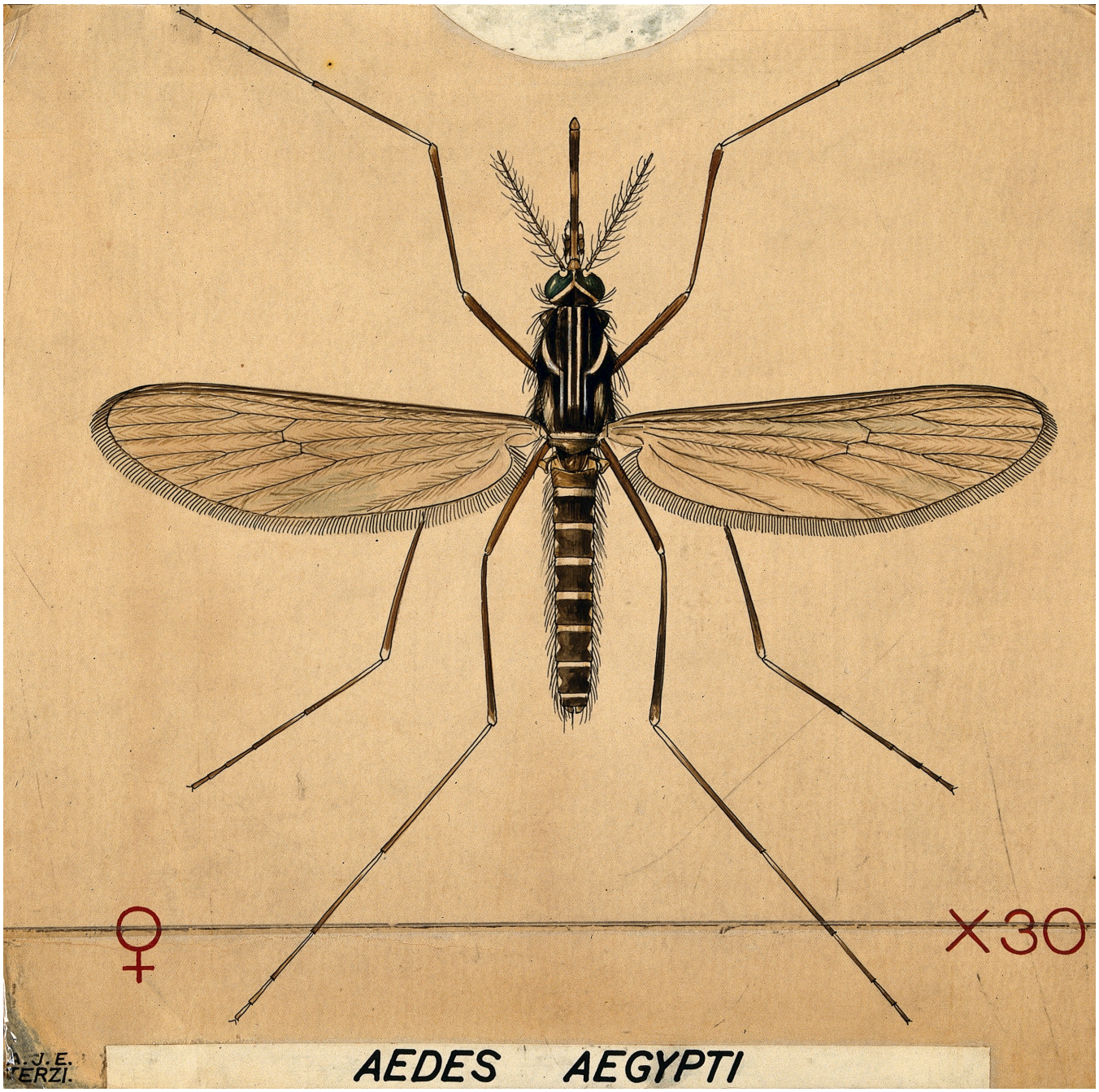


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# SURVEY RESULTS

## COMPLEXITIES & OVERLAPS IN EXISTING CITIZEN SCIENCE MOSQUITO PROJECTS

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# SURVEY RESULTS

## COMPLEXITIES & OVERLAPS IN EXISTING CITIZEN SCIENCE MOSQUITO PROJECTS

### INTRODUCTION: TOWARDS A LOCALLY BASED, YET GLOBAL PLATFORM

As citizen science as a field advances so does the tools, applications and other enabling conditions for conducting projects in the field. In many different disciplines, most notably biodiversity, the ways these projects and their tools collect, store and analyze data are manifold and create interoperability issues when trying to aggregate and cross-reference the data at scale. While many of these interoperability issues -- legal, semantic, fitness for use -- are persistent across disciplines and not unique to just citizen science, there are some nuances. Because of this we designed a brief survey to determine what some of those nuances might be in the field of citizen science and mosquito monitoring in preparation for a technical workshop in April 2017. There were 12 responses to this survey; table 1 on the next page illustrates the name of the projects and geographic region the respondents are working within.

The questions for the survey were designed to illuminate the complexities and overlaps in existing projects and how those might feed into a citizen science global platform for tracking the mosquito vectors that carry the following diseases: Dengue, Chikungunya, Zika and Malaria. Instead of reinvention, how do we lean into complexity derived from comparing across these projects and leverage the tools and educational materials they have already created? The following is a narrative summary of the responses to this survey divided into thematic areas. For further details please see the end of the report for hyperlinks.

## MOSQUITO TASK FORCE GROUP

Goal: To create a global, yet modular platform for recording, aggregating and disseminating observations from the public and validations from virtual experts, primarily for monitoring the mosquito vectors that carry diseases like Dengue, Chikungunya, Zika and Malaria while simultaneously contributing to other areas of mosquito research.

## TABLE 1: RESPONDENTS WITH EXISTING PROJECTS*

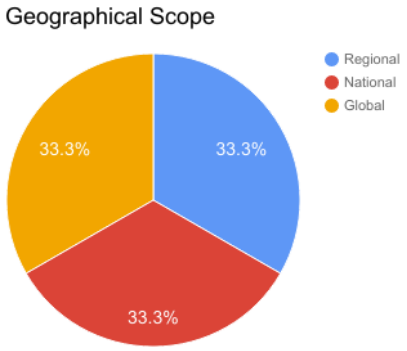
| Project Name | Geographic Region |
|---|---|
| **Mosquito Alert Adaption** | Hong Kong |
| **Mosquito Alert Adaption** | Puerto Rico |
| **Globe Observer Mosquito** | United States & International |
| **Mosquito Alert** | Spain |
| **ZanzaMapp** | Italy |
| **Invasive Mosquito Project** | United States |
| **Pilot Mosquito Monitoring Project** | Colombia |
| **Smarter Crowdsourcing for Zika** | International |
| **Muggenradar** | Netherlands |
| **Indo Biosys** | Germany - Indonesia |

*Respondents in this table either had an existing mosquito monitoring project or citizen science mosquito project. Respondents without a project were not included in the above table. Throughout the survey not all respondents answered every question and some questions had multiple-choice answers.

## ACTIONS ASKED OF THE PUBLIC

The general public plays an important role as data collectors and sometimes reviewers when participating in citizen science projects. Of the 12-existing/anticipated projects surveyed, 9 identify the general public as a major target participant responsible for collecting data. In addition, public health and government officials (4 projects), teachers and students (2 projects) and researchers (1 project) are also identified by some projects as data collectors, showing that some projects also engage the policy, education and research community in data collection.

The projects surveyed have a good balance in terms of their geographical scope, including 4 regional projects, 4 national projects, and 4 international projects.  See below for breakdown.




The majority of the projects collect data about adult mosquitoes (7 out of 12), while the rest focus on mosquito breeding sites and mosquito larvae or eggs. Of all surveyed projects, only 4 collect data on

specific species/genus of mosquitoes (*Aedes albopictus, Aedes aegypti, Aedes, Culex*), while the rest collects data on all types of mosquitoes.

The majority of the projects give significant amount of freedom to participants as to the place, time and frequency of data collection:

- Of all projects surveyed, 8 projects allow participants to collect mosquito data from places/field sites selected randomly by participants, while 3 require participants to collect data at fixed location (targeted local communities/neighborhoods/school areas etc.).
- Regarding the frequency of data collection during the whole year or during the mosquito season, 5 projects do not have a set frequency, and the rest have a required data collection frequency of either once or more every day, or once or more every week, or even less frequently.
- As to the time of data collection within a day, 8 projects allow a random time, and the rest allow data collection at more specific times (mostly morning, late afternoon and evening).

Regarding the data collection tool that participants are asked to use, the majority of projects use smartphone apps with photo uploads (9 out of 12). The projects surveyed also identify a number of other technological and non-technological solutions, including smartphone app with text uploads (1 out of 12); other mobile-enabled technologies (2 out of 12); software and other web technologies (1 out of 12); pen and paper data collection sheet (2 out of 12); microscopes and other laboratory equipment (1 out of 12); and, other non-technological solutions (2 out of 12).

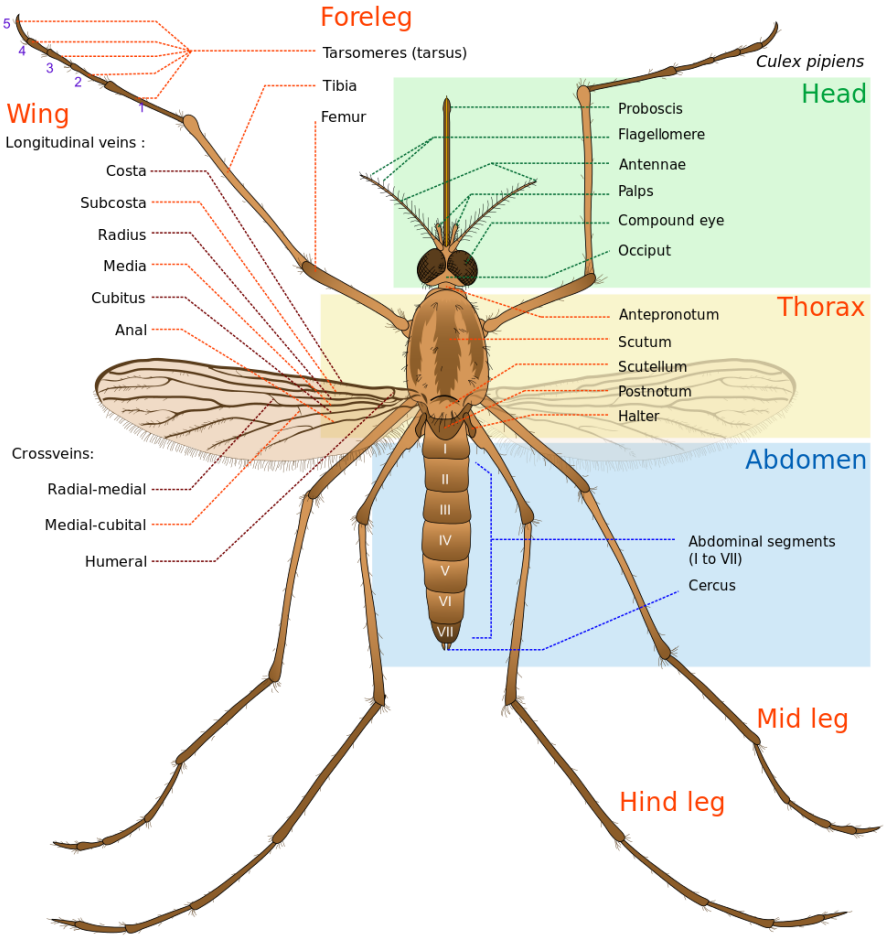
Regarding the data reporting requirements for participants, most projects collect image, geospatial and descriptive data about mosquitoes/mosquito larvae/breeding sites with varying levels of identification required, as well as personal identifiable data about participants:

- Most projects require the participants to submit images of the mosquitoes / mosquito larvae / breeding sites (10 out of 12), geospatial data (9 out of 12) and description of the identification of the mosquitoes / mosquito larvae / breeding sites (7 out of 12). Some projects require the images (5 out of 12) or the description (4 out of 12) of the environmental habitat. Other types of data collected include the description of the data collection process, the number of mosquitoes, location as inside or outside the house, and the time of the day.
- Projects differ in the level of identification required for the mosquito data: apart from 4 projects requiring no identification of mosquitoes from participants, 4 projects require the species level of identification, 2 require the genus level, and one requires a different level for different types of mosquitoes.
- Most projects (7 out of 12) also collect personal identifiable data (name, home address, e-mail, social media accounts, etc.); among them 5 projects store such personal data in the project database, 1 stores it with a third party and 1 does not store the personal data.

Regarding the project support for participants, most projects provide training materials (10 out of 12) and data validation support (8 out of 12) to help the participants during data collection.

- The training provided to participants includes interactive training formats such as mobile-enabled interactive training (e.g. exercises/quizzes embedded in smartphone apps; 6 out of 12); in-person interactive training sessions with experts (5 out of 12) and online interactive training (e.g. webinars, interactive websites; 2 out of 12). They also include non-interactive formats such as written or hard copies of project manuals/brochures (6 out of 12), mobile-enabled non-interactive learning materials (e.g. slides, galleries, videos embedded in smartphone apps, websites; 5 out of 12), and online non-interactive learning materials (e.g. PowerPoint slides, YouTube videos, websites; 4 out of 12).
- For projects that provide data validation support to participants during the collection process, virtual or remote (for instance by phone) support/review, either from experts (6 out of 12) or peer participants (2 out of 12), is more common. In addition, some projects provide in-person support/review from experts or peer participants, or use samples provided by the experts to validate the data.

After the data collection process, 6 of the 12 projects also engage participants as reviewers for the submitted data. Except for one project that offers compensation for peer review, participants are usually asked to voluntarily conduct review the data with no compensation (5 out of 12).

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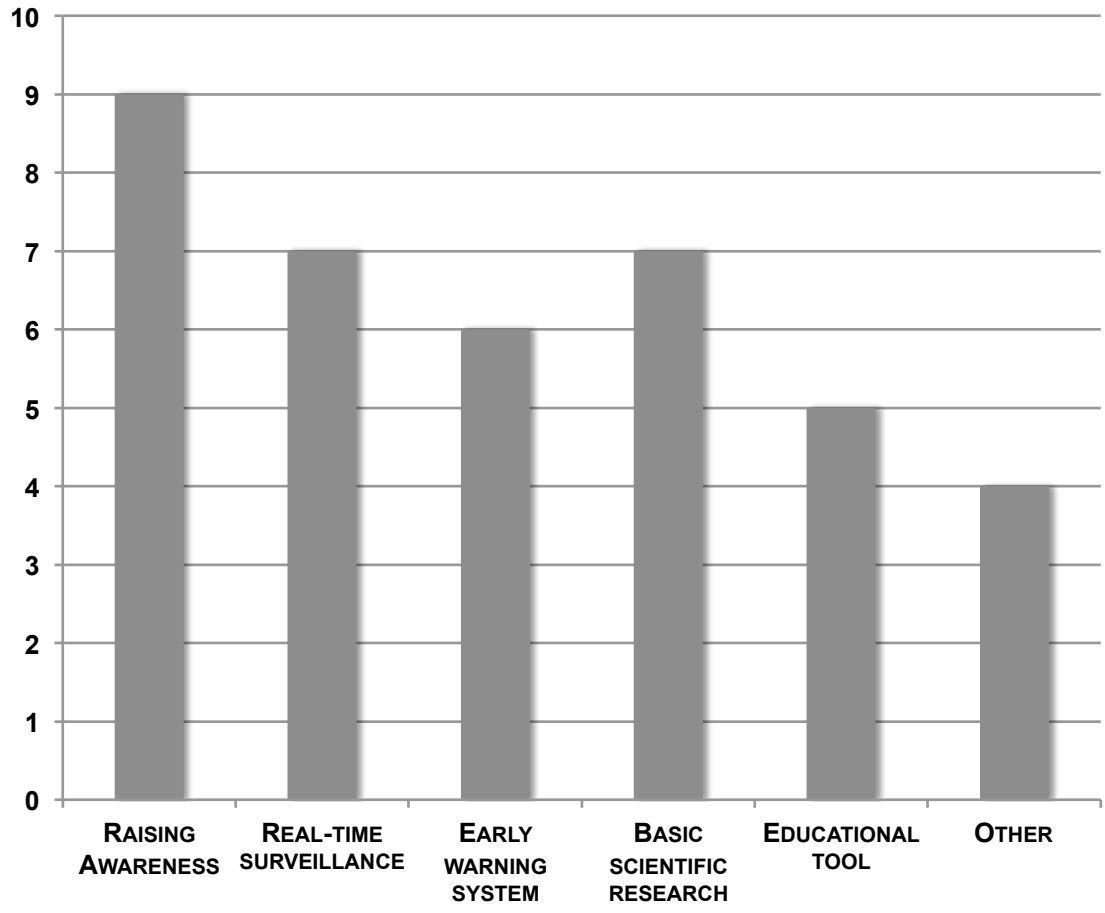
## AREAS OF RESEARCH

Because of the nature of public participation in research, a citizen science project conducting mosquito monitoring not only produces novel scientific research results that may inform public health decisions, but also helps increase public awareness and education in mosquito control. This is evident from the survey of the 12 projects. Raising community/public awareness is identified by most projects (9 out of 12) as a primary goal of the project. This is followed by basic scientific research (biodiversity, indicator system etc.; 7 out of 12), real-time surveillance and control of targeted mosquitoes (disease vectors and invasive species; 7 out of 12), early warning system for targeted mosquitoes in general (6 out of 12), and educational tool to assist formal or informal classroom education (5 out of 12). Some projects also identify particular goals/research areas to contribute to, including the open data movement, research on genetics, education for government officials, and monitoring the spatial and temporal variation of mosquito nuisance for citizens.

## GRAPH 1: PROJECT GOALS



## POLICY IMPACT

Citizen science project data are often made publicly available and thus may reach a wide range of users to inform policy making. This is evident from our survey result: among the 12 mosquito monitoring projects surveyed, 8 projects have or plan to have open data available to anyone. Specific groups, such as researchers, national/local government agencies, and the educational community, can also use the project data. Concerning the projects surveyed, the mosquito control researchers (using data for research and/or vector control purposes) is a major group of data users, as identified by 8 out of 12 projects. Public sector/government mosquito surveillance and/or control agencies are another major user group, as identified by 7 out of 12 projects. Teachers or students using the data for education/research purposes are also identified as a major data user group, each by 5 out of the 12 projects. Some projects also identify national government agencies (other than specific surveillance and/or control agencies) (4 out of 12), local government agencies (other than specific surveillance and/or control agencies) (4 out of 12), and private sector surveillance and/or control agencies (4 out of 12) as data users.

Most projects (10 out of 12) indicate or perceive some policy impact from their research. The policy impact may include contribution to the public sector (government) mosquito surveillance/control or mosquito-borne disease response (5 out of 12), contribution to national or local level of public health planning (3 out of 12), contribution of more public health data or increase in data transparency (3 out of 12), contribution to the surveillance of new species and responses to new species (2 out of 12), and increase in public awareness or education (2 out of 12). Most projects identify policy impact that cut across multiple areas, showing that a citizen science project in mosquito monitoring can contribute to policy making in various ways.

## DIGITAL TOOLS & DATA PRIVACY

Because of the public-facing and open collaboration features of citizen science projects, digital tools are often used not only in data collection but also in other parts of the research process. As described in the “actions asked of citizens (public)” section, most mosquito monitoring projects in our survey require participants to use smartphone apps with photo uploads, or other types of digital tools, for data collection. In addition, most projects provide virtual or remote (for instance by phone) tools for data validation support/review from either experts or peer participants during the data collection process.

Almost all projects in our survey also use digital tools for data validation after submission. Most projects conduct remote/virtual data validation using experts (samples are sent to expert's labs by mail, experts validate photo as species/genus; 10 out of 12), the non-expert online community (5 out of 12) and other virtual tools (artificial intelligence algorithms etc.; 1 out of 12). Some projects conduct data validation after submission in person, either using experts at the field site (4 out of 12) or non-experts using dichotomous keys (1 out of 12).

Maintaining a virtual network of experts for data validation is crucial for projects that rely on online/remote experts to conduct data validation (10 out of 12). Experts are usually either part of the project/institution (5 out of 12), or recruited from local/national public health or other government agencies (4 out of 12) or local/national universities or research institutes (4 out of 12). A few projects

also recruit such a virtual network of experts from local/national/international professional organizations (3 out of 12) or online networks (communities of practice, discussion groups, etc.; 2 out of 12). Experts are mostly not compensated for data validation work (8 out of 12). Project participants are mostly given feedback regarding the accuracy of the data that they submitted (7 out of 12).

Privacy is an important aspect of using any digital tool. Most projects (10 out of 12) surveyed have some kind of measure to maintain data privacy: 6 out of 12 projects have data repository/data server protected by passwords only known to project administrators; 5 out of 12 projects have data encrypted in transit from participant to the database; 4 out of 12 projects have data repository/data server in a secure location (for instance, a locked room). A couple of projects have specific measures, such as maintaining a security expert that ensures security and safety at all stages of the project.

## CONCLUSION

The purpose of this brief report is to educate interested partners on the nuances of each individual project and the overlaps for the purpose of starting a discussion on how to create a global platform for tracking the mosquito vector that carries Dengue, Chikungunya, Zika and Malaria. A follow-on technical workshop to this publication was held on April 3rd & 4th 2017 with support from the **United Nations Environment Programme** and in coordination with the **European Citizen Science Association** and the **Woodrow Wilson International Center for Scholars**. The goal of the workshop was to work through the technical aspects of creating a global platform and produce a vision document outlining the needs for such a platform.

## CREDITS & MORE INFORMATION

This survey and narrative report was produced in March & April 2017. Survey design and feedback was conducted in collaboration between Yujia He & Elizabeth Tyson at the Woodrow Wilson International Center for Scholars and Frederic Bartumeus & Aitana Oltra in the Centre d'Estudis Avancats de Blanes (CEAB-CSIC).



More information, including output from the workshop, can be found here –

https://www.wilsoncenter.org/publication/citizen-science-mosquito-monitoring-technical-workshop

More information on the European Citizen Science Association –

https://ecsa.citizen-science.net/

United Nations Environment Programme Data Portal (including citizen science data) –

http://www.uneplive.org/