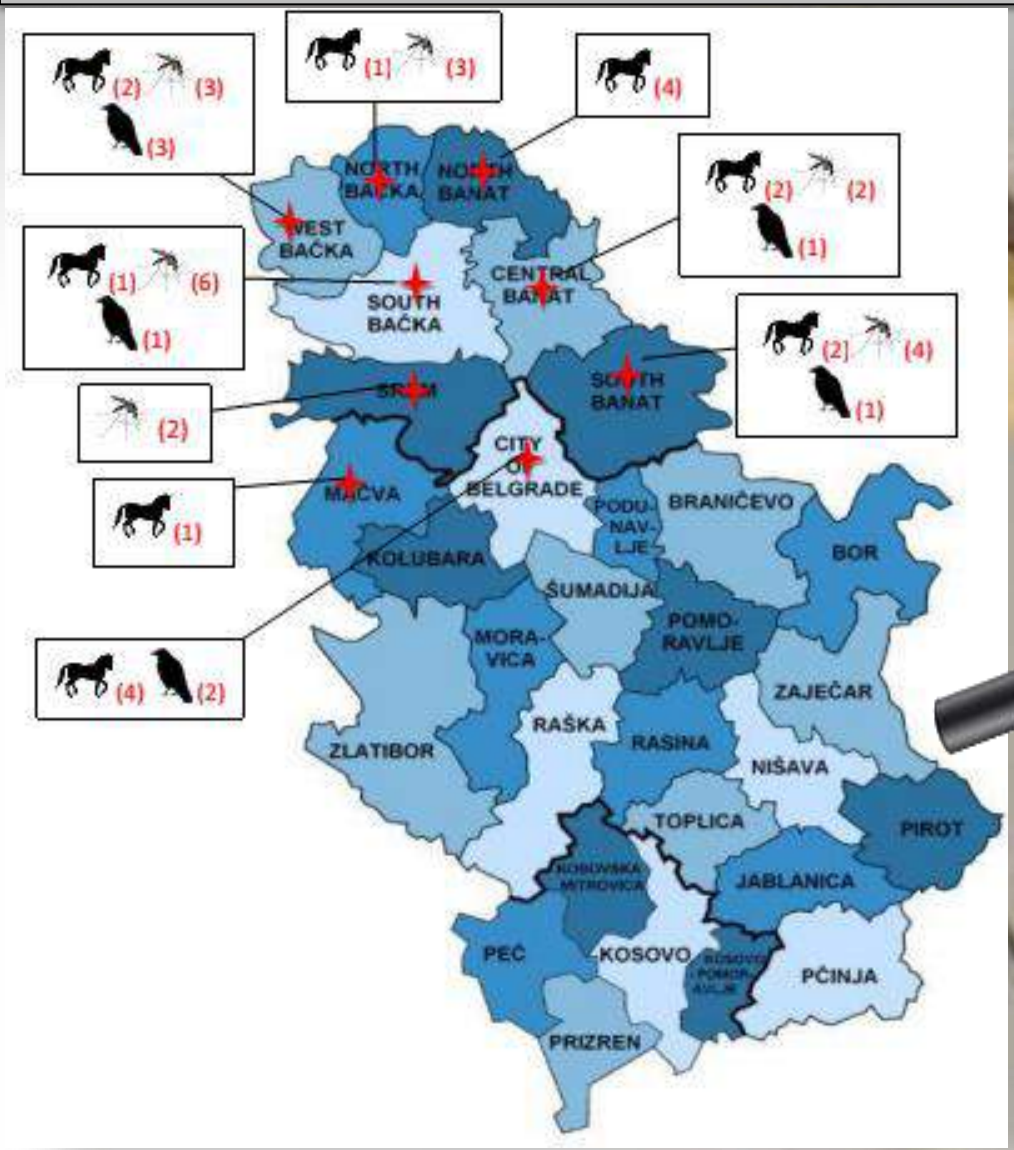
- **956** samples tested,
- first positive sample on **June 13th**,
- total **positive 20**, prevalence **2.09%** (4.57%)

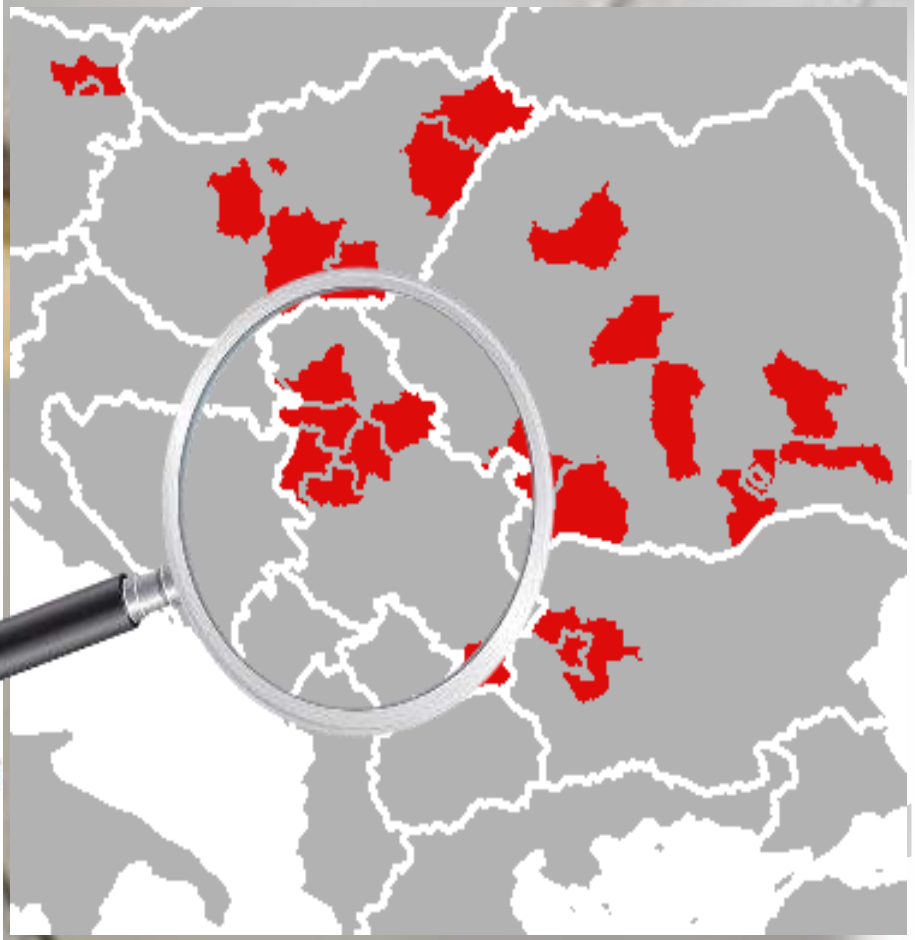
Positive Counties:

- **North Bačka;**
- **Middle Banat;**
- **South Banat;**
- **Western Banat;**
- **South Bačka;**
- **Srem**


WNV positive mosquitoes samples distribution
25
20
15
10
5
0
1
3
13
3
20
June
July
August
September
Total

Comparison of WNV positive samples in surveillance and WND in humans

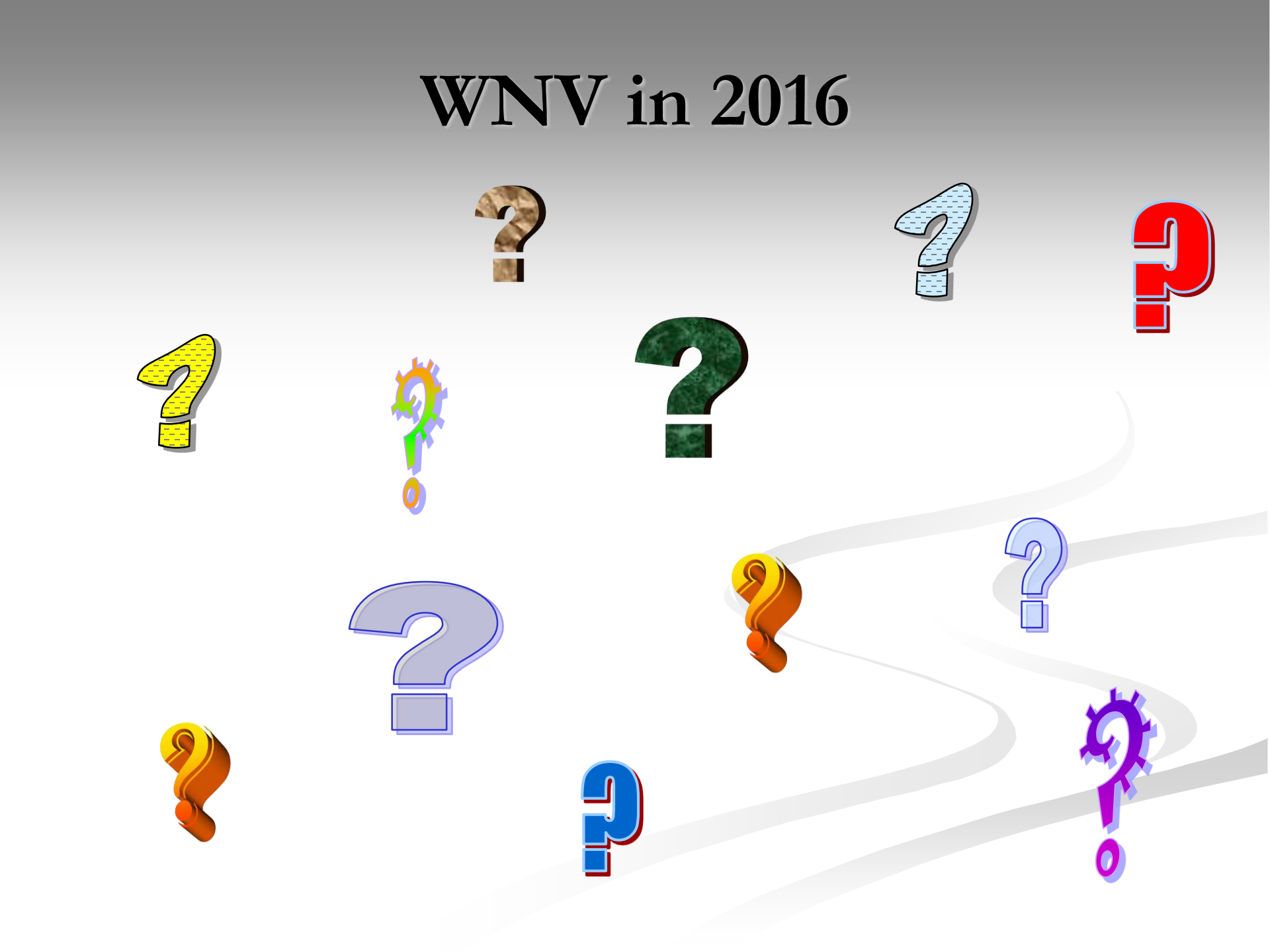




CONCLUSIONS

- WNV is present and circulating in Serbia at least from 2009.
- It is now endemic infection, will be continually present posing significant risk to human and animal health.
- Veterinary service together with colleagues of other professions – ornithologist and entomologist successfully managed to implement the WNV surveillance program and continuously and timely notify the human epidemiological service about the surveillance results.
- For the success of the surveillance, synergy, coordination and standardization of different programmes (Ministry of Health, Ministry of Agriculture and Municipalities) are needed as well as action plan for implementation of mosquito control at all administrative levels.

WNV in 2016



THANK YOU FOR ATTENTION

ENTOMOLOGICAL SURVEILLANCE OF WNV PREDISPOSED BY LOW GDP PER CAPITA - SERBIA

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Acknowledgements

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Part of the work was done under the frame of EurNegVec COST Action TD1303.

ENTOMOLOGICAL SURVEILLANCE OF WNV PREDISPOSED BY LOW GDP PER CAPITA – SERBIA

Why and how we started monitoring

Why we shifted to backward monitoring

Change back to forward mosquito “surveillance”

If “surveillance” changes to surveillance, what control tools are available

Definitions of surveillance and monitoring (ECDC, 2014)

Monitoring - consists of procedures implemented for temporary or continuous observation and is not followed by any additional activities (e.g. population dynamics).

Surveillance - consists of procedures developed in response to a risk and carried out to support subsequent actions.

Why and how we started

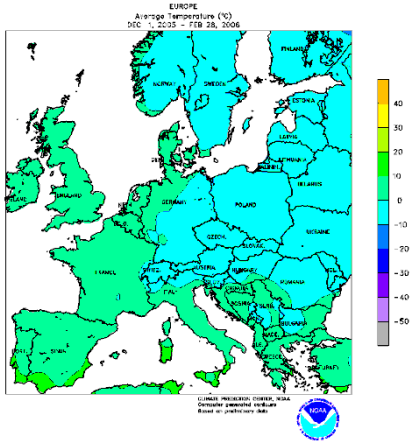
Situation in Serbia before 2005	
Public and policy makers' awareness of WNV risk	none
Capacity for detection of human cases, infestation of mosquitoes, horses and birds	none
Logical outcome – mosquito, horse, bird, sentinel chicken surveillance	none

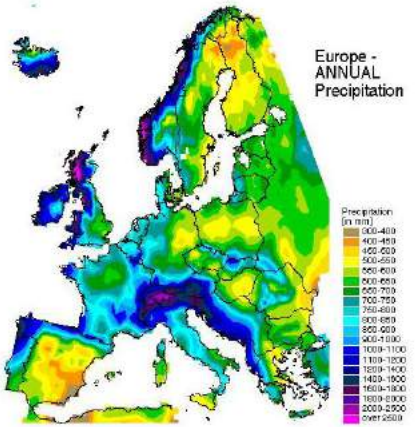
Why and how we started

1972 - Borđoški et al. 1972 found 2.6% - 4.7% positive human sera in Vojvodina (Serbia)

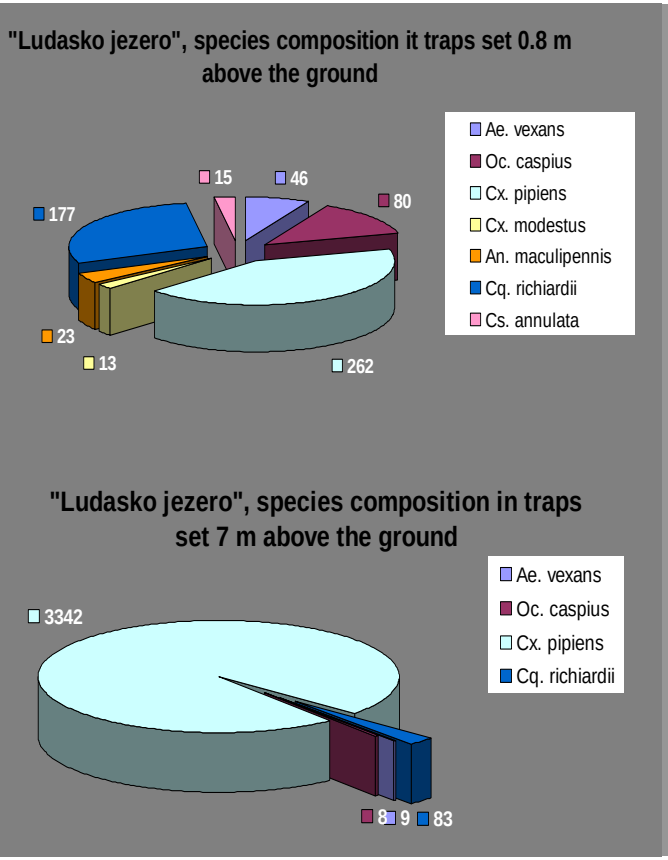
2003 – comparing climates of Bucharest region (Romania) - Central Valley (California) – Vojvodina (Serbia)

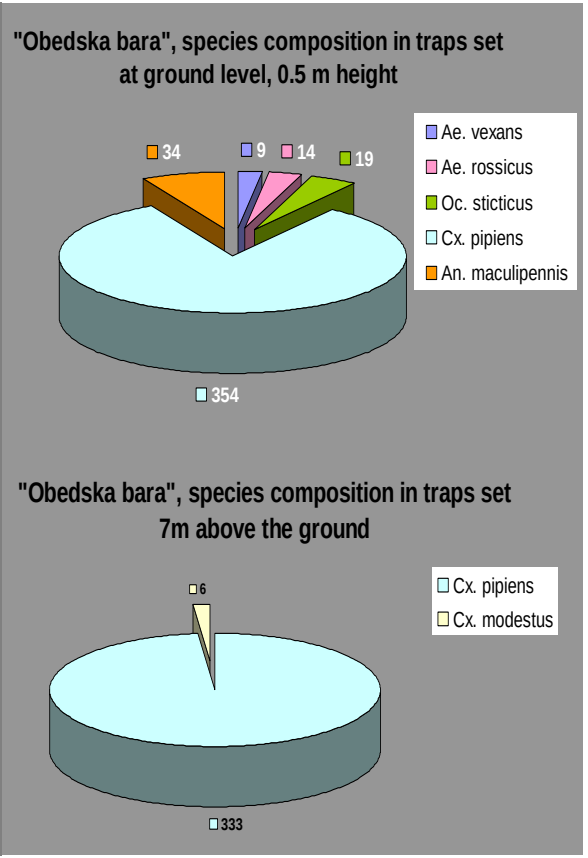
2005 - 2009 – mosquitoes sampled at bird reservoirs and human settlements, Vero cell suspect samples sent to NPHI of Spain, seroprevalence in humans (≤ 6.04%),





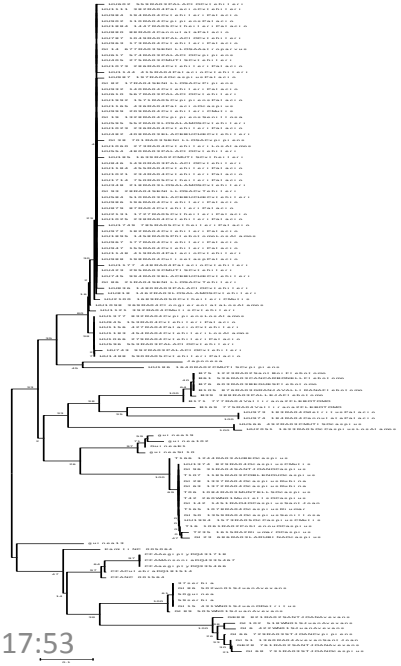
Why and how we started





Why and how we started

49.426 adult mosquitoes tested (630 pools)



Mosquito species	Mosquito species
Anopheles claviger	*Oc. caspius*
An. hyrcanus	*Oc. dorsalis*
An. maculipennis	*Oc. sticticus*
An.	
Ae.	
Ae. rossicus	*Cx. pipiens*
Aedimorphus vexans	*Culiseta annulata*
Ochlerotatus annulipes	

In 2005 mosquito-only flavivirus, cell fusing agent virus *Aedimorphus* [*Aedes*] *vexans* (Petrić et al. 2012)

Why and how we started

Surveillance of mosquitoes is part of the global response to MBD. Risk assessment and management of threats to human or animal health includes several activities (e.g. surveillance of human health and of intermediate hosts), but surveillance and control of the vector are crucial elements (ECDC, 2012).

Serbia

- no human cases, no virus detection = no surveillance

- we decided to change strategy and increase probability for virus detection

... AND SO WE DID

Shift to backward approach

Searching the evidence of WNV circulation in order to elevate alert of public health officials - in 2009/2010 the system of entomological surveillance of WNV was set backwards.

2009 IgG positive humans (likely cases) mapped
2009 grouping pattern detected - “hotspots”
2009 WNV detection allocated to “hotspot” mosquitoes (tailor made to funds available)
2010 mosquito sampling planned on “hotspots” only - area for vector sampling minimized (tailor made to funds available)

Shift to backward approach

2010 - sampling 3 times at 10 localities in September only, testing *Culex pipiens pipiens* only, 3 out of 29 pools positive to WNV – Novi Sad authorities prohibited disclosure of the results to public

2011 - sampling widened, sampling spots defined according to funding and priority: 1) old "hotspots" 2) new groupings of serological human/horse cases; positive pools detected – authorities prohibited disclosure of the results to public

Shift to backward approach

Might be that intense WNV circulation started in 2010, and we were just timely enough (lucky) to detect the virus in mosquitoes, anyhow:

- entomologists, veterinarians and medical/public health experts in Vojvodina started to work together (from 2005);
- capacities were developed for WNV detection in mosquitoes, birds, horses and humans (compleated in 2010);
- awareness of public health authorities was elevated;
- results not disclosed to the public;
- mosquito surveillance not initiated.

Present time

2012 - the first human cases detected, mosquito "surveillance" initiated by Ministry of Health, 3 out of 4 institution that started (2005, 2007, 2009) and developed WNV surveillance system in Serbia not included.

At the teritories covered by MH surveillance, approach to entomological surveillance shifted from "backward" to "forward" in order to facilitate predictive risk assessment, but no vector control plan developed?
Mosquito surveillance conducted by LME financed from the projects at IgG positive human cases

2013 - Mosquito surveillance conducted by LME financed from the projects within districts with human cases in 2012, City of Novi Sad started independent surveillance programme .

Present time

2014/2015 – parallel mosquito "surveillance" initiated by Ministry of Agriculture and Environment Protection including, in adition to mosquitoes, also horses, birds and sentinel chickens.

MAEP National programme based on experience gained in Vojvodina (2005-2013) and prepared in close colaboration between veterinary and medical entomology specialists

ENTOMOLOGICAL SURVEILLANCE OF WNV PREDISPOSED BY LOW GDP PER CAPITA – SERBIA

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MAEP Surveillance system performance 2014/2015

- Surveillance system showed satisfactory results in area specificity and sensitivity.
- Highly significant clustering of infected mosquito, horse, bird and human WNND cases.
- Average seasonal VI was strongly correlated to incidence of human WNND cases.
- NUTS3 proved better than NUTS2 for analysis of WNV circulation.
- Mosquito, bird and horse surveillance can signal the start of WNV circulation.

Present time

2014/15 – 64 sampling stations, 21,506 km^2, 7 times (May– September)

Number of *Culex pipiens pipiens*/trap/night 2000 - 12000

Randomly sampled ≥ **200** females/trap

WNV detection in **50** females/pool

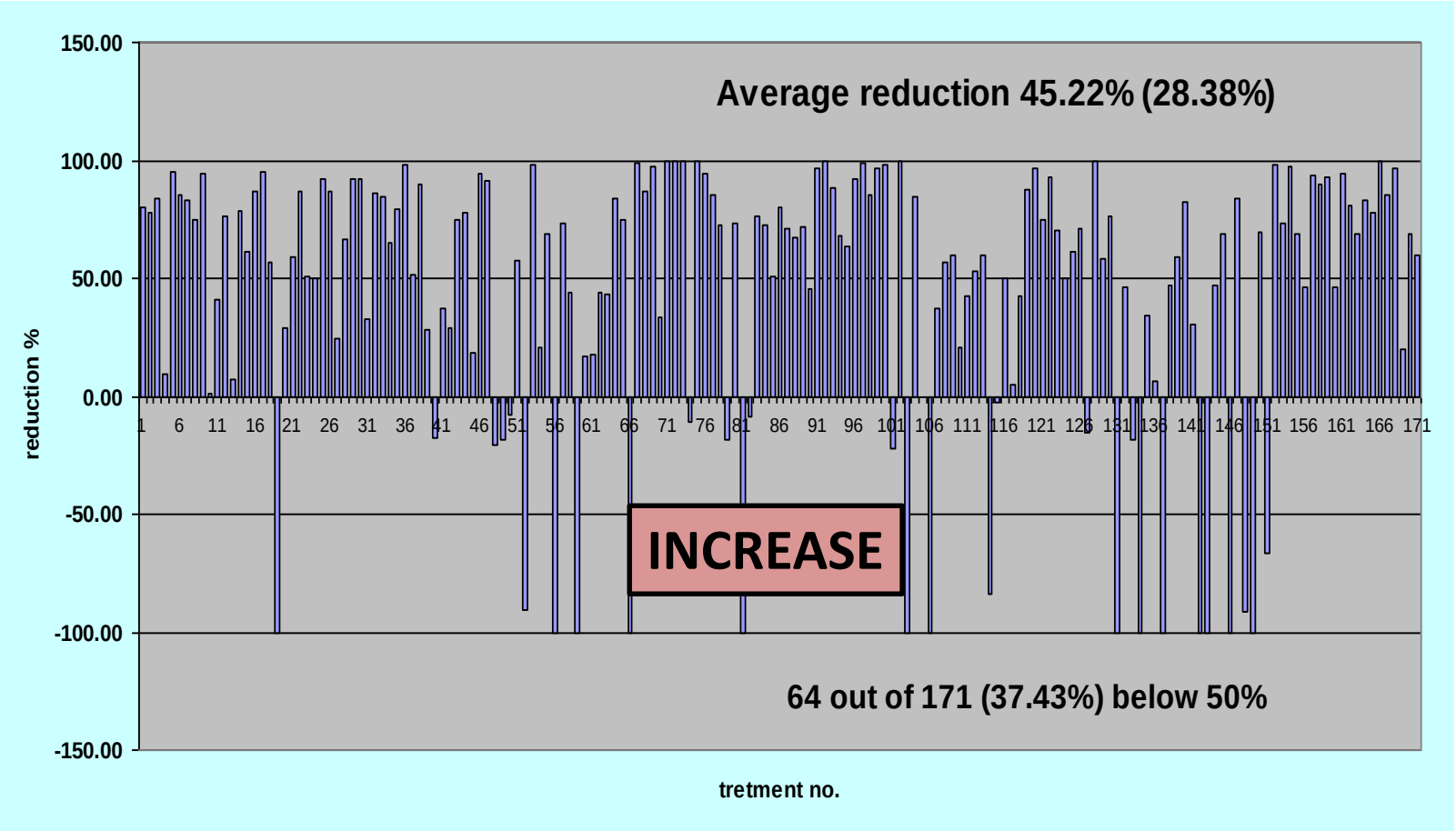
- **Sensitivity?**

Definitions of surveillance and monitoring (ECDC, 2014)

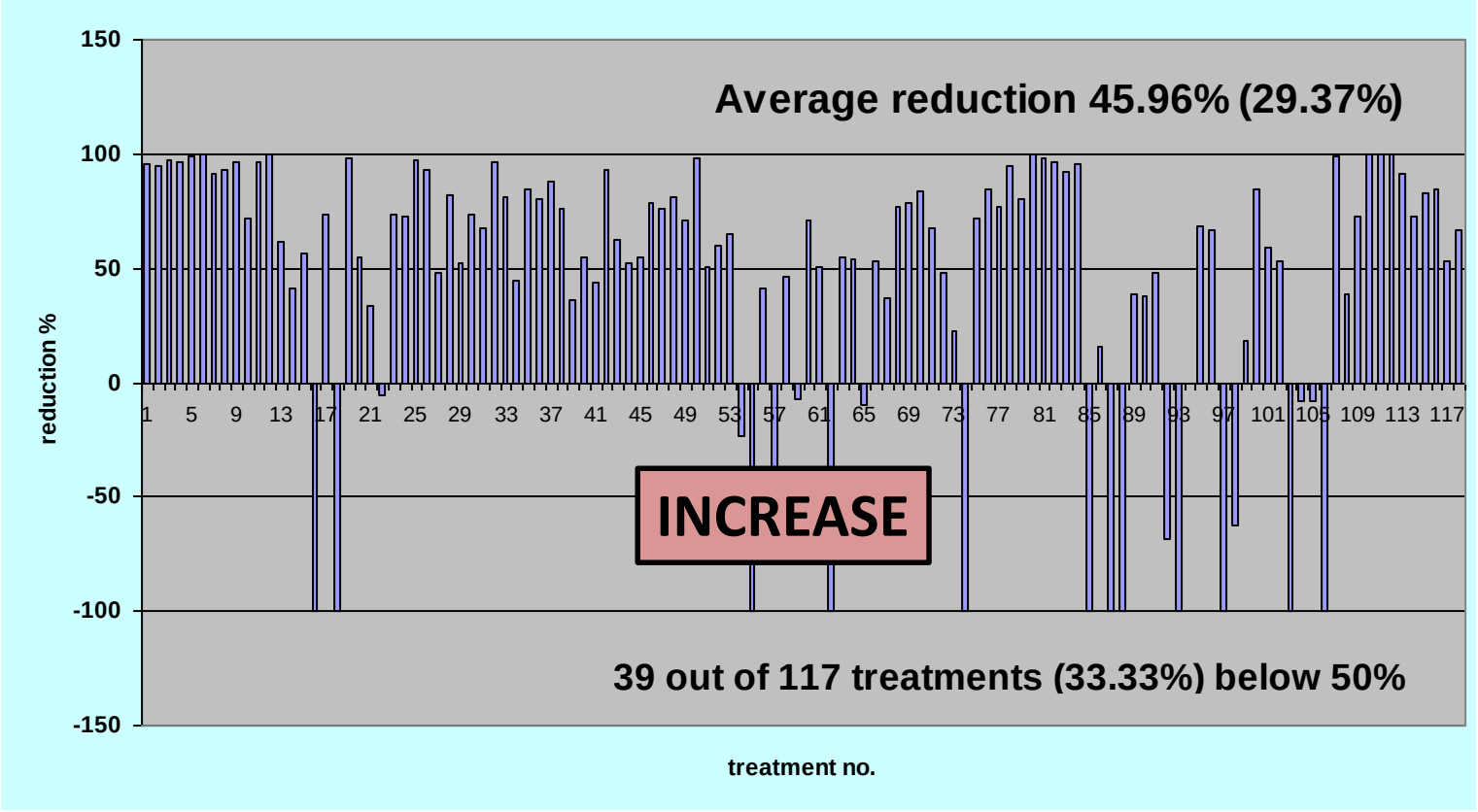
Monitoring - consists of procedures implemented for temporary or continuous observation and is not followed by any additional activities (e.g. population dynamics).

Surveillance - consists of procedures developed in response to a risk and carried out to support subsequent actions.

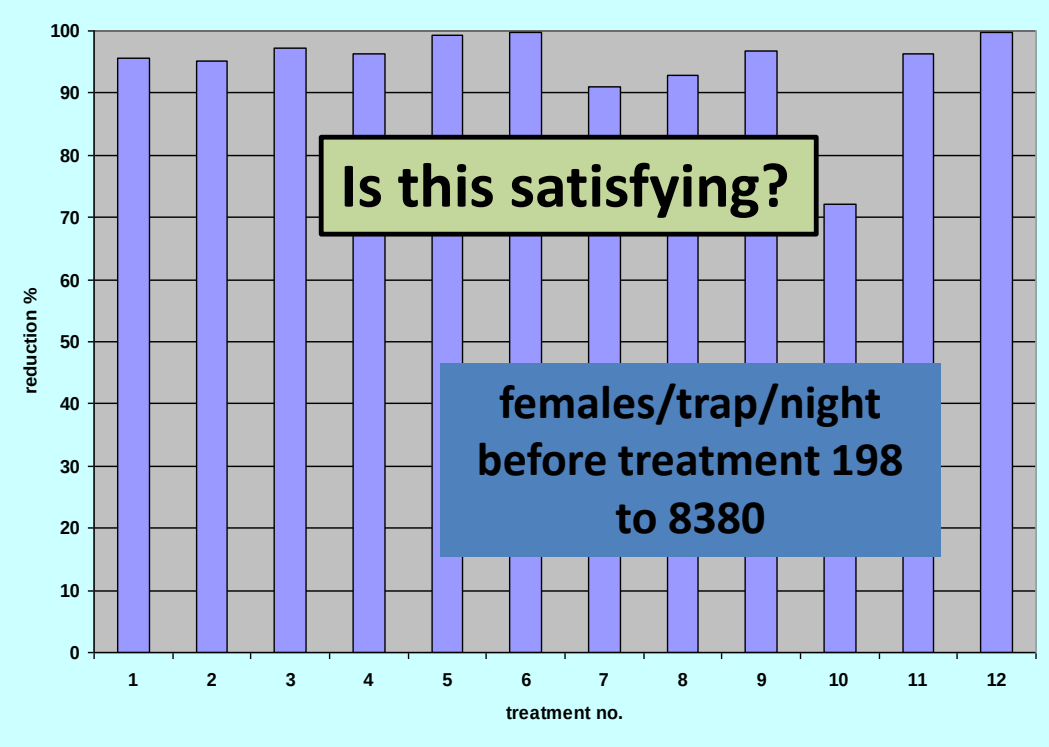
Impact of aerial ULV treatments on adult *Culex pipiens pipiens*



Impact of **routine** ground ULV treatments on adult *Culex pipiens pipiens*

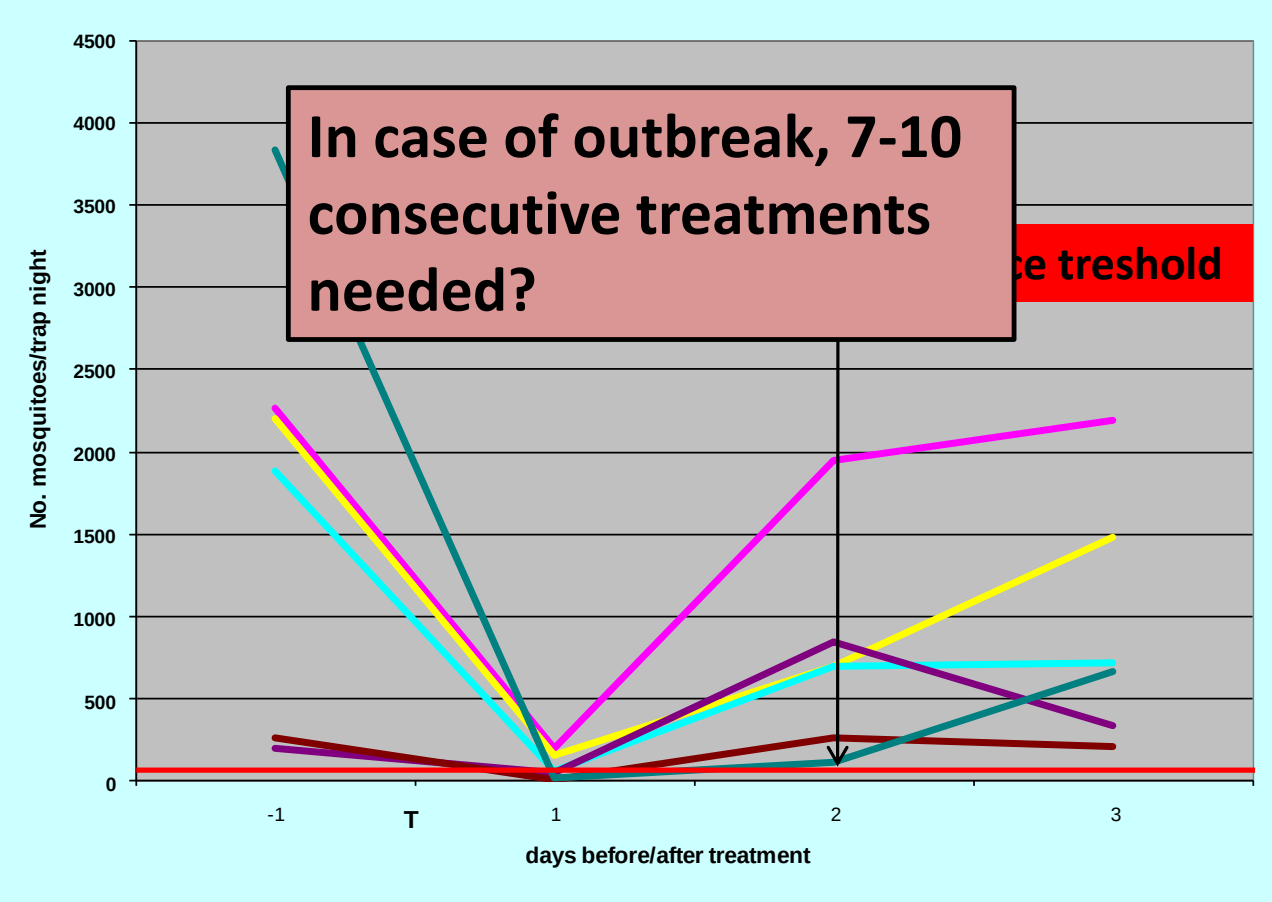


Impact of **precise** ground ULV treatments on adult *Culex pipiens pipiens*

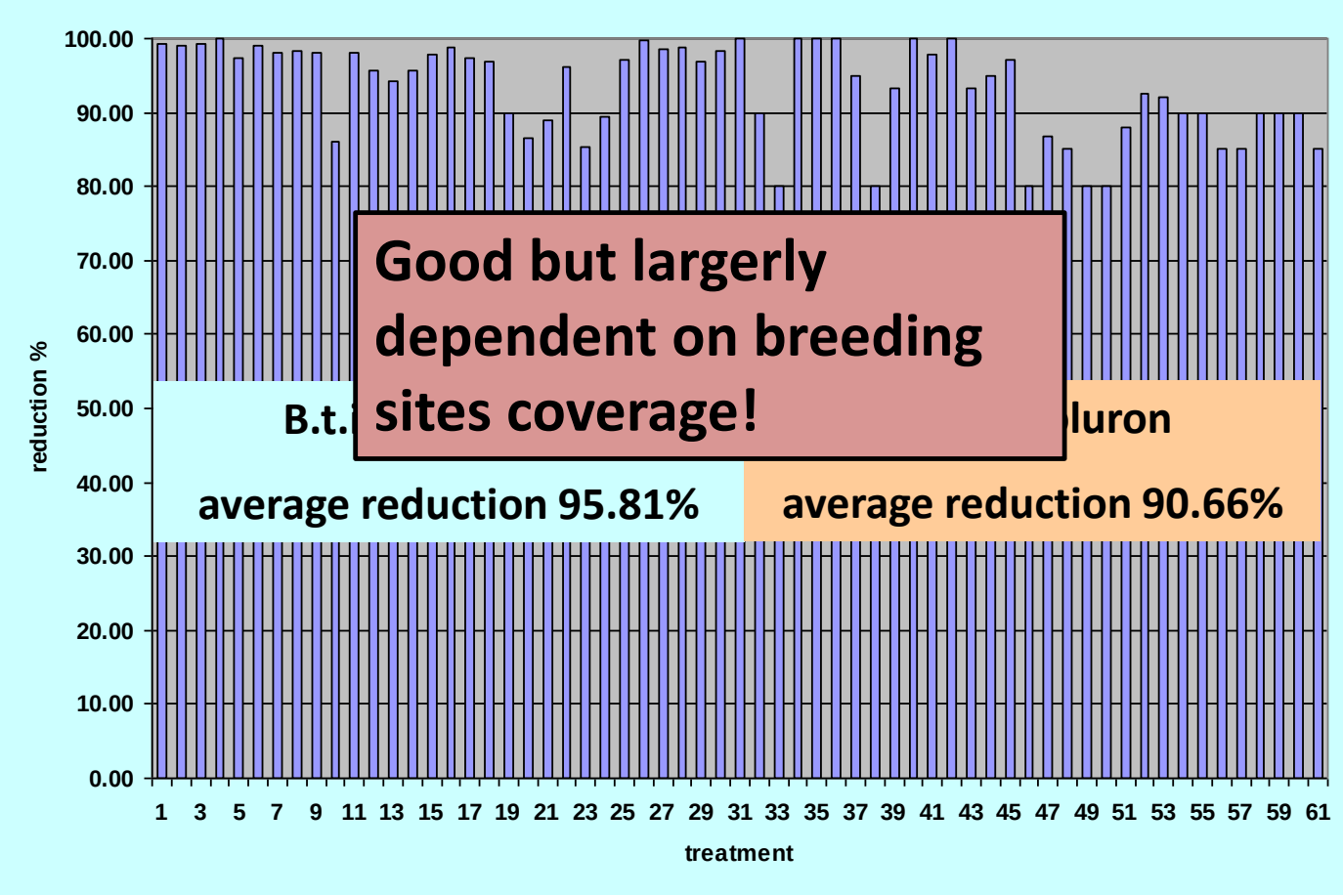


No, it is not!

Average number of *Culex pipiens pipiens* females before and after precise ground ULV application

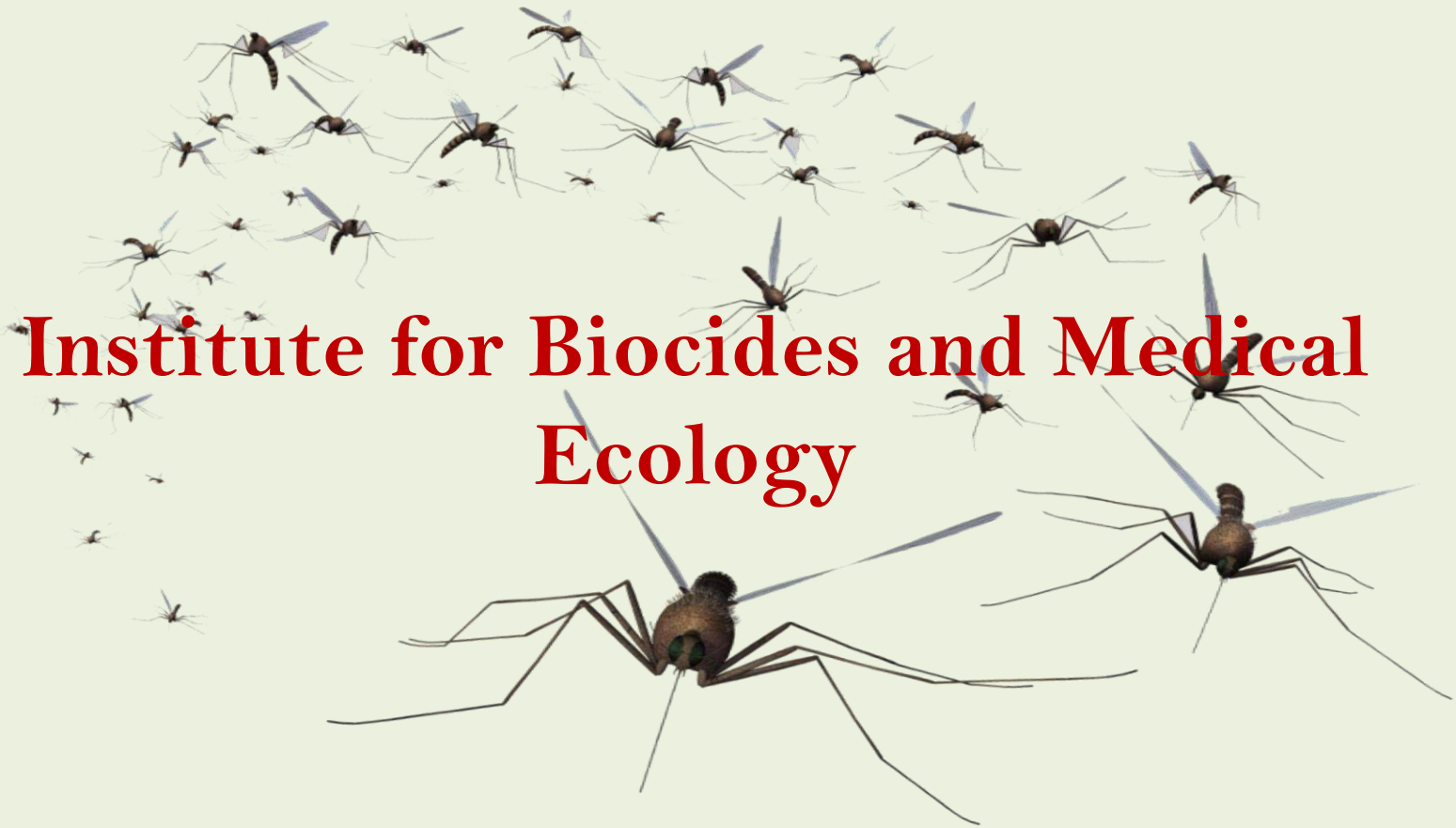


Reduction of *Culex pipiens pipiens* larvae after applications of B.t.i. ice granules and IGR novoluron



Thank you

Zavod za biocide i medicinsku ekologiju



Institute for Biocides and Medical Ecology

Zavod za biocide i medicinsku ekologiju

Founded 1891 years

Activities:

- Detection of West Nile virus in mosquitoes population
- Detection of Borrelia burgdorferi, agent of tick-borne viral encephalitis and human granulocytic anaplasmosis in the tick population
- Detection of Borrelia burgdorferi in the tick taken from human patients
- Program implementation measures of pest control in the public health care institutions
- Surviellance of pest organisams in Belgrade
  - Contol of rodent population in Belgrade
  - Contol of tick population in Belgrade
  - Contol of larvae and adult mosquitoes population in Belgrade
- Desinfection and other preventive measures during emergency situations

Zavod za biocide i medicinsku ekologiju

Entomological laboratory

- Rearing of field strain of *Culex pipiens* mosquitoes

Zavod za biocide i medicinsku ekologiju

Entomological laboratory

- Rearing of laboratory strain of *Blata orientalis, Blatella germanica* and *Blatella americana* cockroaches

Zavod za biocide i medicinsku ekologiju

Entomological laboratory

- Biological activity testing of biocides

Zavod za biocide i medicinsku ekologiju

Entomological laboratory

- Field colection of larval and adult forms of mosquitoes, ticks and flies and their determination in laboratory

Zavod za biocide i medicinsku ekologiju

- High Performance Liquid Chromatography (**HPLC**) and Gas Chromatography for biocides chemical testings

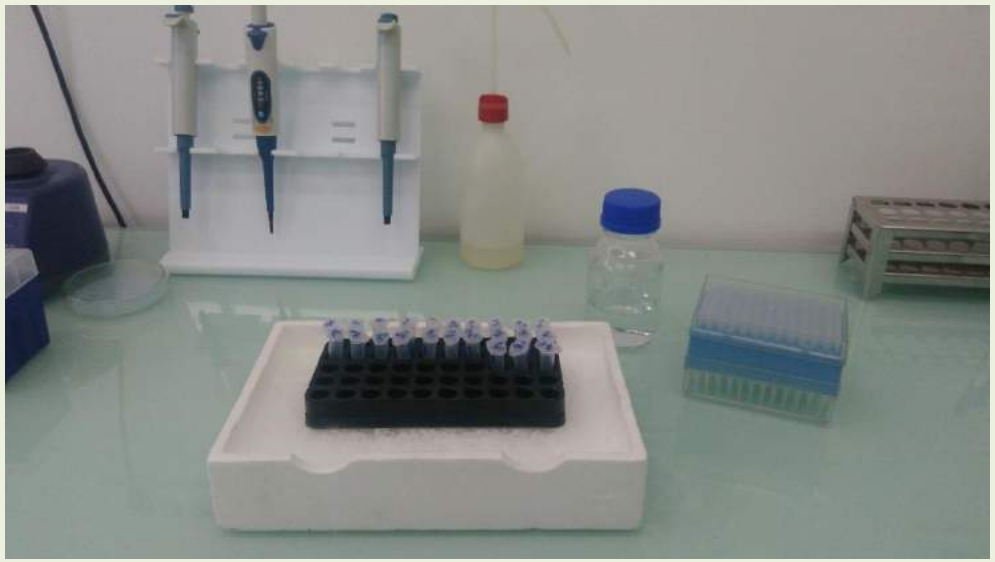
Zavod za biocide i medicinsku ekologiju

Microbiological laboratory

- RT- PCR detection of *WNV, Chikungunya virus, Zika virus* and *Malaria* from field colected mosquitoes
- RT- PCR detection of *Borrelia burgdorferi*, tick-borne viral encephalitis and *human granulocytic anaplasmosis* agents from field colected ticks

Zavod za biocide i medicinsku ekologiju

- Darkfield microscopy detection of *Borrelia burgdorferi*
- Storing samples in deep freeze (-80˚C)

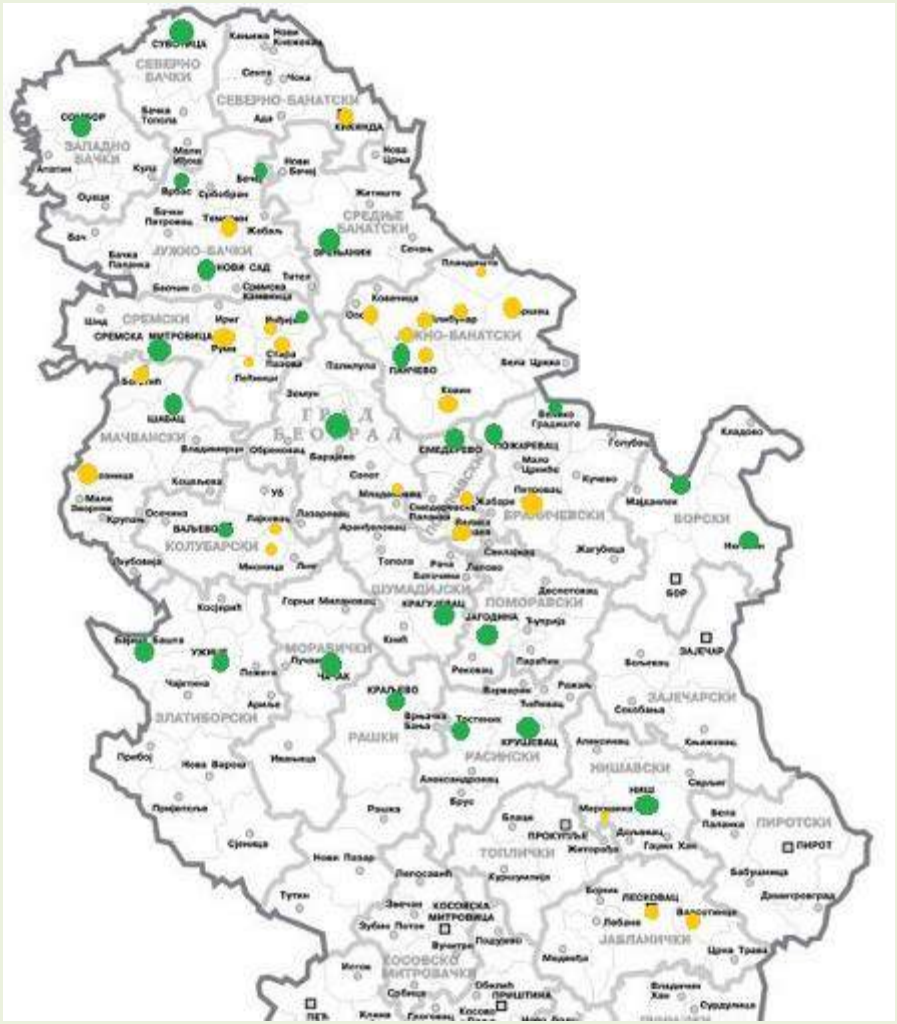


Zavod za biocide i medicinsku ekologiju

Outbreak of WNV fever in Serbia during 2012

Zavod za biocide i medicinsku ekologiju

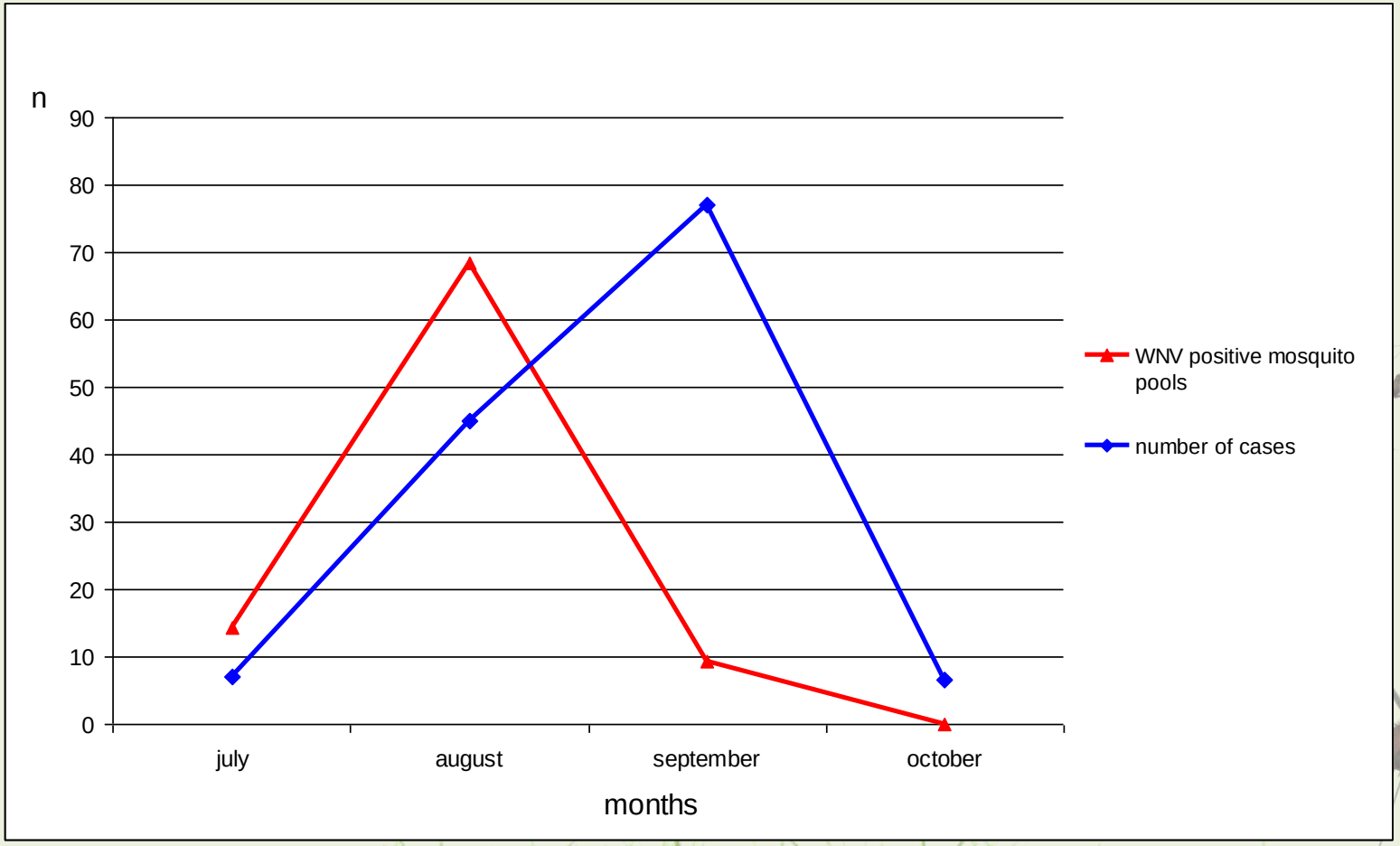
Cities chosen for surveillance 2013-2015



- Cities monitored every year (26)
- Cities with human cases of WNV (24)

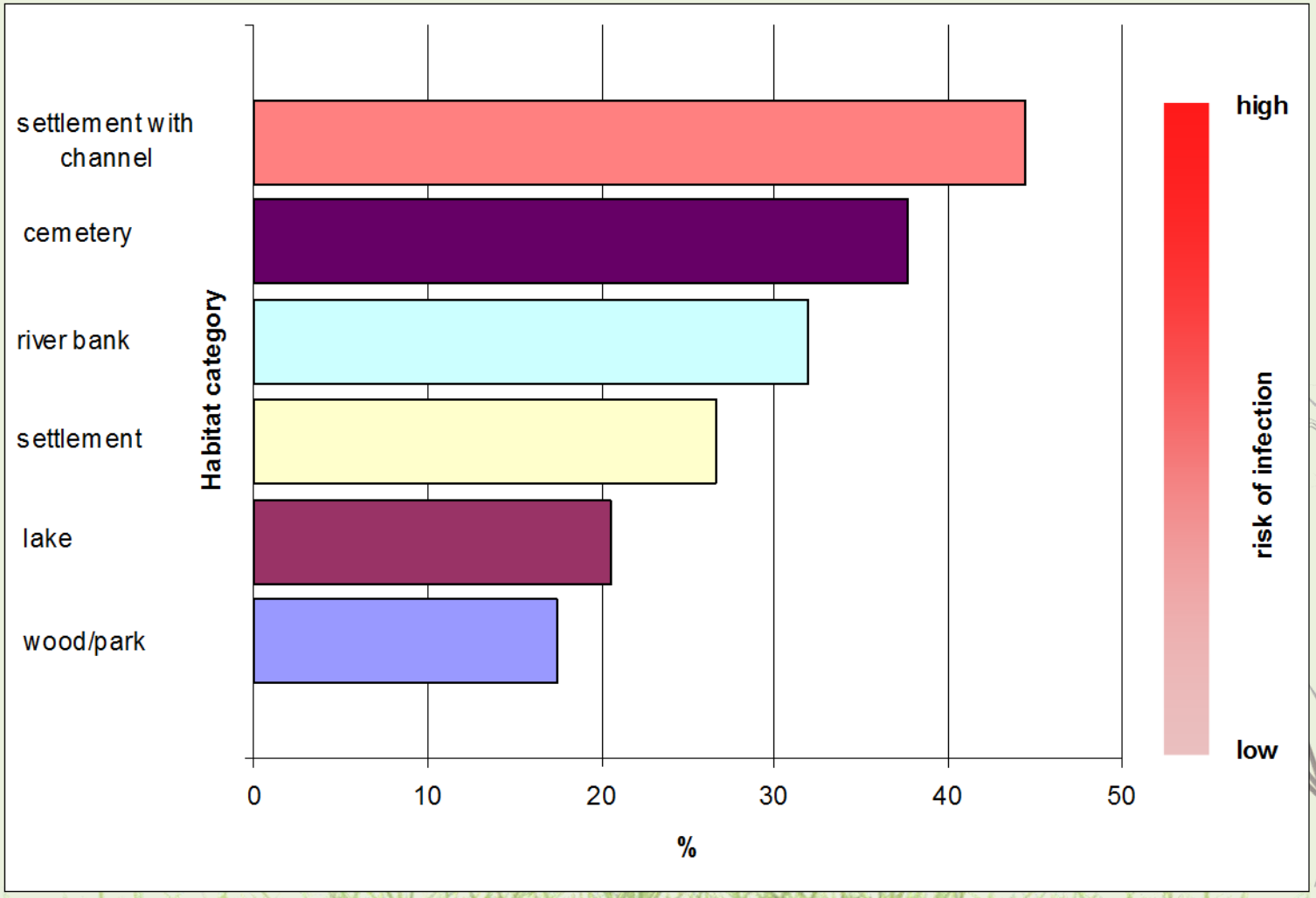
Zavod za biocide i medicinsku ekologiju

Seasonal dynamic of WNV infected mosquitoes and humans (data pooled over three years)



Zavod za biocide i medicinsku ekologiju

WNV positive habitats by categories and level of WNV infection risk



Zavod za biocide i medicinsku ekologiju

Review of WNV analisis in Serbia

years	2013.	2014.	2015.
number of towns	46	40	14
number of set traps	1.466	1.512	1.664
number of analisis	1.335	1.250	1.290
number of WNV positive analisis	124	52	100

Zavod za biocide i medicinsku ekologiju

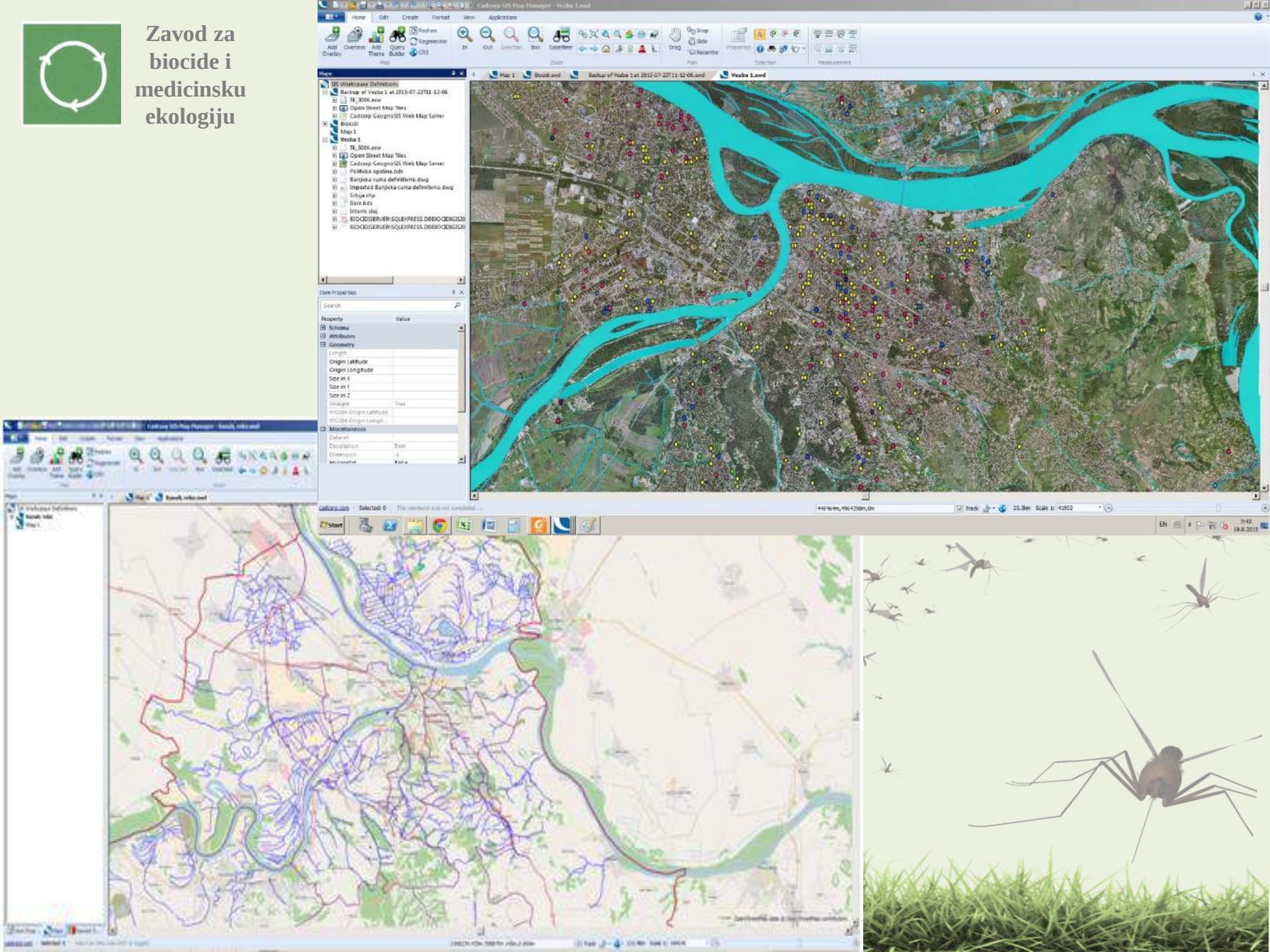
Geographic information system (GIS)

- Control of mosquito populations is one of the most important measures to prevent the spread and control of vector-borne infectious diseases in humans and animals.

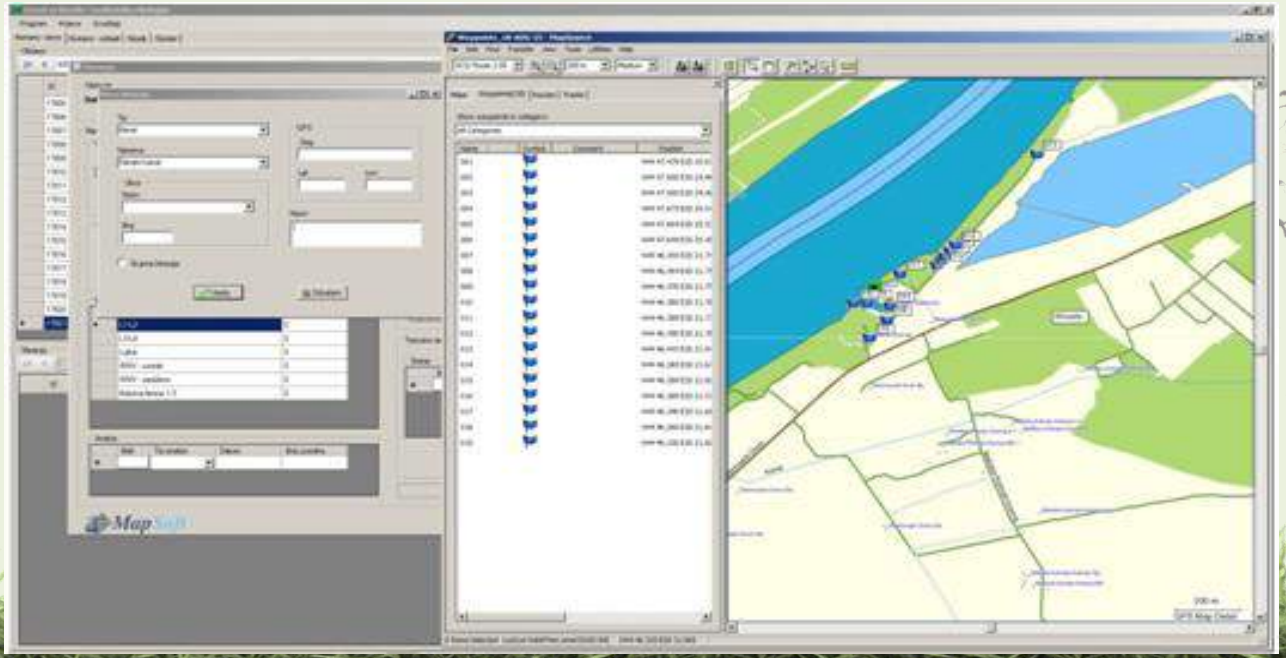
- Institute for Biocides and Medical Ecology 2015 implemented a system of GIS in order the collected data from the field be better process and visually display.

- GIS platform that is used for mosquitoes control is CadCorp SIS, version 8.0.

Zavod za biocide i medicinsku ekologiju

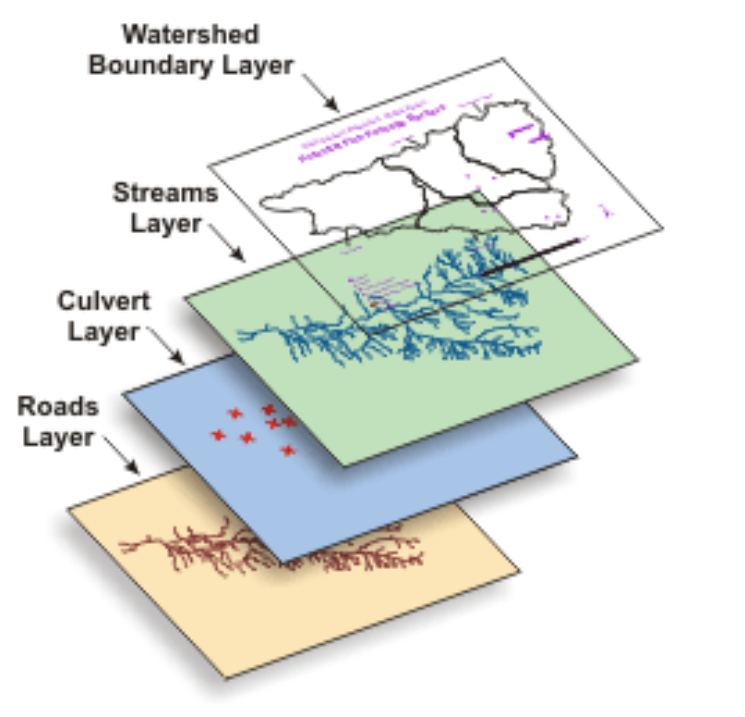


- Locations where larvae and adult forms of mosquitoes were found classified into the database.



Zavod za biocide i medicinsku ekologiju

- Data from the field and laboratory tests are being digitized and integrated into a single database - Microsoft SQL Server 2012.

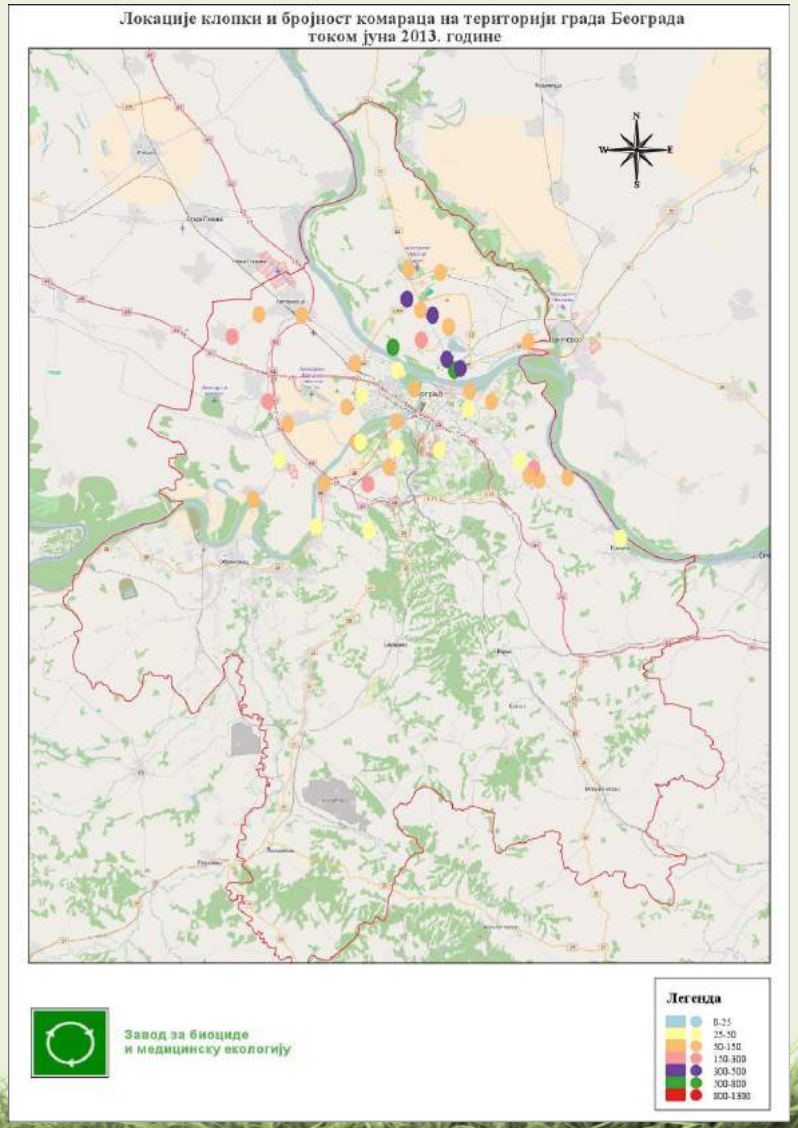


- Data is processing in GIS.
- Created maps contsist of different layers that contain information about the number, location and distribution of mosquitoes, as well as the locations where the West Nile virus was detected.

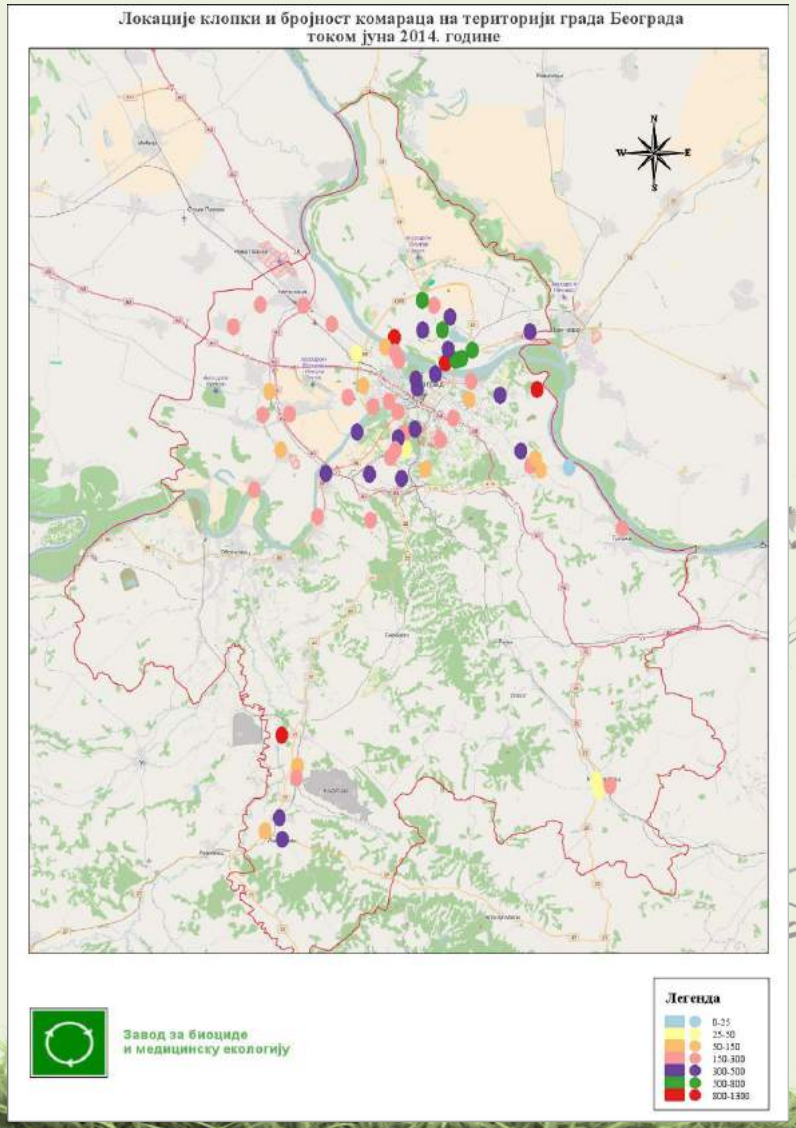
Zavod za biocide i medicinsku ekologiju

Locations of traps and number of mosquitoes in Belgrade

June 2013. years



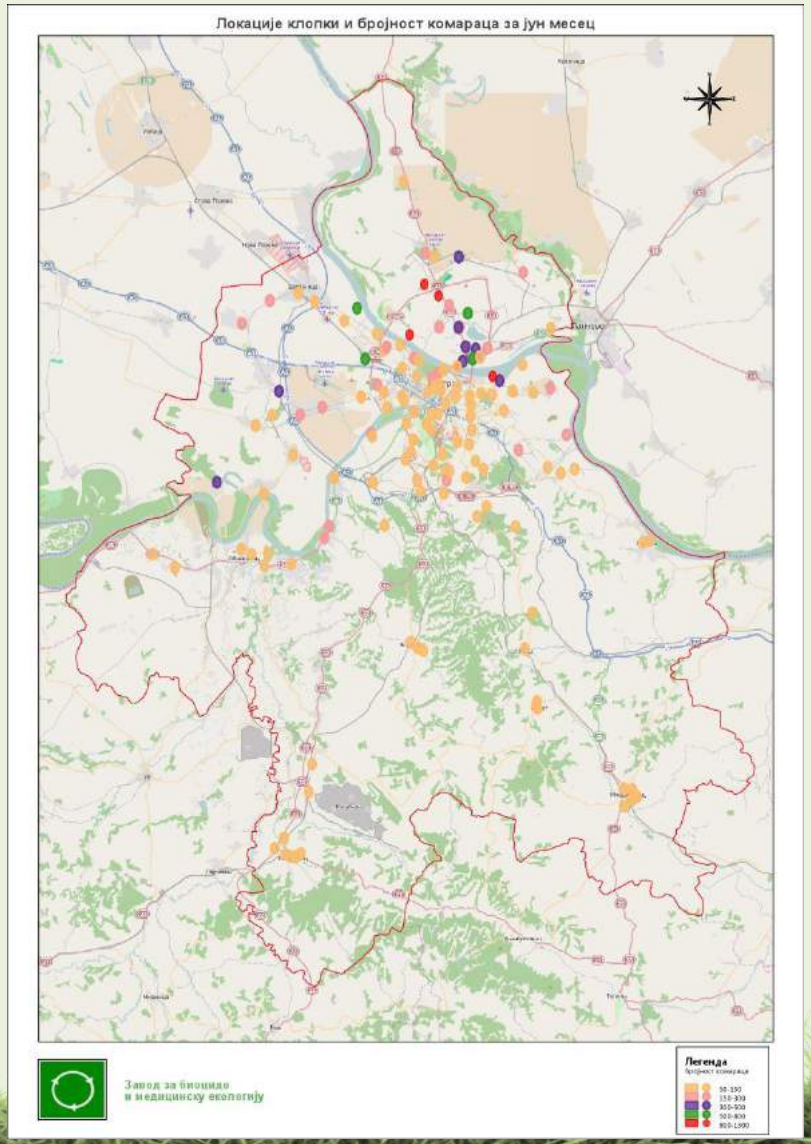
June 2014. years



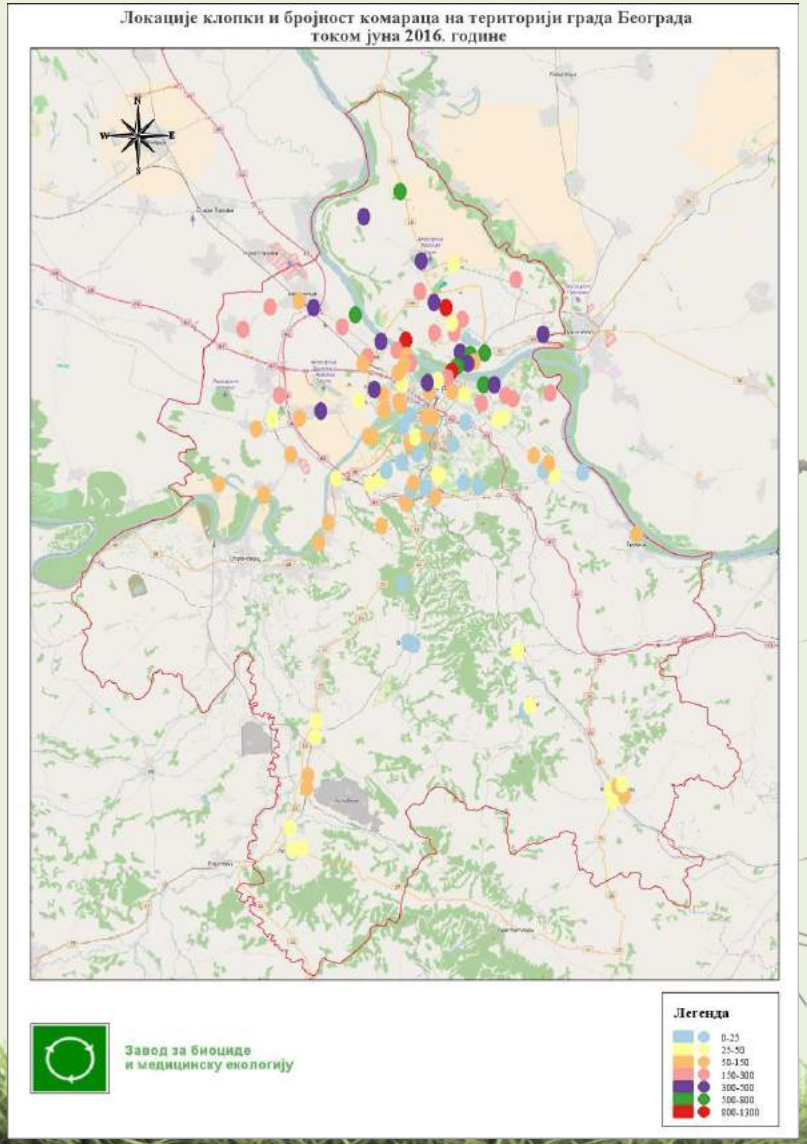
Zavod za biocide i medicinsku ekologiju

Locations of traps and number of mosquitoes in Belgrade

June 2015. years

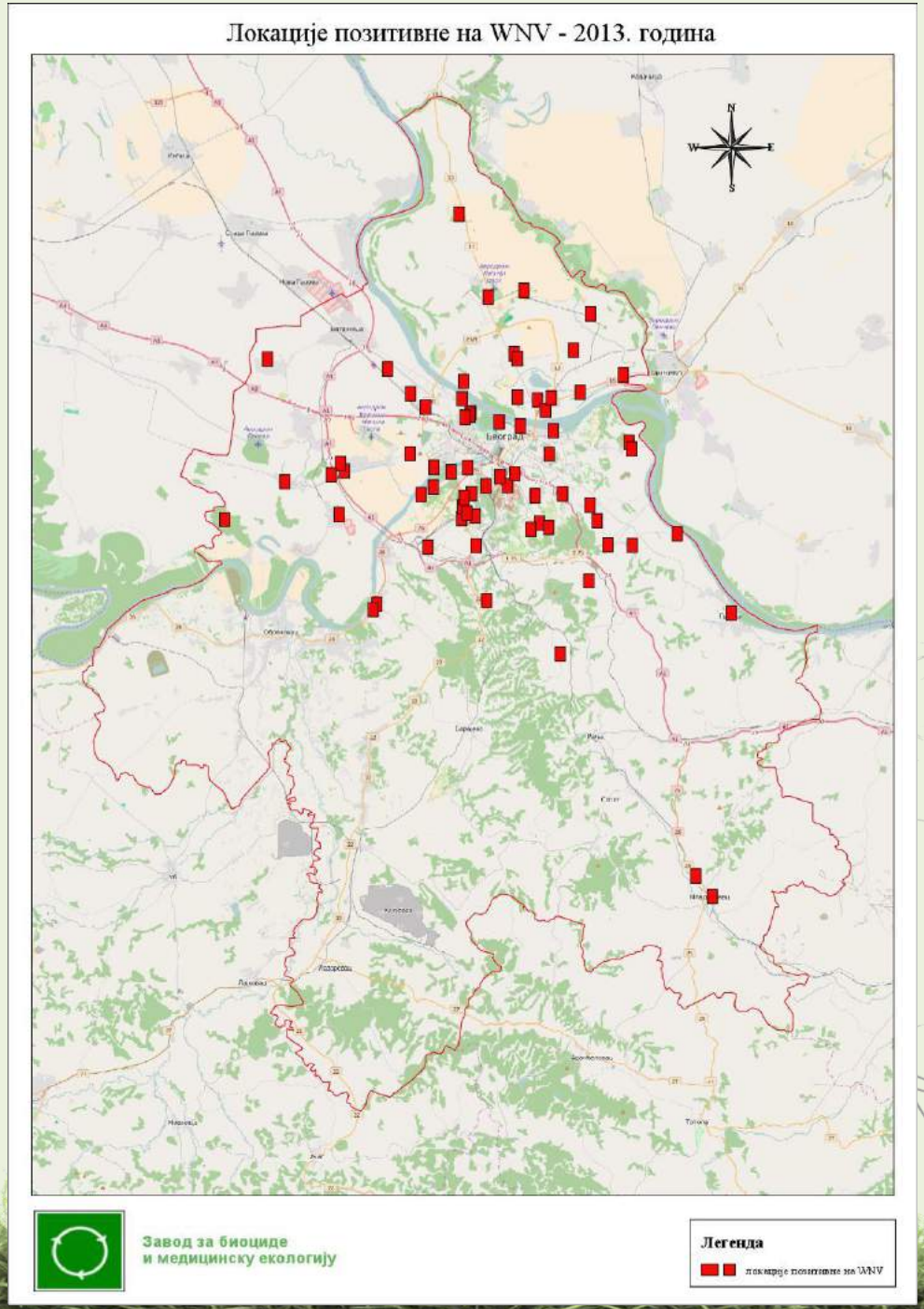


June 2016. years



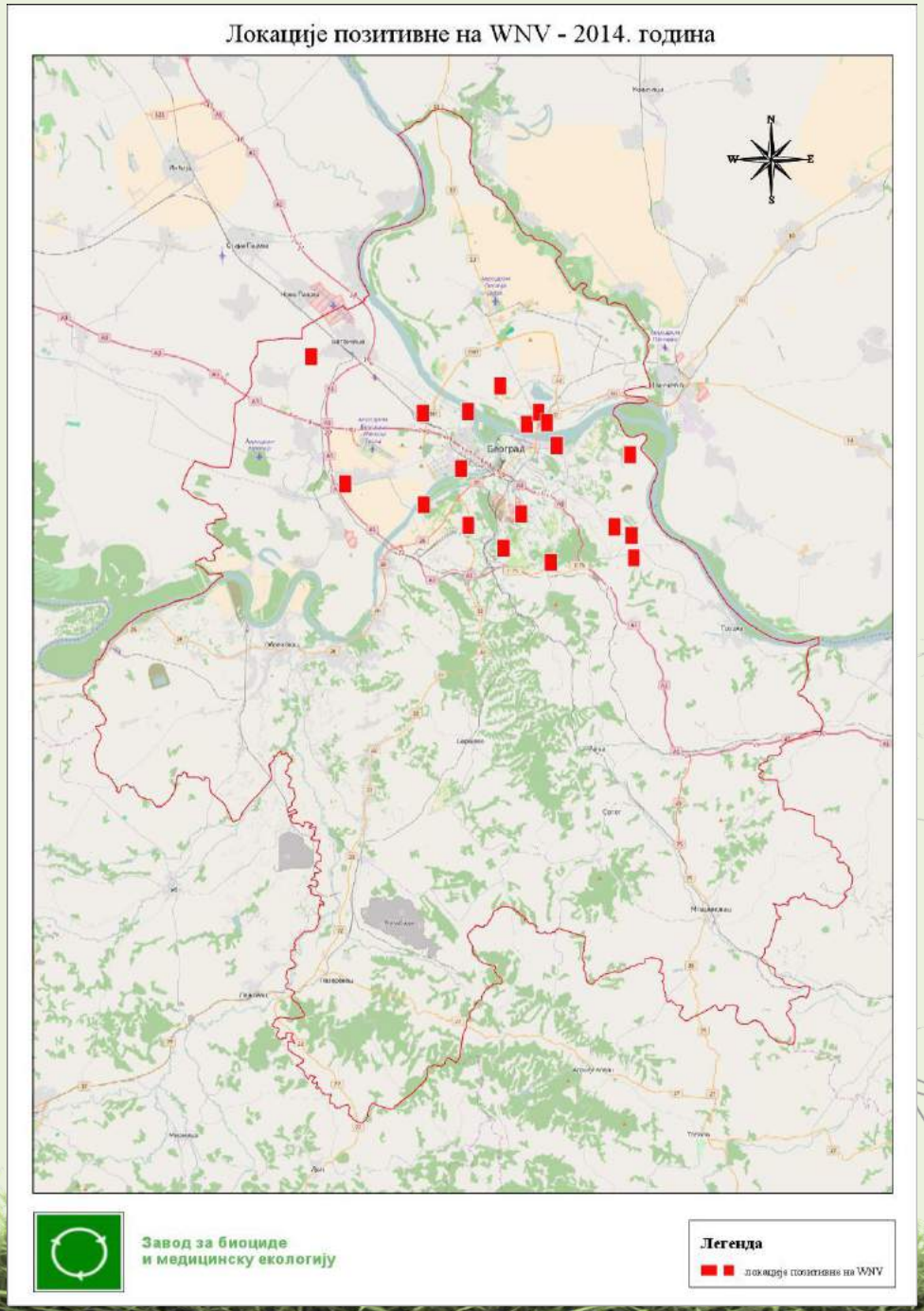
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Belgrade – **2013.**



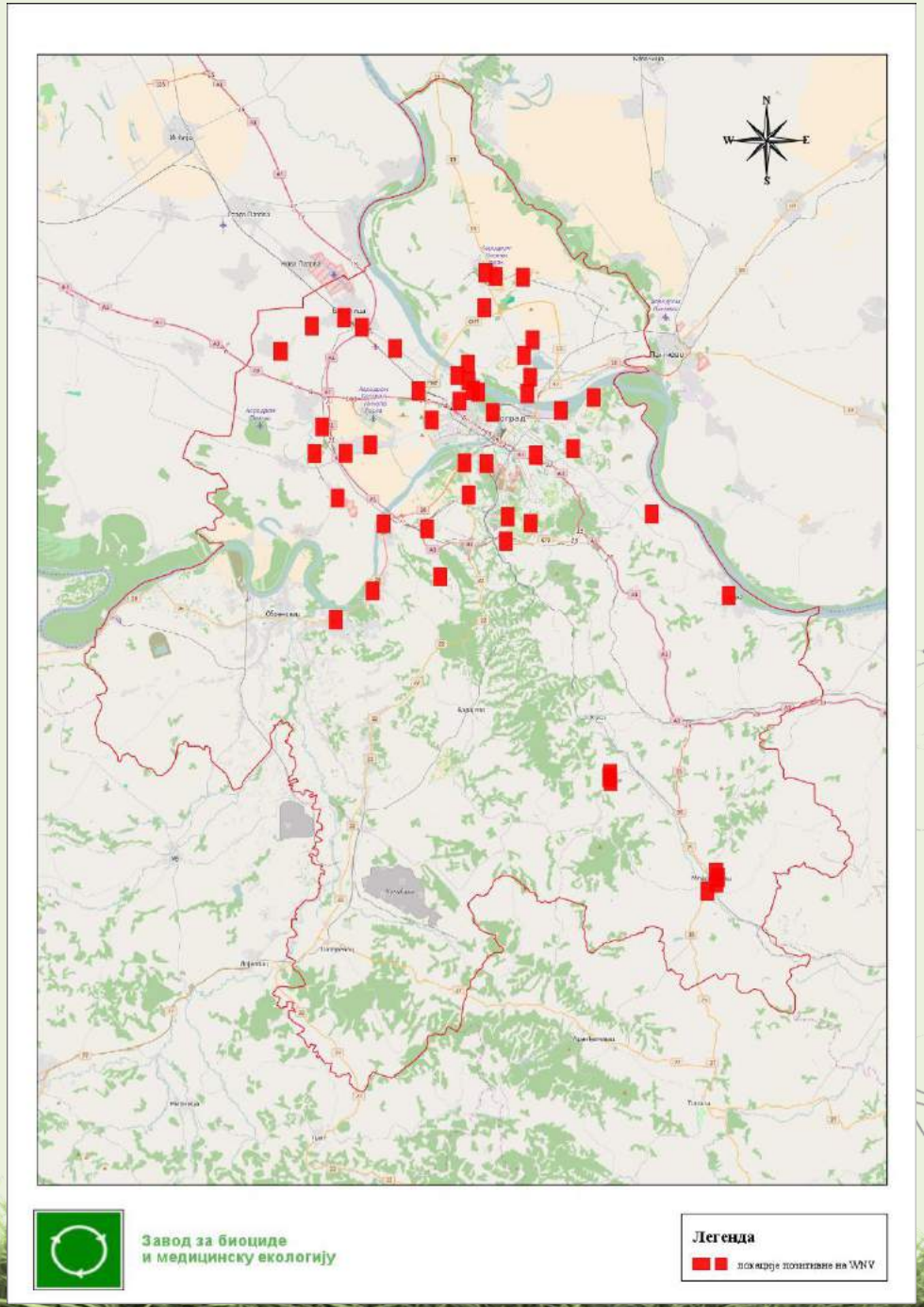
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Belgrade – **2014.**



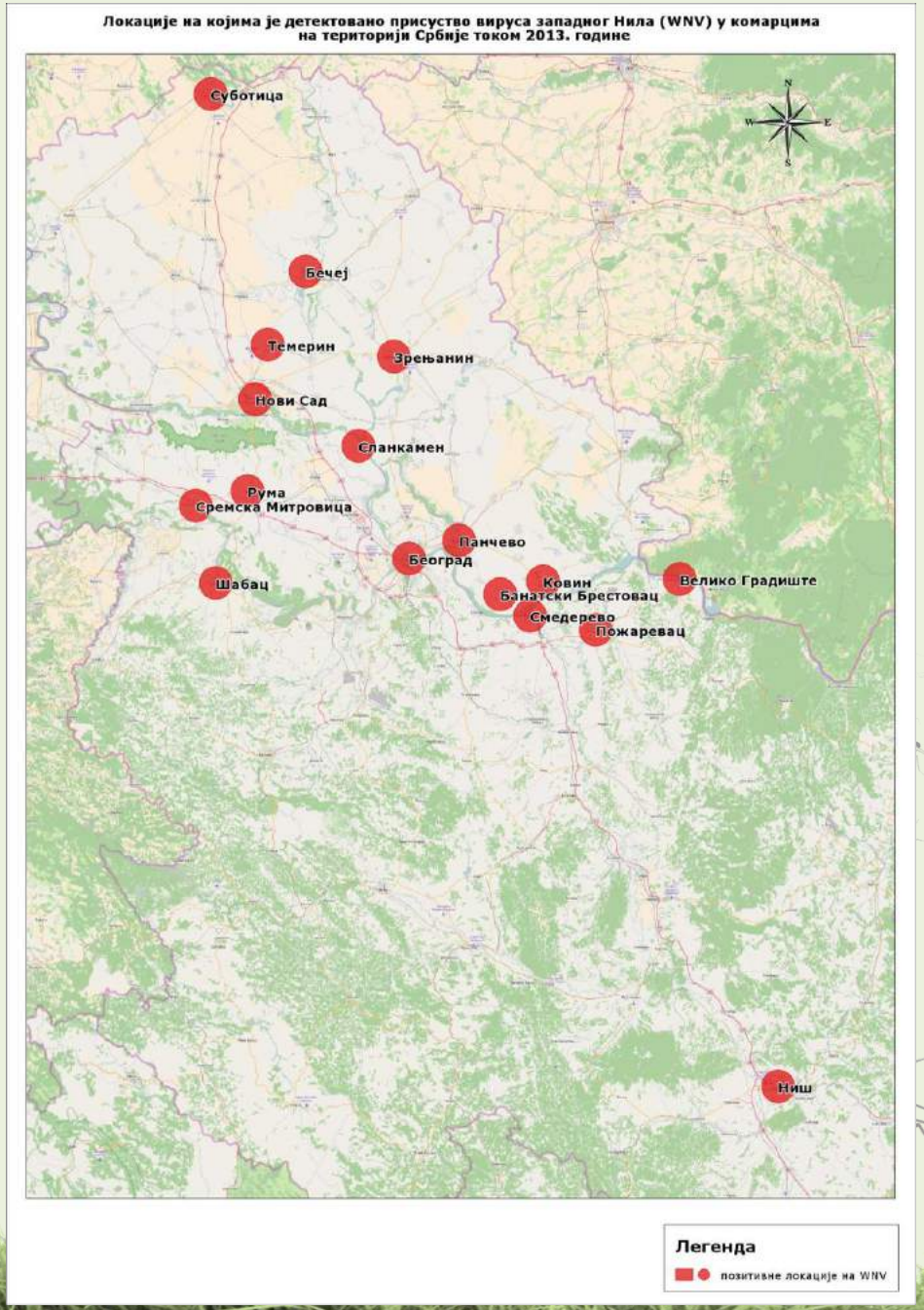
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Belgrade – **2015.**



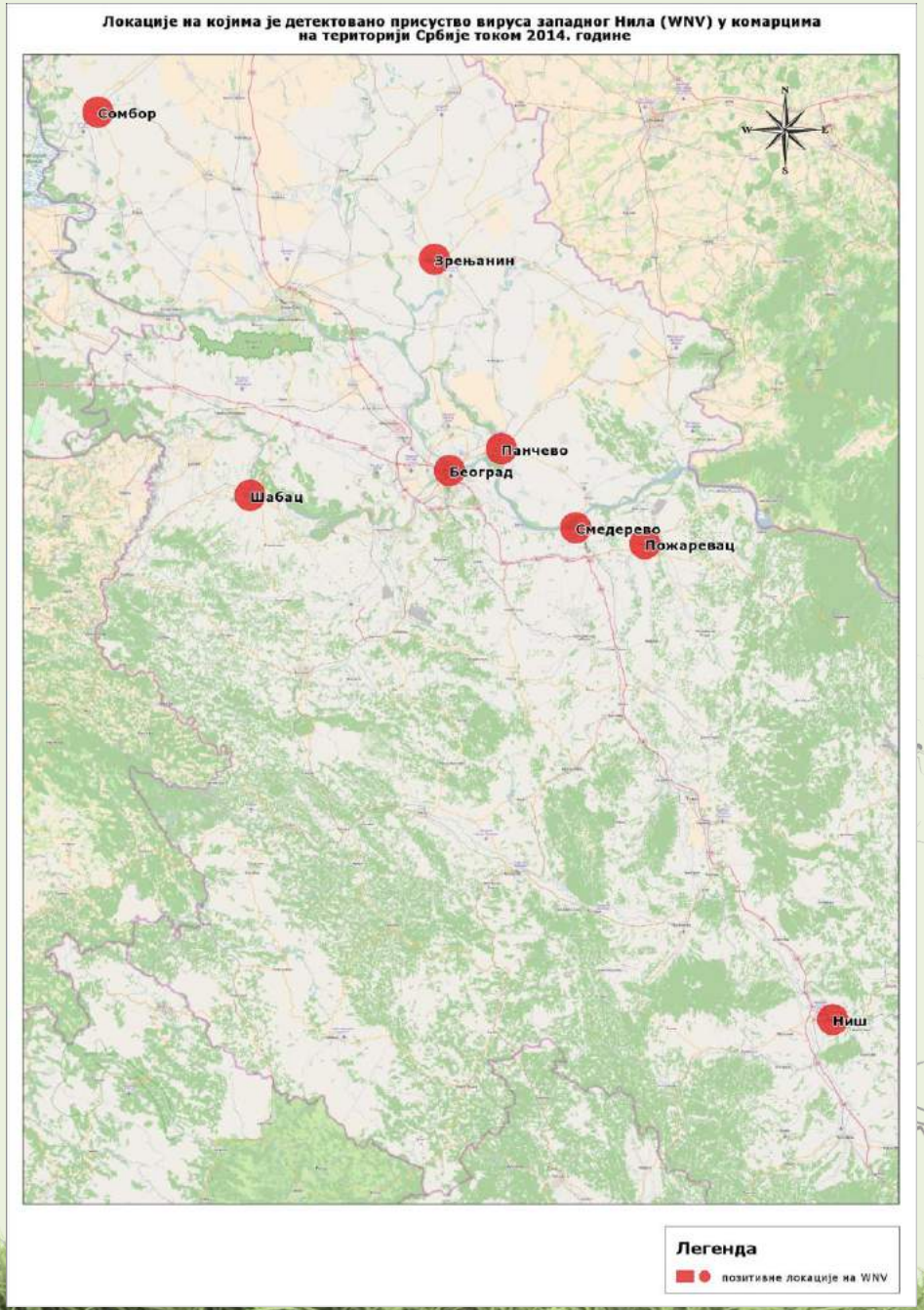
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Serbia – **2013.**



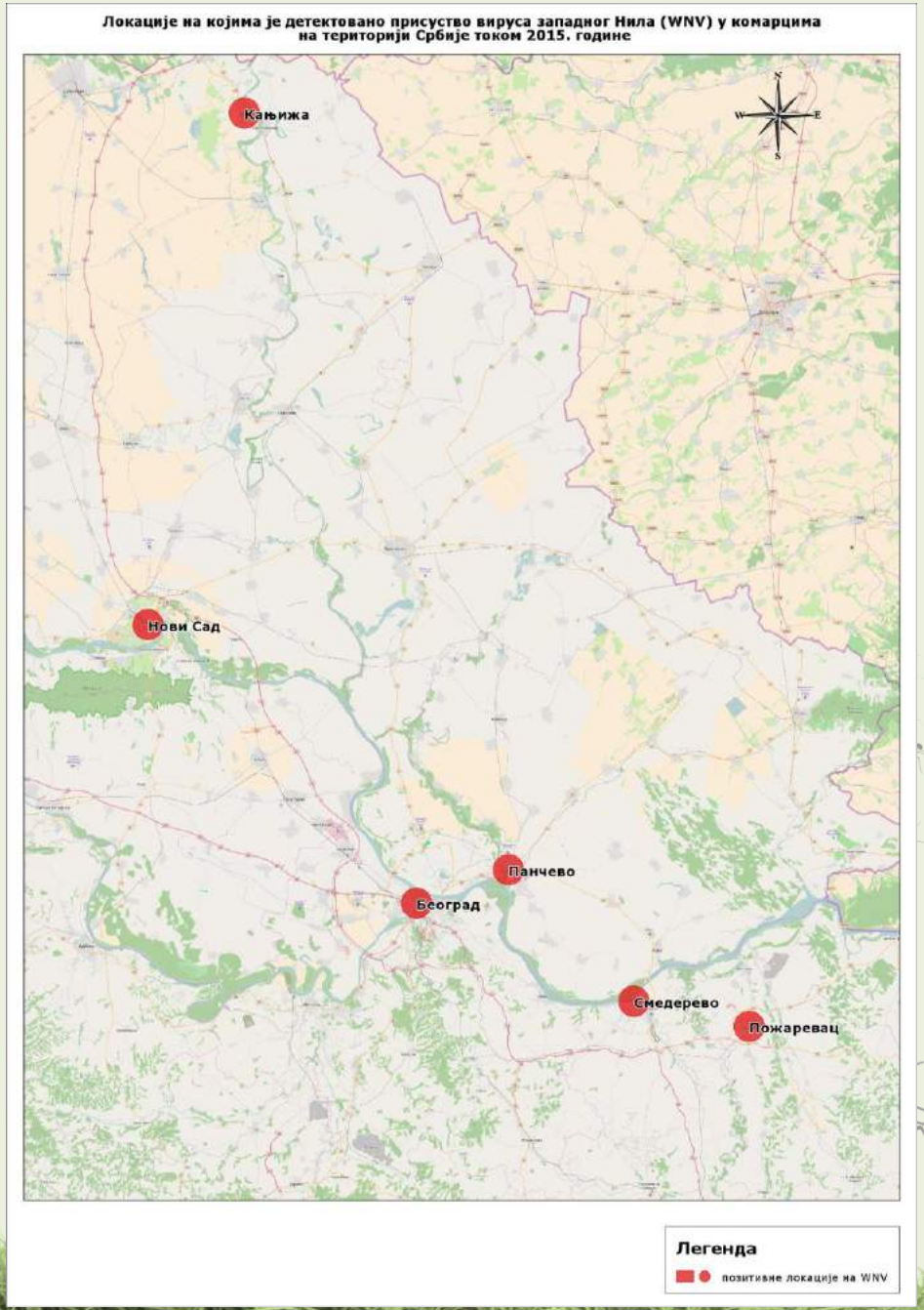
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Serbia – **2014.**



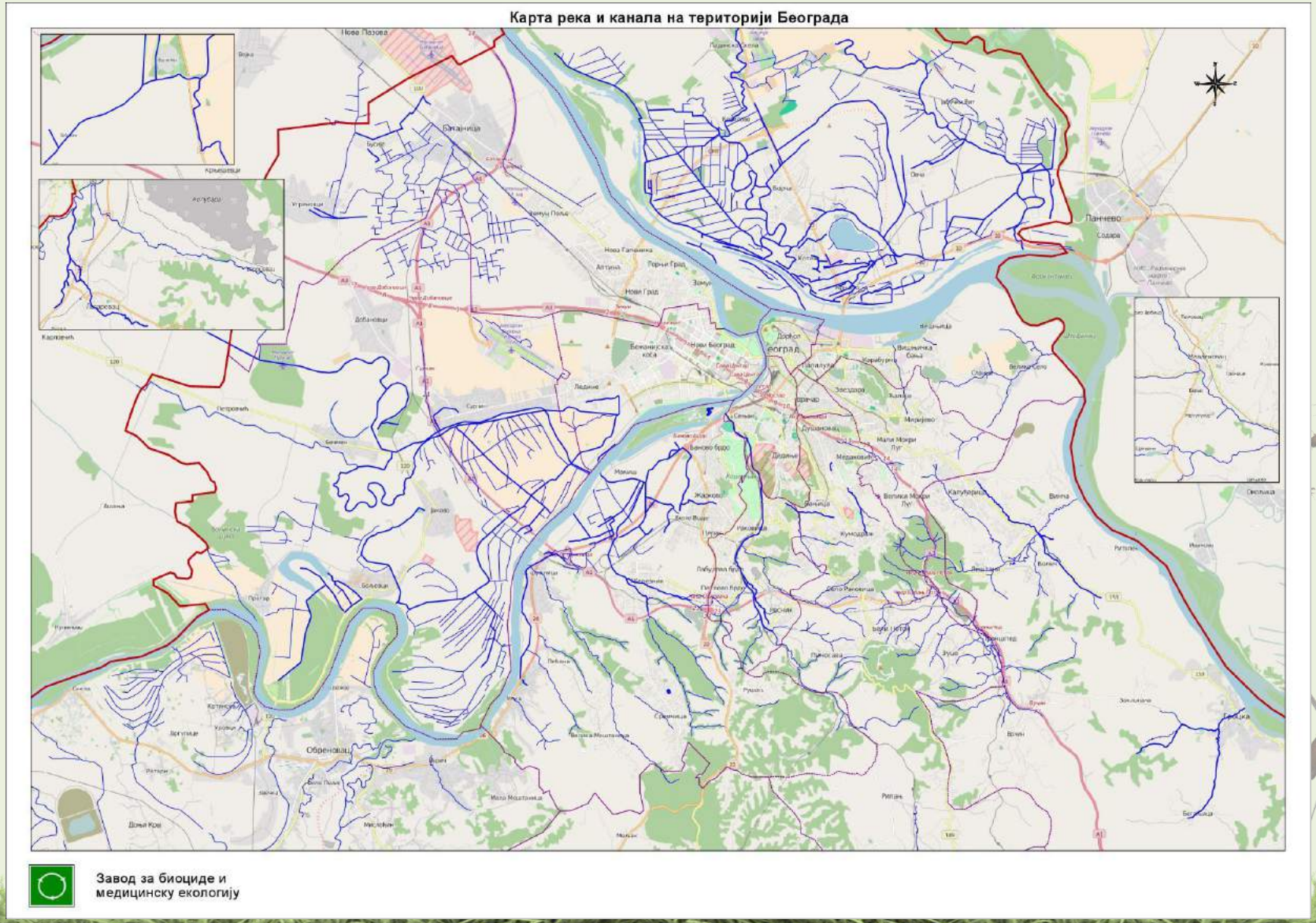
Zavod za biocide i medicinsku ekologiju

Distribution of West Nile virus in Serbia – **2015.**



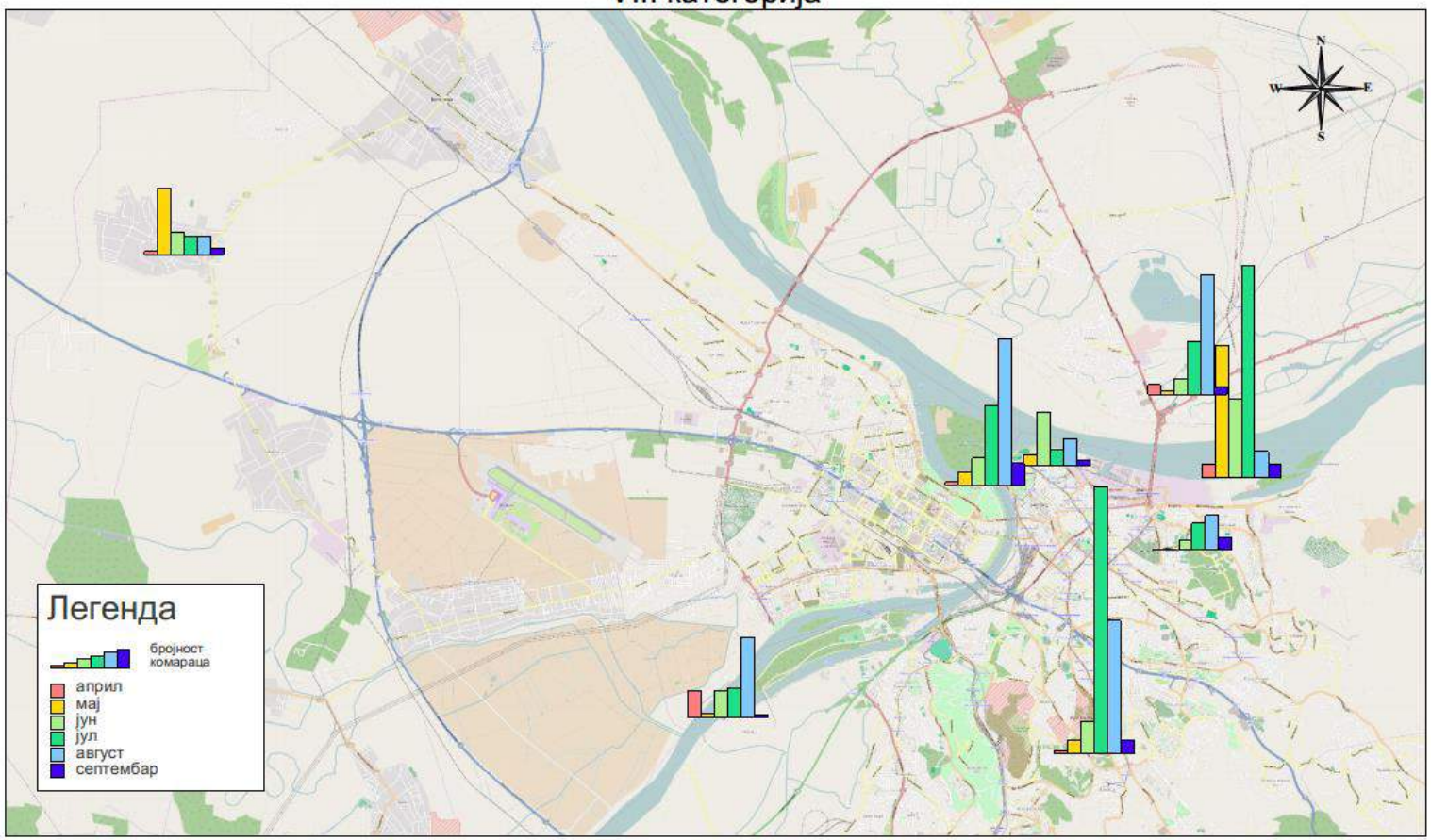
Zavod za biocide i medicinsku ekologiju

Water surface as a potential mosquito larval habitats in the Belgrade



Zavod za biocide i medicinsku ekologiju

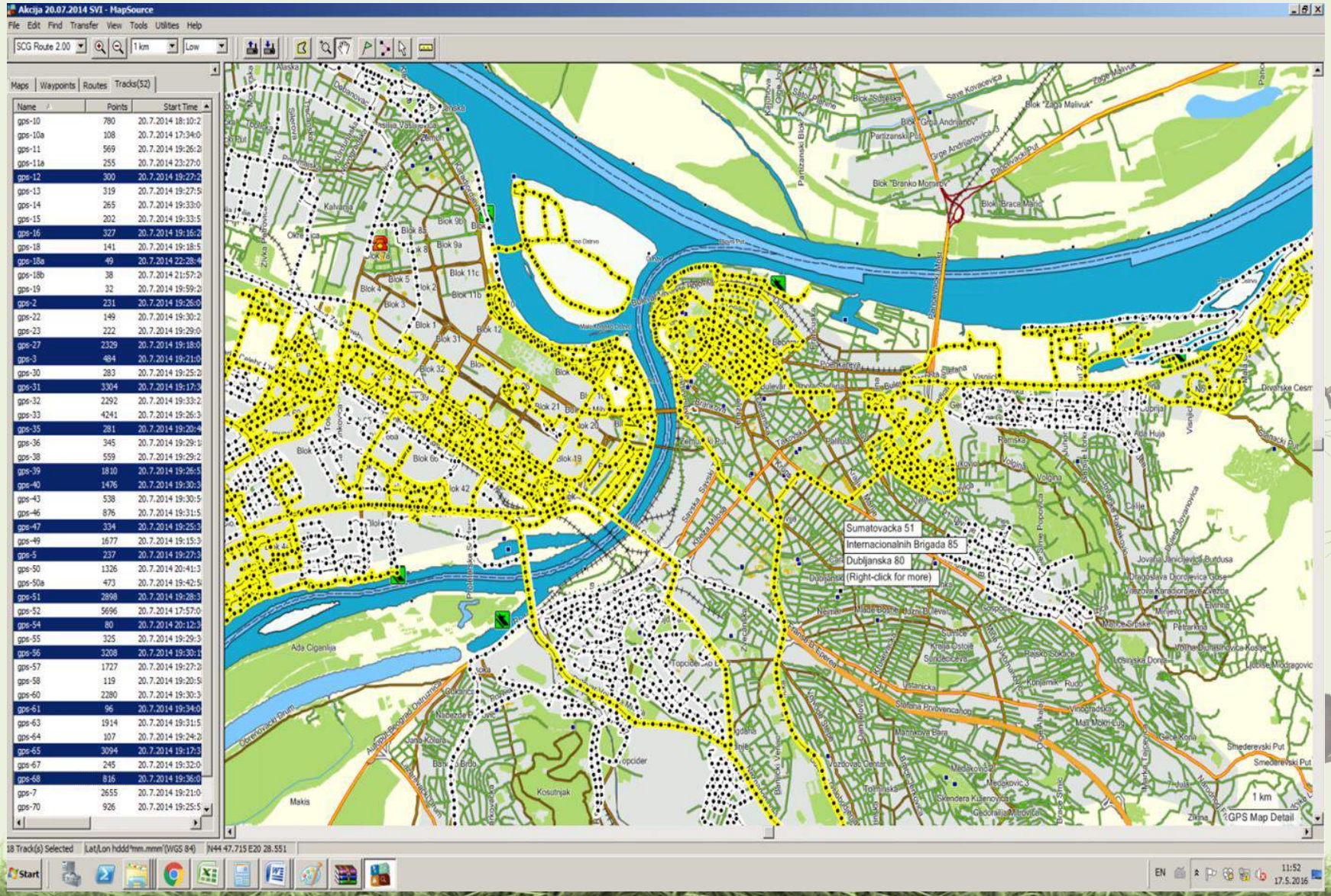
8 categories for treatment - Based on the population, the configuration of the terrain, the presence of water sources and the presence of mosquitoes in these parts



Завод за биоциде и медицинску екологију

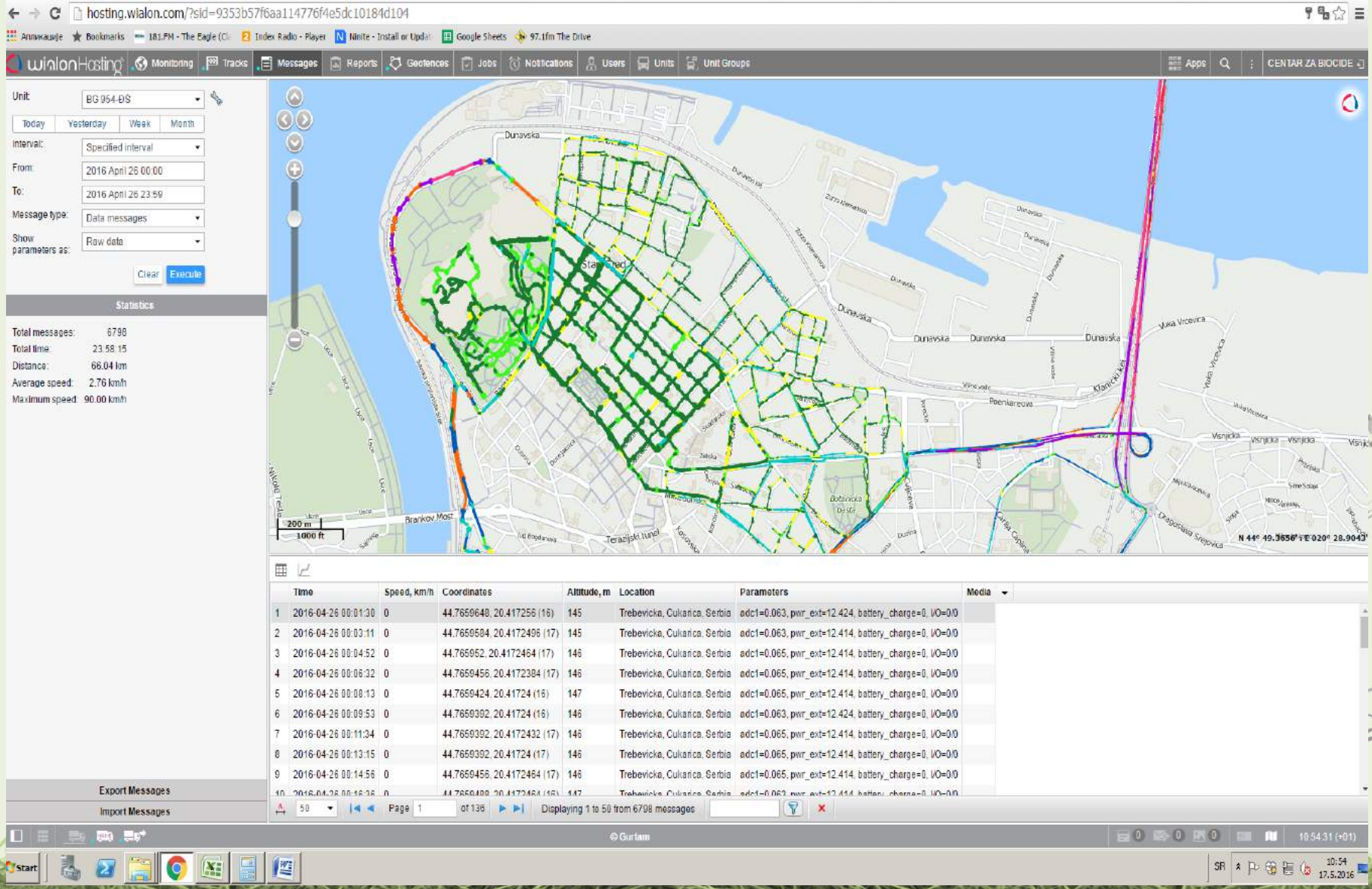
Zavod za biocide i medicinsku ekologiju

GPS tracks after treatment



Zavod za biocide i medicinsku ekologiju

Wialon Hosting program - for control during the tretment



Zavod za biocide i medicinsku ekologiju

Mosquitoes larvae control on field

- Treatment from ground

Zavod za biocide i medicinsku ekologiju

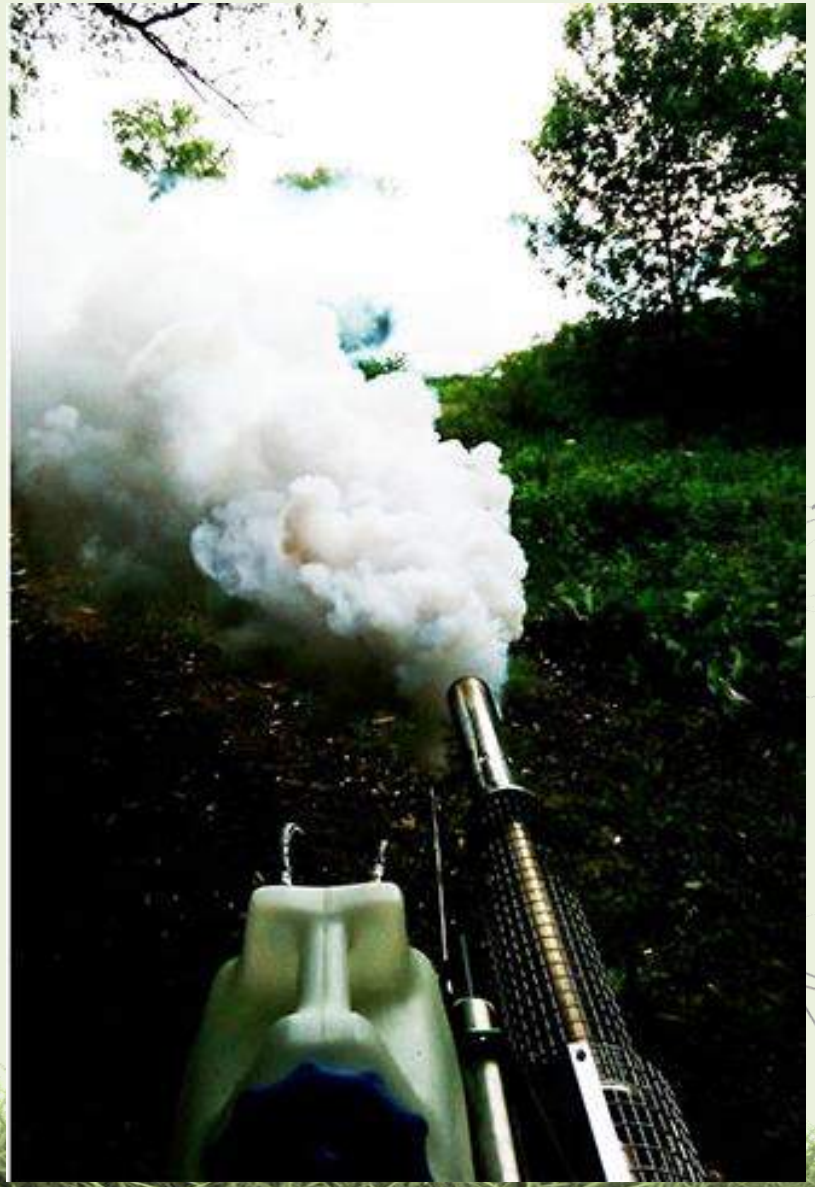
Adult mosquitoes control on field

- Manual Fogging

Zavod za biocide i medicinsku ekologiju

Adult mosquitoes control on field

- Fogging from the ground



Zavod za biocide i medicinsku ekologiju

Adult mosquitoes control on field

- Cold fogging from the ground

Zavod za biocide i medicinsku ekologiju

Thank’s for your visite


INSTITUTE OF VETERINARY
MEDICINE OF SERBIA

INSTITUTE OF VETERINARY MEDICINE OF SERBIA

INSTITUTE OF VETERINARY MEDICINE OF SERBIA IS THE OLDEST VETERINARY INSTITUTE IN SERBIA, FOUNDED IN 1926th "CENTRAL VETERINARIAN BACTERIOLOGY INSTITUTE"

SINCE 1993 – "INSTITUTE OF VETERINARY MEDICINE OF SERBIA"

DIRECTOR OF THE INSTITUTE:
PhD Dobrila Jakić-Dimić

INSTITUTE FOR FOOD SAFETY AND DRUG CONTROL

INSTITUTE FOR ANIMAL HEALTH

INSTITUTE OF VETERINARY MEDICINE OF SERBIA

INPLEMENTATION OF ISO STANDARDS

ISO 9001:2008 – 2005

SRPS ISO IEC 17025:2008 – 2006

ACREDITATION IN SCIENCE 2007
DECISION 110-00-34/58 03/12/2007 – ADDED IN THE REGISTER OF SCIENTICFIC – RESEARCH INSTITUTIONS

•DECISIONS FROM MINISTRY OF AGRICULTURE AND ENVIRONMENTAL PROTECTION PROCLAIMED AS NATIONAL REFERENCE LABORATORIES FOR:

1. FMDV
2. SVDV
3. CSFV
4. ASFV
5. BT
6. AHS
7. RABIES
8. EVA
9. EHV
10. EIA
11. EBL
12. BRUCELOSIS
13. DOURINE
14. GLANDERS
15. FISH DISEASES etc.

- LABORATORY DIAGNOSTICS
- REFERENCE TESTING
- STORAGE OF REFERENCE SERA, STANDARD REAGENTS
- IMPLEMENTATION OF NOVEL DIAGNOSTIC METHODS
- TESTING AND QUALITY CONTROL OF VACCINES AND DIGNOSIC REAGENTS
- RING TEST ORGANIZATION
- CONFIRMATORY TESTING

ACTIVITIES OF THE INSTITUTE OF VETERINARY MEDICINE OF SERBIA:

- Research and experimental development in biotechnical sciences
- Veterinary activities (epizootiology, clinical examination, pathology examination, laboratory diagnostics, expert opinion, food control, drug safety etc.)
- Prophylaxis
- Technical examination and analyses
- Wholesales of pharmaceuticals
- Disinfection, disinsection and deratisation etc.

MAJORITY OF ACTIVITIES ARE PERFORMED IN THE FRAME OF ROOLEBOOKS ADOPTED BY MINISTRY OF AGRICULTURE AND ENVIRONMENTAL PROTECTION

INSTITUTE FOR ANIMAL HEALTH IN 2015 TESTED 106.000 SAMPLES

ORGANISATION OF THE INSTITUTE

INSTITUTE OF VETERINARY MEDICINE OF SERBIA

INSTITUTE FOR ANIMAL HEALTH

1. DEPARTMENT FOR SAMPLE RECEPTION AND STERILISATION
2. VIROLOGY DEPARTMENT
3. BACTERIOLOGY AND PARASITOLOGY DEPARTMENT
4. IMMUNOLOGY DEPARTMENT
5. EPIDEMIOLOGY DEPARTMENT
6. PATOLOGY DEPARTMENT
7. SWINE DISEASES DEPARTMENT
8. BIRD DISEASES DEPARTMENT
9. FISH DISEASE DEPARTMENT
10. BOVINE AND EQUINE REPRODUCTION DISEASES DEP.

INSTITUTE FOR FOOD SAFETY AND DRUG CONTROL

1. DEPARTMENT FOR SAMPLE RECEPTION
2. DEPARTMENT FOR FEEDING AND FEED CONTROL
3. DEPARTMENT FOR DRUG CONTROL
4. CHEMISTRY AND BIOCHEMISTRY DEPARTMENT
5. DEPARTMENT FOR CONTROL OF FOOD of ANIMAL ORIGINE
6. DEPARTMENT FOR RADIATION HYGIENE

VIROLOGY DEPARTMENT

ACTIVITIES:

- LABORATORY DIAGNOSTICS OF VIRAL DISEASES OF DOMESTIC AND WILD ANIMALS (MORE THAN 50 VIRUSES)
- EPIDEMIOLOGY ACTIVITIES
- RESEARCH ACTIVITIES
- GIVING OF EXPERT OPINION
- MAKING OF REPORTS FOR AUTHORITIES
- ORGANISATION OF NATIONAL RING TRIALS

METHODES IN USE:

VIRUS ISOLATION IN CELL CULTURE
ELISA
TFA
VNT

HA-HI
AGID
MOLECULAR METHODES

PROJECTS:

NATIONAL (Ministry of Education, Science and Technological Development)

INTERNATIONAL:

2010 – 2015	IPA project: Support for the Control/Eradication of Classical Swine Fever and Rabies in the Republic of Serbia
2010 – 2013	COST project: Understanding and combating PRRS in Europe - COST FA0902
2014 – 2017	MediLabSecure project: Preventing vector borne diseases around the mediterranean and black sea regions by creating new networks

THANK YOU FOR YOUR ATTENTION

Experiences in intersectorial surveillance integration

Flavia Riccardo and Maria Grazia Dente
Istituto Superiore di Sanità, Rome, Italy

MeSA Study

Serbia

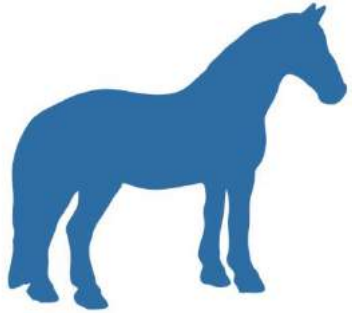
4-8-July 2016

Debriefing meeting, Belgrade 7 July 2016

Outline

- Mesa Study in Serbia focussing on WNV surveillance
  - timeline and process
- Main Preliminary Findings for discussion
  - Comments, suggestions, integrations and corrections
- Structure of the study report
- Next steps



Timeline

- First feedback on the experience of Serbia in intersectorial surveillance (MedilabSecure Survey 2014)
- Consultations during the MediLabSecure Mid Term Meeting (December 2015)
- Agreement to participate in the MediLabSecure MeSA Study (February 2016)
- Site Visit to Serbia (July 2016)
- Follow up activities (2016-2017)

During three days we asked different actors involved in WNV surveillance across the human, veterinary and entomological sectors

To Describe how the collection, analysis and dissemination/exchange of information is organized within and between human, animal and entomological surveillance of arboviruses in three countries of the MediLabSecure network,

To Highlight the formal procedures, informal practices and legal constraints for integrated surveillance and inter-sectoral collaboration,

To Discuss main challenges and success stories in establishing a functional inter-sectoral collaboration and integration of surveillance between the human, animal and entomological sectors.

Agenda

MEDILABSECURE- PROGRAMME OF VISIT

4 JULY (DAY 1) MONDAY
Activities
Arrival of the team's members to Belgrade

5 JULY (DAY 2) TUESDAY
Activities
Morning
9.00 -10.30 Institute of Public Health of Serbia **11.00 – 12.30 Ministry of Health**
Afternoon **13.00-15.00 Institute of Virology, Vaccines and Sera Torlak National Reference Laboratory for Arboviruses**

6 JULY (DAY 3) WEDNESDAY
Activities
Morning **8:30-9:30 Institute of Veterinary Medicine, Virology Department** **Travel to Novi Sad** **11.00 – 13.00 Faculty of Agriculture, University of *Novi Sad* Laboratory for Medical and Veterinary Entomology** **Travel to Belgrade**

7 JULY (DAY4) THURSDAY
Morning **9.00-11.00 Institute for Biocides and Medical Ecology**
Afternoon **12.00 – 16.00 Debriefing meeting with all the stakeholders (at the**

Methodology of provisional findings presentation and discussion

Serbia has experience in experimenting for several years intersectorial surveillance integration for WNV disease

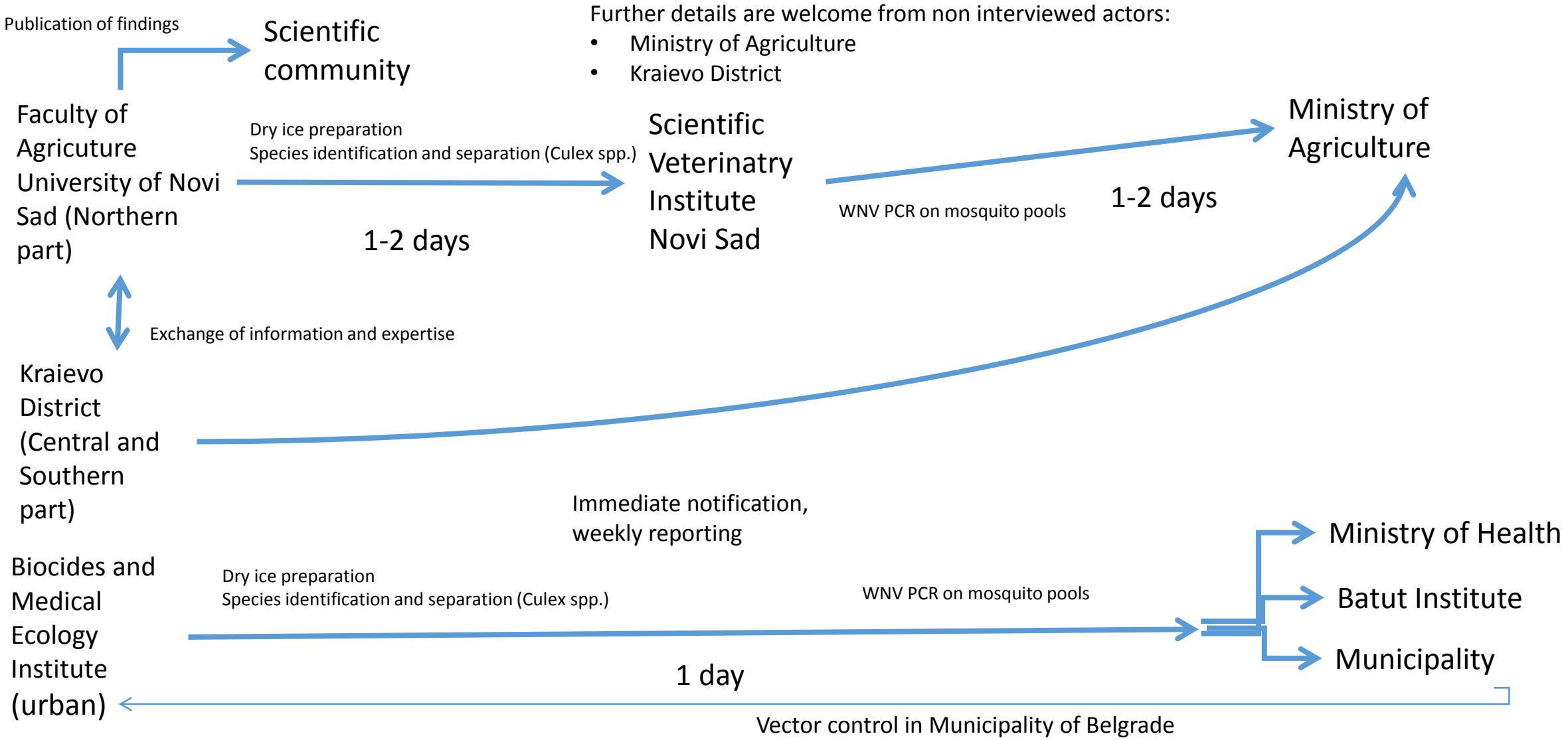
- Intra-sectorial procedures/processes (entomology, veterinary and human health)
- Inter-sectorial collaboration processes

How will we proceed?

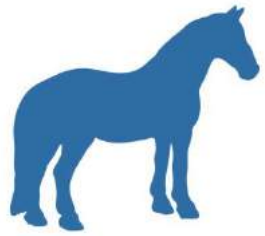
- Presentation of the general picture we have captured
- Collect your comments, corrections and integrations in general (before lunch) and for each sector picture as appropriate (after lunch)

Entomology Sector

- Actors interviewed: Faculty of Agriculture University of Novi Sad, Biocides and Medical Ecology Institute



Veterinary Sector



- Actor interviewed: Institute of Veterinary Medicine of Belgrade, Faculty of Virology
- Active surveillance 2013-14 with distinction by endemicity areas, currently only passive surveillance
- Part of a network of 11 regional veterinary laboratories

Veterinary Doctors
District Offices

Sample and data (DB)
1 week from symptom onset for sick horse
1-2 days for dead bird

Institute of Veterinary Medicine, Dept Virology (Serology, PCR)

Immediate notification, monthly reporting for admin purposes, DB update

1 day

Directorate of Veterinary Medicine, Ministry of Agriculture (response, communication)

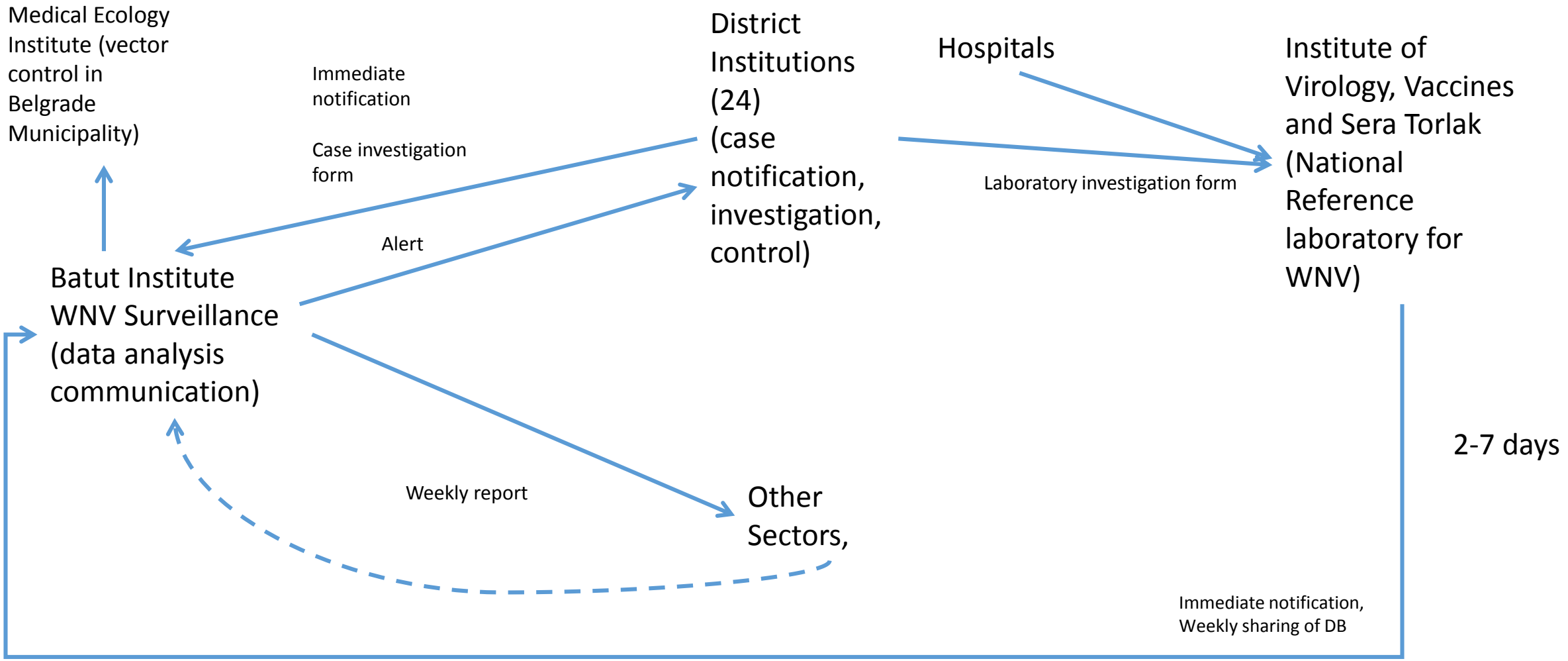
Activation of veterinary inspectors, monthly reporting of all notifiable diseases online

Further details are welcome from non interviewed actors:

- Ministry of Agriculture

Human Sector

- Actors interviewed: Ministry of Health, Batut Institute, Torak Laboratory
- National preparation of the case investigation form (Batut) and the laboratory investigation form (Torak)

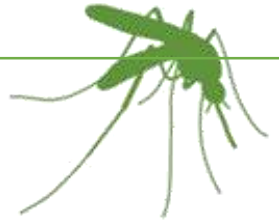


Inter-sectorial collaboration mechanisms

- During the first large human outbreak of WNV disease, an inter-sectorial committee was established:
- On the basis of a law promulgated by the MoH in 2014
- Aim: early warning of WNV circulation in animals and mosquitoes to the PH sector in order to issue alrets and trigger action
- The committee met 2 times a month during previous transmission seasons, this year in March 2016
- Reasons to call meetings include other emerging infections (Zika virus)
- Coordination and Communication leadership → Batut Institute
- Exchange of information during meetings, exchange of official weekly reports across sectors

The General Picture

MediLabSecure



General comments and suggestions?

District Institutions /Hospitals(24) (case notification, investigation, control)

Institute of Virology, Vaccines and Sera Torlak (National Reference laboratory for WNV)

University of Novi Sad

Kraievo District

Veterinary Doc
District Office

Notification

Alert

Notification

Notification

Biocides and Medical Ecology Institute

Scientific Veterinatry Institute Novi Sad

Institute of Veterinary Medicine, Dept Virology (Serology, PCR)

Batut Institute WNV Surveillance (coordination communication)

Ministry of Health

Ministry of Agriculture

INTERSECTORIAL COMMITTEE

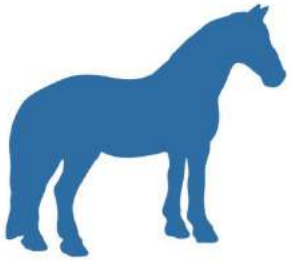
Transfusion Institute

Intersectorial integration in the Serbian WNV surveillance system

General comments and suggestions?

Level of integration	**Sublevels of integration**	**The Serbian example**
Policy and institutional level	Policy level	1. Legislation issued by the Ministry of Health h … **orial committee** in order to share information acr … eraly circulation of WNV and make decisions … (coordination/communication role of the PH … 2. National and district level **projects** supported financially by the Ministry of Agriculture and by the Ministry of Health have sustained intersectorial integration of entomological with veterinary and human surveillance of WNV. 3. Unique reporting system legislation for entomological and veterinary surveillance.
	Institutional level	Presence of formal institutional collaboration mechanisms within sectors (e.g. agreementes in place for the entomological surveillance in Vojvodina) and of informal collaboration mechanisms (across sectors)
Data collection and analysis level	Interoperability mechanisms at data collection level	Data sharing is in place within sectors with distinct databases. Unique web-based database across all administrative level exists for veterinary surveillance
	Interoperability mechanisms at data analysis level	
Dissemination level		Information and weekly reports are shared across sectors

thank you . . .



Hvala!

A little break

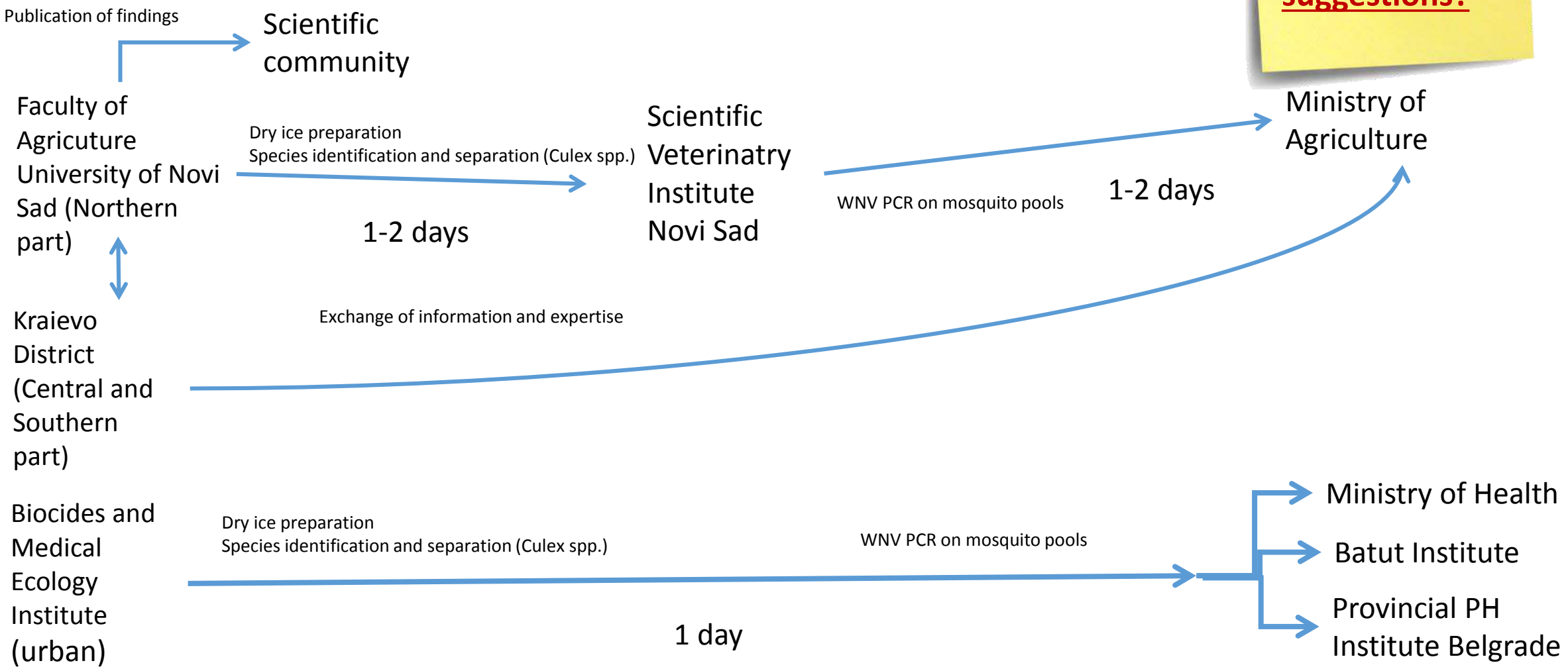
Comments by sector

- We will now go through each sector process flow for comments

Entomology Sector

- Actors interviewed: Faculty of Agriculture University of Novi Sad, Biocides and Medical E

Specific comments and suggestions?



Veterinary Sector

- Actor interviewed: Institute of Veterinary Medicine of Belgrade, Faculty of Virology

Specific comments and suggestions?

Veterinary Doctors
District Office

Sample and data (DB)
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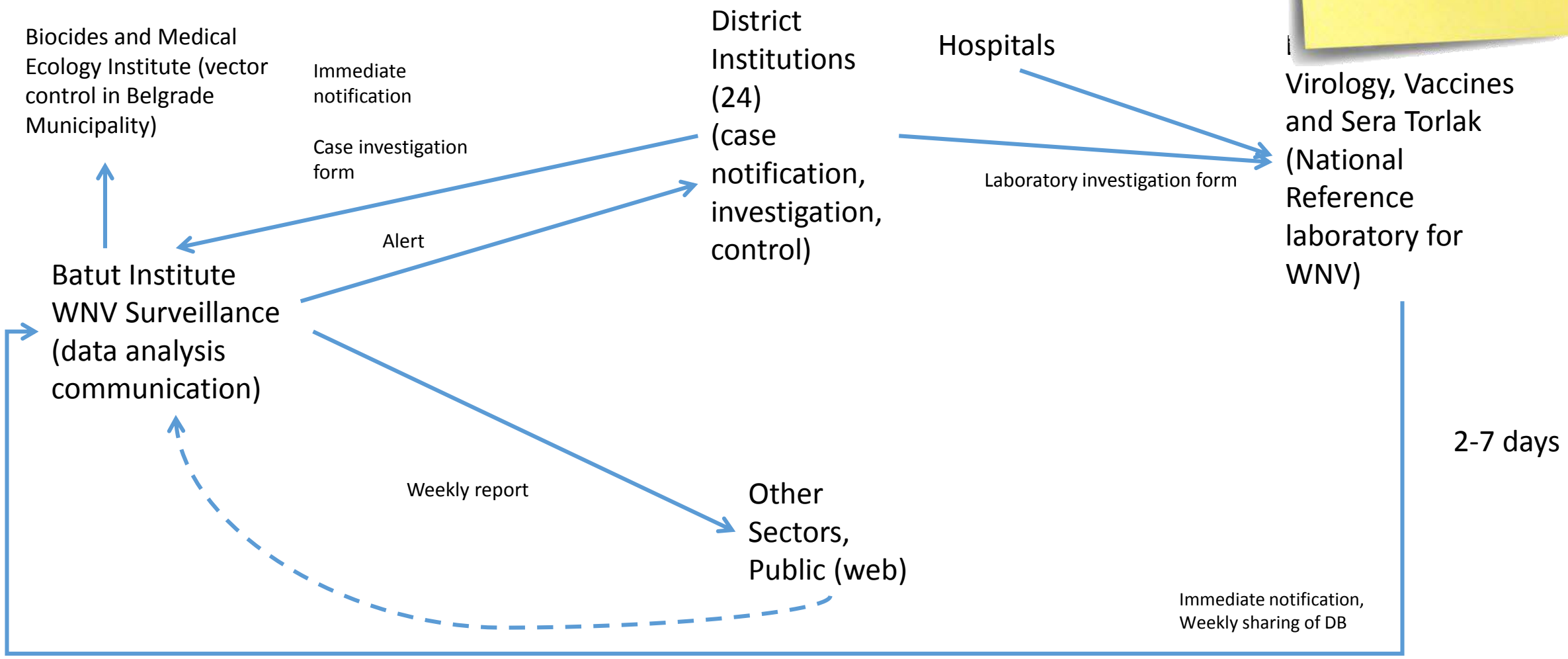
Human Sector

- Actors interviewed: Ministry of Health, Batut Institute, Torak Laboratory
- National preparation of the case investigation form (Batut) and the labor investigation form (Torak)

Specific comments and suggestions?



Lessons learned

- Intersectorial integration widely appreciated as essential for early warning and ultimately cost-effectiveness of response to WNV
- This coordination effort facilitated cross sectorial collaboration for the current Zika Virus emergency in Serbia
- Challenges in establishing a cross-sectorial system include sustainability (financial, human resources), need for standardization of methods (detection, response), need for joint reporting/DB, need for calculation and interpretation of commonly undestood and chosen indicators across sectors and within sectors, need for a strong central coordinating authority for each sector with clear roles and responsibilities.

Presumptive structure of the study report

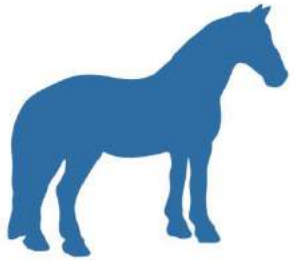
- Introduction on the organization of the Serbian surveillance system
- Introducion on the history of WNV tranmission in Serbia and evolution of the surveillance systems and their integration
- Analysis of surveillance processes (intra/inter sectorial) possibly using Business process modelling
- Conclusions
- Annexes: portfolio, checklists, list of interviewed actors.

Next Steps

- Draft study report (to be tentatively sent for your feedback at the end of summer)
- Finalization of the report
- Use of the findings of WP5 (survey, scoping review, 3 MeSA Studies) to formulate a Strategic Document (2017)

MediLabSecure

Any final observations or comments?



Hvala!

Thank you for your warm welcome to your beautiful country, for the knowledge you shared with us and for all the patience you had with all of our questions!