ADVANCE CONTRACT AWARD NOTICE (ACAN)

Title: Tracking the transmission of mosquito-borne diseases arboviruses and their drivers in eastern Canada

Solicitation Number: 1000255932

1. The Purpose and Explanation of an ACAN

An Advance Contract Award Notice (ACAN) allows the Public Health Agency of Canada to post a notice for no less than fifteen (15) calendar days, indicating to the supplier community that a goods, services or construction contract will be awarded to a pre-identified contractor. If no other supplier submits, on or before the closing date, a Statement of Capabilities that meets the minimum requirements identified in the ACAN, the Contracting Authority may then proceed to award a contract to the pre-identified contractor.

2. Rights of Suppliers

Suppliers who consider themselves fully qualified and available to provide the services or goods described in this ACAN may submit a Statement of Capabilities demonstrating how they meet the advertised requirement. This Statement of Capabilities must be provided via e-mail only to the contact person identified in Section 12 of the Notice on or before the closing date and time of the Notice. If the Bidder can clearly demonstrate they possess the required capabilities, the requirement will be opened to electronic or traditional bidding processes.

3. Proposed Contractor

Carleton University
318B Nesbitt Building
1125 Colonel By Drive
Ottawa, ON K1S 5B6

4. Definition of Requirements or Expected Results

The requirement is to use mosquito trapping data and mammal field density measurements to estimate arbovirus circulation in South Nation River Watershed, Ottawa, ON. The supplier must explore how microhabitat and microclimate determinants, as well as reservoir abundance influence this transmission.

More specifically, the supplier will have to do mosquito field sampling, mammal field sampling, mosquito identification, RNA extraction in mosquito-samples and screening of the RNA samples for the detection of 4 viruses (West Nile virus, Eastern Equine Encephalitis virus, Jamestown Canyon virus (JTCv) and Snowshoe Hare virus(SSHv)), geospatial analysis, microclimate data modelling, and risk of infection modelling.

The work will include multiple tasks. Specific requirements are provided below:

Task 1 - Mosquito and mammal field sampling:

- Mosquito traps set-up: use CDC light traps , dried CO2 attractant, 96 trapping site locations (The coordinates of the locations will be provided by PHAC). All materials required are to be provided by the supplier.
  Mammal trap set-up: 5-7 trail cameras per mosquito sites, 48 small mammals tunnels per site (PVC pipes lined with carbon-inked paper, papers to be collected and replaced every two weekly during each site visit). 6-8 Temperature and Humidity sensors (HOBO). The coordinates of the locations for additional setups will be provided by the PHAC

- Additional set up: 6-8 Temperature and Humidity sensors (HOBO), the coordinates of the locations for additional setups will be provided by the PHAC
- Trapping duration: early May to end of September 2024
- Trapping frequency: each site sampled biweekly for 24h (12 traps per site, 96 trap collections biweekly).
- Obtaining and documenting permission for sampling on private lands will be necessary and it will be under the responsibility of the supplier.
- Samples collected must be be stored at a temperature of minus 20 degree celsius until analysis.
- Collected data pre-processing (CDC light traps, camera and tunnel footprint data): create a database with the presence/absence of mosquito, small mammals species by trapping site and the time of the summer.

Task 2 Morphological identification of mosquito:

- Morphological identification will bebased on Darsie and Ward identification key (Darsie Jr., R.F., R. A. Ward, and C. C. Chang. 2005. Identification and Geographical Distribution of the Mosquitoes of North America, North of Mexico, 2nd Edition. Series: Mosquito Systematics Supplement 1:1-313. American Mosquito Control Association, Fresno, California.),
- Specimen will come from mosquitoes already sampled (to be provided by PHAC) and from specimen captured in Task 1.
- The expected final number of samples will be around 400 and the number of mosquitoes to identify is expected to be up to 150 specimens by sample.

Task 3 RNA extraction in mosquito samples and screening of the RNA samples for the detection of 4 viruses (West Nile virus, Eastern Equine Encephalitis virus, Jamestown Canyon virus and Snowshoe Hare virus)

The RT-qPCR assay needs to distinguish true viral negatives, from failed reactions, and successfully detect the following viruses: Jamestown Canyon, Snowshoe Hare, West Nile, and Eastern Equine encephalitis.
Specifically, RNA extraction in mosquito samples and screening of the RNA samples for the detection of 4 viruses (West Nile virus, Eastern Equine Encephalitis virus, Jamestown Canyon virus and Snowshoe Hare virus) must meet the following criteria:

a. The RNA extraction method needs to successfully yield quality RNA with a performance similar or superior to commonly used commercial kits (Qiagen RNeasy® Mini Kit and Macherey-Nagel NucleoSpin®RNA Plus Kit).
b. If the supplier is not using one of the commercial kit mentioned (Qiagen RNeasy® Mini Kit and Macherey-Nagel NucleoSpin®RNA Plus Kit), the extraction method and the RT-qPCR assay need to be validated and compared with the kits mentioned above on a minimum of 100 samples (40 viral positive and 60 negative control). More specifically, the validation of the RNA extraction and RT-qPCR assay needs to include:
    i. Efficiency tests on mosquito pools sorted by species, with a minimum of 25 species spanning 8 genera, representative of the sampling region
    ii. Sample storage conditions: methods should be viable regardless of different storage temperatures over time (e.g., 80% at -80 and the rest at - 20, with a short phase in transportation-like conditions with dry ice)
    iii. Method efficiency should be viable for samples aged between 1 and 4 years old
    iv. Efficiency and validation tests on different pool sizes: one, five, 10, 20, 30, 40, and 50 individuals for a minimum of four species to minimize species-specific biases.
    v. Method should be time efficient to process ~6000 samples

Task 4 Geospatial Analysis

Provide spatial and temporal descriptive analysis of the infection rates or prevalence of collected mosquito pools, in our study region.

List of outcome variables: MIR (Mosquito pools Minimum Infection Rates) or IR (Mosquito pools infection rates). Methodological boundaries and requirements for Hotspot analysis are specified in: https://www.publichealth.columbia.edu/research/population-health-methods/hot-spot-spatial-analysis#:~:text=Hotspot%20analysis%20is%20a%20spatial,locations%20of%20events%20or%20objects.

Task 5 Microclimate data modeling

Develop predictive models to characterize the microclimate of sampling sites at fine spatial (<30m2) and temporal (hourly) scales.
List of predicting variables that need to be obtained and used for modeling microclimate (and data sources): day/night mean/max/min temperature and humidity (at site level scale, using in situ measurements), wind speed/direction (using ECCC and WEBS weather station data), leaf-area index (via NDVI), albedo (via NDVI), cloud cover (via ECCC), regional temperature, atmospheric pressure, vapor pressure, precipitation (DayMet), and fine-scale DSM/DEM grids. Calculate the predicted value of the microclimate variables using the models developped, for the study region and the years of interest (2017-2023). The data required to support modelling for the period anterior to 2023 will be provided by PHAC.
Predicted value must be validated through a comparison of modelled outputs with in *situ* temperature and humidity logger data in both space and time, for the study region. The target accuracy required to determine validity will be determined by the PHAC project authority.

Task 6 Risk of infection modelling:

Task 6.1 Peform mosquito presence/abundance modelling:
List of outcome variables: Vector presence/absence, vector abundance:
Choice of 'vector species': a subset of species will have to be selected according to their vector competence. The content of the subset will need to be validated by the PHAC project authority.
List of predicting variables: Day/night mean/max/min temperature/humidity/wind/precipitation (trap location level), solar exposure (leaf-area index) (trap location level), vegetation structure/density (spring and summer) (trap location level), presence of stagnant water pools near trapping location (trap level), canopy type/height (trap level), distance to permanent water sources (trap level), distance to anthropogenic elements (trap level), regional daily mean/min/max temperature and humidity, regional land use
Data sources: Outputs from microclimate model, NDVI, in situ qualitative and quantitive measurements, Agriculture and Agri-Food Canada land use database, Google Earth, DayMet data
Modelling regression approach: Time series GLMM Bayesian modeling
Calculate the predicted value for the study region and the years of interest (2017-2023). Data required to support modelling for the period anterior to 2023 will be provided by PHAC.

Task 6.2 Infected mosquito modeling:
List of outcome variables: MIR, IR for JTCv and SSH
Choice of 'vector species': a subset of species will have to be selected according to their vector competence. The subset list will need to be validated by the PHAC project authority.
List of predicting variables: Vector presence/absence, vector abundance, relative density of large and small mammals, Day/night mean/max/min temperature/humidity/wind/precipitation (trap level), solar exposure (leaf-area index) (trap level), vegetation structure/density (spring and summer) (trap level), presence of stagnant water pools near trapping location (trap level), canopy type/height (trap level), distance to permanent water sources (trap level), distance to anthropogenic elements (trap level), regional daily mean/min/max temperature and humidity, regional land use.
Data sources: Outputs from microclimate model, NDVI, in situ qualitative and quantitive measurements, Agriculture and Agri-Food Canada land use database, Google Earth, DayMet
Modelling regression approach: Time series GLMM Bayesian modeling.
Model validation: Data will be divided into a training and testing dataset to assess overall model performance. The target accuracy required to determine validity will be determined by the PHAC project authority.
Calculate the predicted value for the study region and the years of interest (2017-2023). Data required to support modelling for the period anterior to 2023 will be provided by PHAC.

5. Minimum Requirements

Any interested supplier must demonstrate by way of a Statement of Capabilities that it meets the following minimum requirements:

a) 15 years full-time experience working on landscape and population genetics, zoonotic disease spread, and Mosquito-borne diseases
b) Academic degrees in Biology or Ecology, with experience in Epidemiology
c) Experience comprising of leading 2 projects within the last 5 years involving trapping mosquitoes for research.
d) Experience drafting and publishing a minimum of 2 scientific peer-reviewed journal articles on mosquito related studies.
e) 15 years full-time experience working on ecological data modeling and advanced statistical regression modeling.
f) A minimum of 6-month hand-on experience in mosquito species identification using morphological identification keys.
g) 5 years full-time experience equivalent working on molecular analysis of mosquito samples for virus detection (specifically viruses endemic to Canada).
h) The supplier must be able to identify any of the mosquito species on a list of mosquito susceptible to be present in Canada (list to be provided by PHAC). The supplier must be able to process mosquito identification up to 60 000 specimens, to be completed within 10 weeks from receipt of samples.
i) The supplier must be able to perform the RNA extraction using one of the commercially available kits specifically identified in the list below, or if another method is used, the supplier must demonstrate it successfully yields quality RNA with a performance similar or superior to the kits listed. The demonstration of validity must meet all the specific performance requirements detailed in Task 3.
   List of acceptable kits: Qiagen RNeasy® Mini Kit and Macherey-Nagel NucleoSpin®RNA Plus Kit.

6. Reason for Non-Competitive Award

Section 6 of the Government Contracts Regulations contains four exceptions that permit the contracting authority to set aside the requirement to solicit bids. For the proposed procurement, the following exception applies:

6d) Only person or firm is capable of performing the contract

7. Applicable trade Agreements and Justification for Limited Tendering or the Procurement Strategy for Aboriginal Business

This procurement is subject to the following:

- Canada-Korea Free Trade Agreement

8. Ownership of Intellectual Property

No Intellectual Property terms in the resulting contract.

9. Period of the Proposed Contract

The contract period shall be from date of contract award until March 31, 2027.

10. Estimated Value of the Proposed Contract

The total estimated value of the proposed contract should not exceed $115,000.00, including travel and living expenses (if applicable), and all applicable taxes.

11. Closing Date and Time

The Closing Date and Time for accepting Statements of Capabilities is February 23, 2024, 2 p.m. ET.

12. Contact Person

All enquiries must be addressed by e-mail to:

Name: Montana Myers
E-Mail: montana.myers@hc-sc.gc.ca