



Innovation and Translational Research in One Health for Occupational Medicine: The CALLIOPE Project Experience

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Time to treat the climate and nature crisis as one indivisible global health emergency

[Kamran Abbasi](#) • [Parveen Ali](#) • [Virginia Barbour](#) • [Thomas Benfield](#) • [Kirsten Bibbins-Domingo](#) • [Stephen Hancocks](#) • et al. [Show all authors](#)

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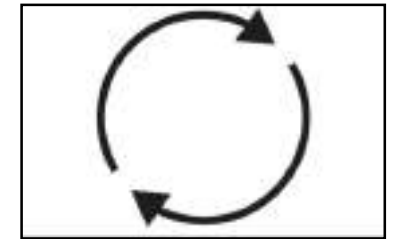
Countdown to climate change

- «**Health professionals** must be powerful advocates for both restoring biodiversity and tackling climate change for the good of health. **Political leaders** must recognise both the severe threats to health from the planetary crisis as well as the benefits that can flow to health from tackling the crisis»

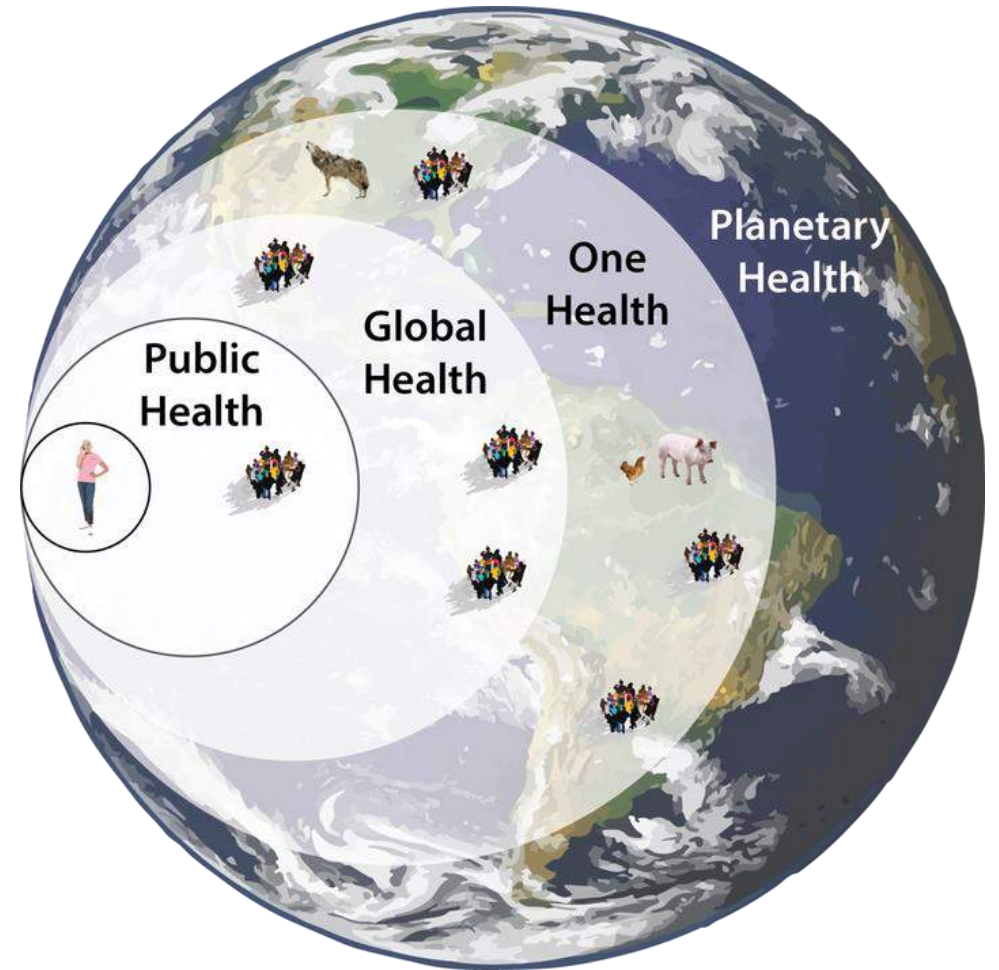
One Health

One Health can be thought of as a framework for evaluating health problems, and developing and implementing contextualized and appropriate interventions (WHO FactSheet 2019)

- for example, insecticides, such as **Pyrethroids** and **Neonicotinoids**, are used in intensive agriculture to boost crop productivity and **control pest species**
- however, they are also **toxic** to non-pest species such as **bees and birds**.
- **Their use, along with other drivers such as climate change and habitat loss**, disrupts the ecosystems to which both pests, and non-target species are integral.
- This has led to a **decline in pollinator species**, paradoxically **reducing crop yield and food security**, which then affects human health



Urban Health



THE LANCET
Public Health

COUNTDOWN | VOLUME 7, ISSUE 11, E942-E965, NOVEMBER 2022

The 2022 Europe report of the *Lancet* Countdown on health and climate change: towards a climate resilient future

Kim R van Doalen, MPhil • Marina Romanello, PhD • Prof Joacim Rocklöv, PhD • Prof Jan C Semenza, PhD • Cathryn Tonne, ScD • Prof Anil Markandya, PhD • et al. [Show all authors](#)

7

million people globally are dying prematurely every year due to toxic levels of air pollution, according to the World Health Organization (WHO).

70%

By 2050, almost 70% of people globally are projected to live in urban areas.

20%

Cities can avoid 20% of premature deaths with better urban and transport planning.

ISGlobal

Over 4% of summer mortality in European cities is attributable to urban heat islands



30%

Increasing **tree cover** in cities to **30%**



can reduce the **temperature** of urban environments by up to **1.3 °C**



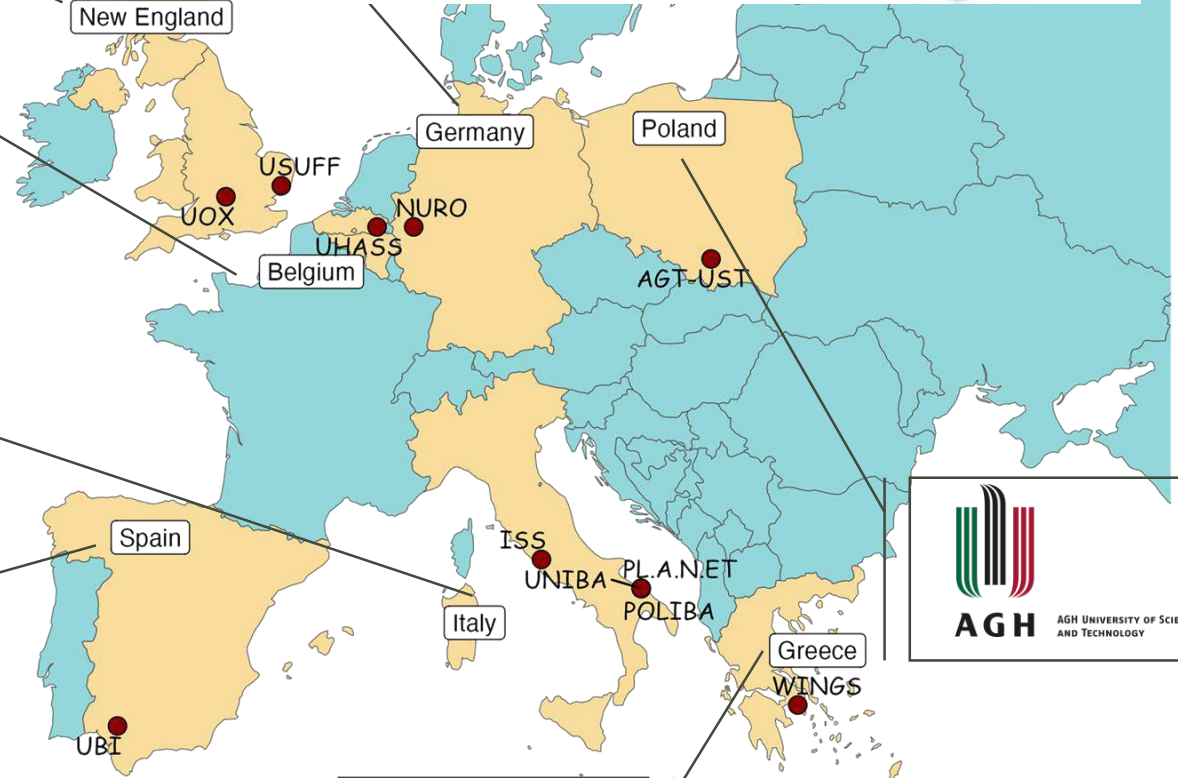
and **prevent 1/3 of premature deaths** attributable to urban heat islands in summer

Source: Jungman T., et al., *The Lancet*, 2023.



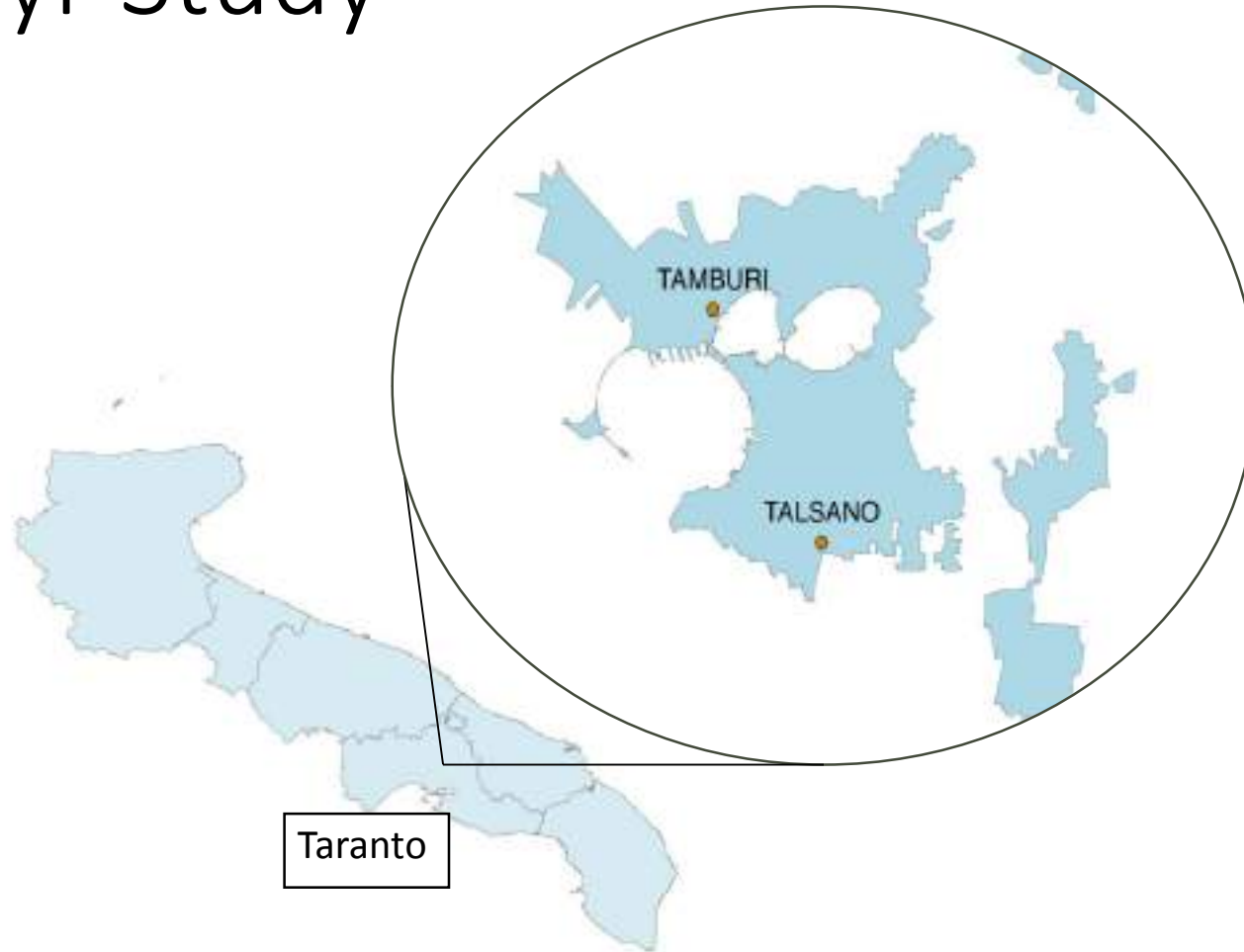


Horizon Europe
THE NEXT EU RESEARCH & INNOVATION PROGRAMME (2021 - 2027)

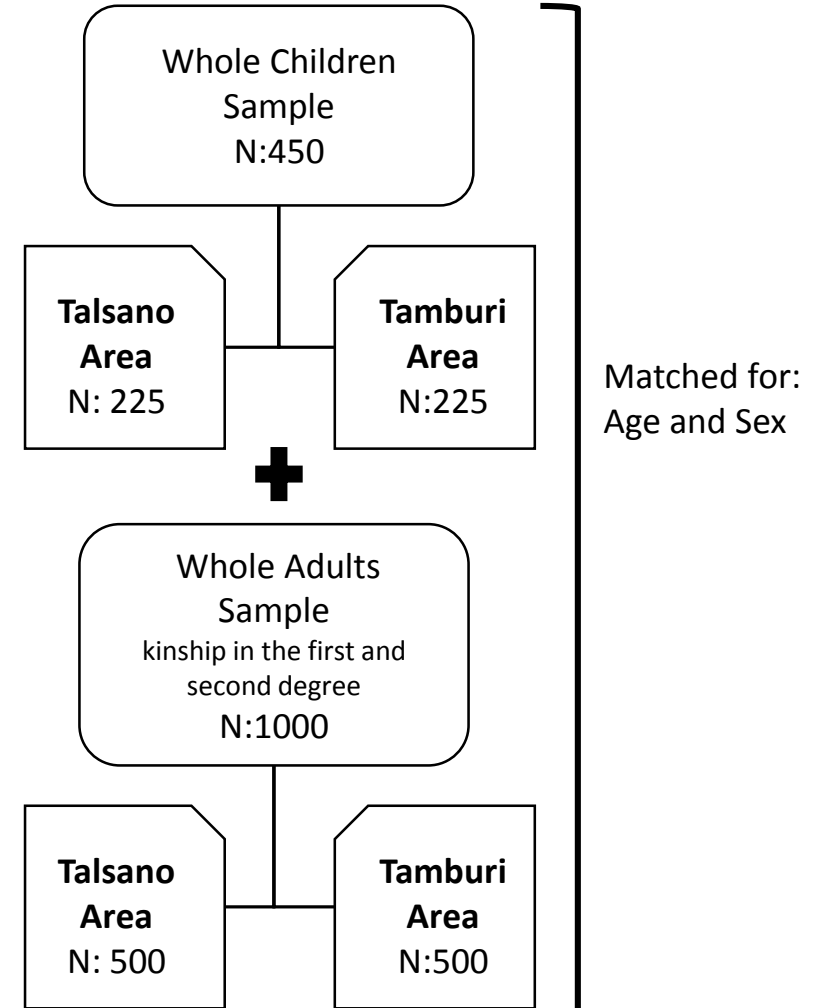


Funded by the European Union

Zephyr Study



Clustered Sampling Scheme



GLI ALIMENTI ULTRA-PROCESSATI



Food-frequency questionnaire (NFFQ) to assess food consumption based on the NOVA classification

VERDURA E LEGUMI	FREQUENZA <small>Indicare 1 sola opzione per ogni alimento</small>										QUANTITÀ <small>Indicare 1 solo valore per ogni alimento</small>					
	Mai o meno di 1 volta al mese	1-2 volte al mese	1 volta a settimana	2 volte a settimana	3 volte a settimana	4 volte a settimana	5 volte a settimana	6 volte a settimana	Tutti i giorni	Se tutti i giorni, quante volte al giorno?	PORZIONE DI RIFERIMENTO	LA SUA PORZIONE IN OGNI OCCASIONE D'USO				
Verdure e funghi (freschi, cotti, surgelati senza ingredienti aggiunti)											200 g (es. 2-3 pomodori, 1 finocchio, 1 patito spinaci)					
Verdure pronte da scaldare/cuocere (con ingredienti aggiunti)											200 g (es. 11 patito di salmone con formaggio)					
Insalata											80 g (1 scodella/1 porzione grande)					
Sacchi 100% verdura (freschi o pastorizzati, senza aggiunta di zucchero o altri ingredienti)											200 ml (1 bicchiere versato)					
Verdure in lattina o in lattiglia (es. salsa di pomodoro, sottaceti)											150 g (es. 1 bicchiere piccolo di salsa di pomodoro, 10 cetriolini verdi)					
Verdure sott'olio											50 g (es. 2-3 carciofi, 2-4 pomodori secchi)					
Legumi freschi (es. fagioli, piselli, lenticchie)											150 g (1 piatto)					
Legumi secchi											50 g (1-4 cucchiai)					
Legumi in lattina (con aggiunta di sale o altri ingredienti)											150 g (es. 1 scodella pronta)					

Dinu, M., Bonaccio, M., Martini, D., Madarena, M. P., Vitale, M., Pagliai, G., Esposito, S., Ferraris, C., Guglielmetti, M., Rosi, A., & Angelino, D. (2021). Reproducibility and validity of a food-frequency questionnaire (NFFQ) to assess food consumption based on the NOVA classification in adults. *International journal of food sciences and nutrition*, 72(6), 861–869.

<https://doi.org/10.1080/09637486.2021.1880552>

Development of CTEs



It is a national program to support the implementation of wide range connectivity to different dimensions of technology.

- To support research project and experimentsa
- Activation of new start-up
- Promote technology transfer

- **Blockchain e Crypto Asset**
- **Internet of Things (IoT)**
- **Artificial Intelligence**
- **6G**
- **Quantum technologies**



Umbrella Innovation Platform

Scientific Projects

Horizon Europe
Connecting European Facilities
Interreg
European Urban Initiative

Academia and Education

Scientific Training
Higher Level Training
Academic career acceleration

Multi-purpose funding



Head of Project: Municipality of Taranto
Funding: € 12.299.834,46
Co-Funding: € 1.572.095,75
Duration - 24 Months

Technology Transfer

- Scientific Validation of ideas
- Intellectual Property protection
- Training from Lab to Market approach

Public Administration Acceleration

- Implement AI and other technologies in AP
- Scientific Methods in management
- Increase literacy of human resources

Enterprises Acceleration

- Increase scientific Knowledge
- Accelerate prototypes and ideas
- Support to make achievable business plan

Partners

6 Research Institution (UniBa, PoliBa, ISS, IRCCS De Bellis, UniSalento, CNR, Asl Taranto)
9 Health and Environment Public Institutions
11 Enterprises and Start-up
2 Tech Competence Center (ARTES 4.0, MEDiTECH 4.0)
2 Case delle Tecnologie Emergenti (MATERA, BARI)



Partnership



Universities-Research Centers

- Università degli Studi di Bari
- Istituto Superiore di Sanità
- Università del Salento
- Università LUMSA
- Politecnico di Bari

Enterprises and Start-up

- TIM SpA
- Exprivia SpA
- Links Management and Technology Spa
- Item Oxygen Srl
- DeepTrace Technologies Srl
- Digital Innovation Srl
- Tilebytes Srl
- Befreest Srl
- Mathclick Srl
- Errepi Net Srl
- Key Consulting Srl

Other Subjects

- APS PLANET
- MedITech 4.0
- ARTES 4.0
- DTA
- ITS Logistica Taranto
- Jonian Dolphin Conservation
- ASL Taranto
- ARPA Puglia
- IRCCS "Saverio de Bellis»
- Tecnopolis
- Servizio di Sanità Pubblica OdV
- Fondazione MATRIXS

Objectives :

- 1) One Health Intelligence Center: advanced predictive monitoring and processing of human, animal and environmental health and their impact on biodiversity
- 2) Urban Health Clinic : creation of prototypes of 5g-connected smart devices for "near field" monitoring of Urban Health domains
- 3) Dissemination and Training Hub: knowledge transfer and industrial incubation support facility for the budding of high TRL spin offs.

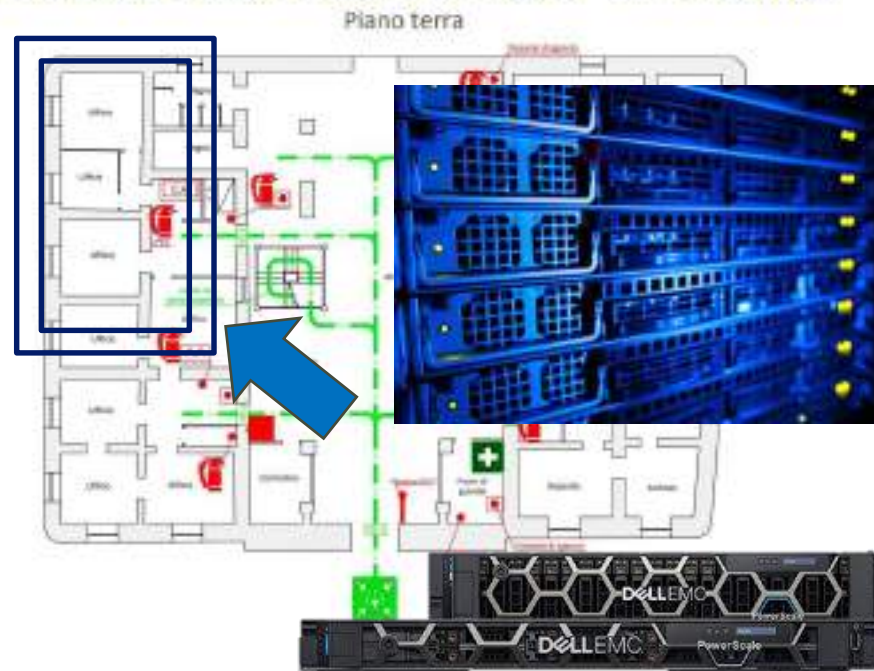


Headquarter: Palazzo di Città (Taranto)

High Performance Computing (HPC) e One Health Intelligence HQ

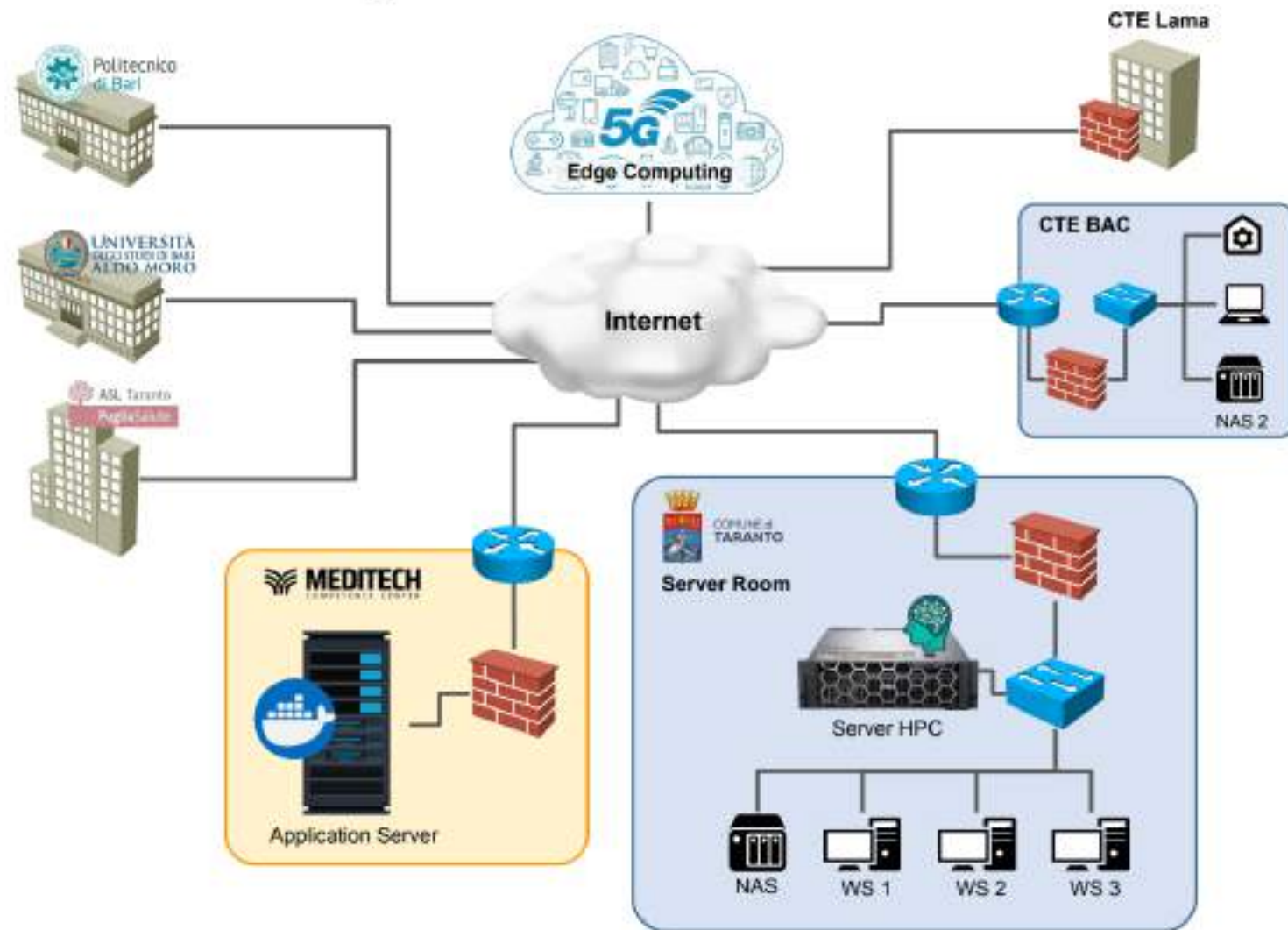


Palazzo di Città, Piazza Municipio - Taranto (Ta)



One Health Data-Space

- Total interoperability between the participants
- Open EU network for Open Data FIWARE
- Rapid query for big data and open VM for elaboration of these data



Occupational and Environmental Health Clinic

“Lotto” 2D Ex-BAC : Municipality of Taranto

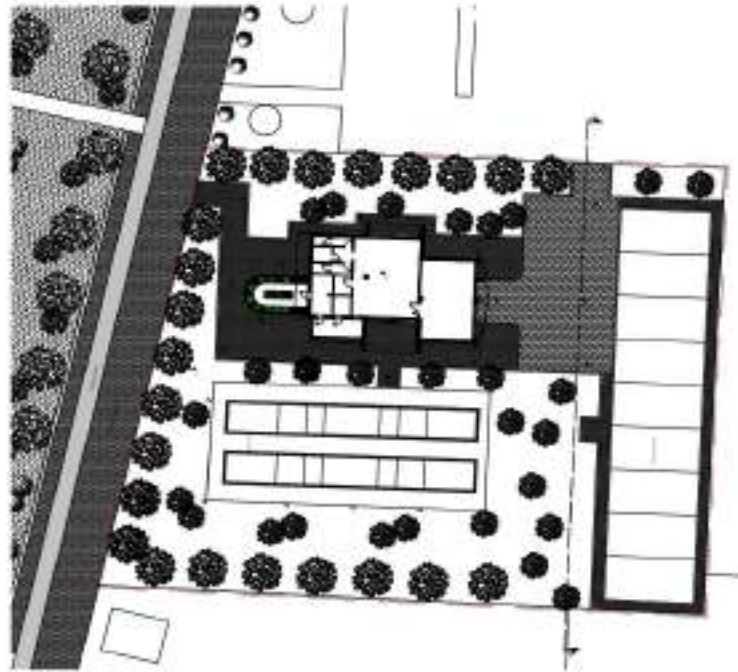


One-Health Living Lab

EX CPA - LAMA – Circonvallazione dei Fiori



- 1) Specific facility for experimental technology development of new electronic technologies applied to One-Health disruption prevention objectives
- 2) The first Drone Academy and training center for experimental bio-monitoring campaign on sea and lands



CALLIOPE Air-Sentinel 1



- **Air Quality** : O₃, CO, SO₂ , NO₂ , PM1, PM2.5, PM10, Temperature, Pressure air and Humidity, Black Carbon
- **Light Pollution**: optical radiation and blue light
- **Noise**: filtered Spl in dBA (38 to 143)
- **LIDAR**: laser scan for building mapping
- **cmosCAM**: biodiversity capturing and modeling
- **Radon daughters** : high-resistivity-silicon BJT detector for 3 min alpha decay log



New One Health Prototypes



1) Animal Health Smart Devices



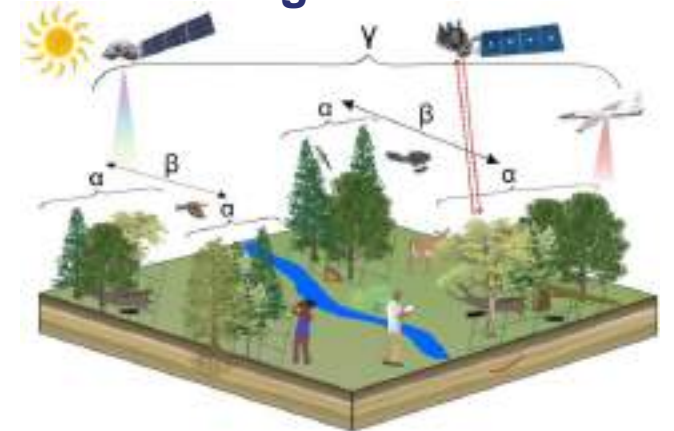
2) OneHealth Biobank



3) Integrated Human-Health Monitor



4) Dynamic Biodiversity Monitoring



Occupational Health AI-Enabled Smart Desk



Near-Miss Perennial Survey



Risk-based pre-
analysis screening

Open-perennial
Survey for risk
assessment

Large number reports

Near-miss decision
matrix

Use of machine
learning for pattern
recognition

Use of AI for
counterfactual report

Creation of an
interactive
Recommender System
for Prevention

Deliverable 25: AIO One Health Biometric IoT Sensors



Health Monitoring

- SpO2, BPM, Indirect SBP, ECG , Temperature, actigraphy)
- monitoraggio dell'esposizione ad agenti fisici-chimici esterni (rumore, radiazioni ottiche, radiazioni ionizzanti, VOC)

Outdoor Air Sensors

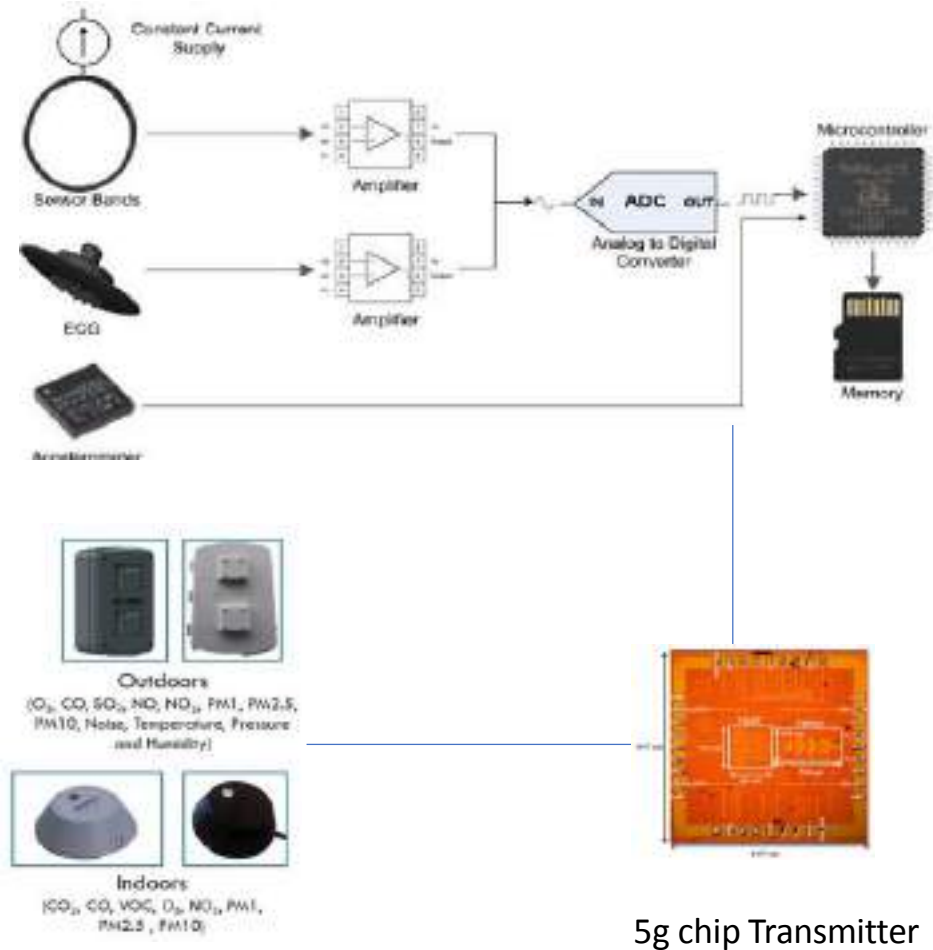
- O₃, CO, SO₂ , NO₂ , PM1, PM2.5, PM10, Noise, Temperature, Pressure air and Humidity, Black Carbon

Indoor Air Sensors

- Black Carbon PM1, PM2.5, PM10, VOC, CO, CO₂

EnvHealth Analytics Platform

- 5g edge to cloud based data stream
- Federated Learning feature engineering and data reduction



TARANTO LOCAL POLICE
HEALTH STUDY

Population and Design

Population :

- n. 150 officers (50 % F)

Inclusion Criteria:

- 1) 25 to 45 y/o
- 2) Police enrollment from at least 2 years
- 3) No major diseases (including pulmonary or neoplasms)



Baseline Exposures

Remote Work Monitoring :

- 1) Wearable All in one Smart Sensors 7 days
- 2) Portable AirSensors



Baseline Assessment

- 1) Physical
- 2) Cognitive
- 3) Behavioural
- 4) Hearing and Vision
- 5) Serum Biomarkers
- 6) GWAS
- 7) Breath analysis

Home Indoor Monitoring :

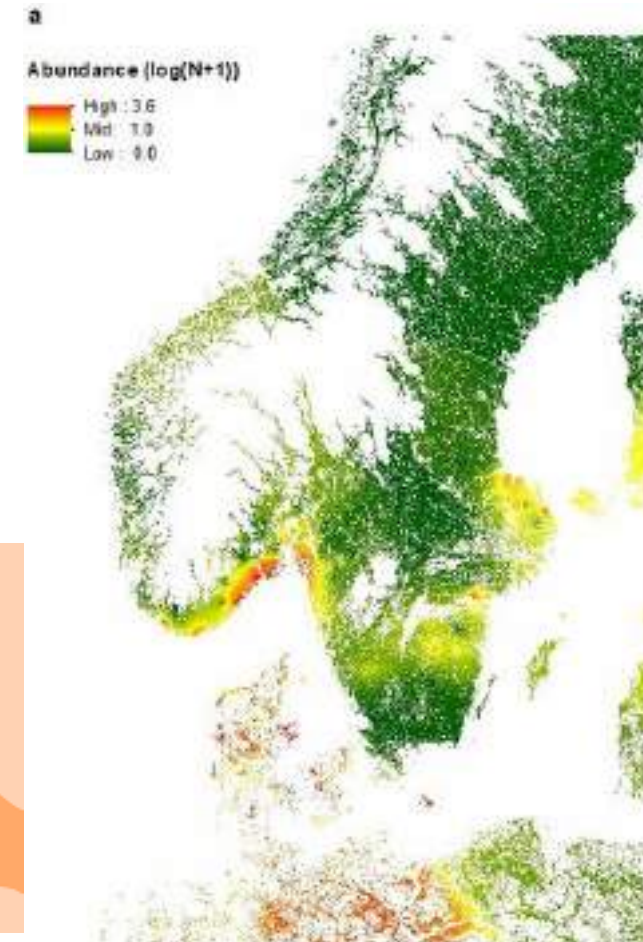
- 1) Indoor air monitoring
- 2) Wearable All in One Smart Sensor 7days

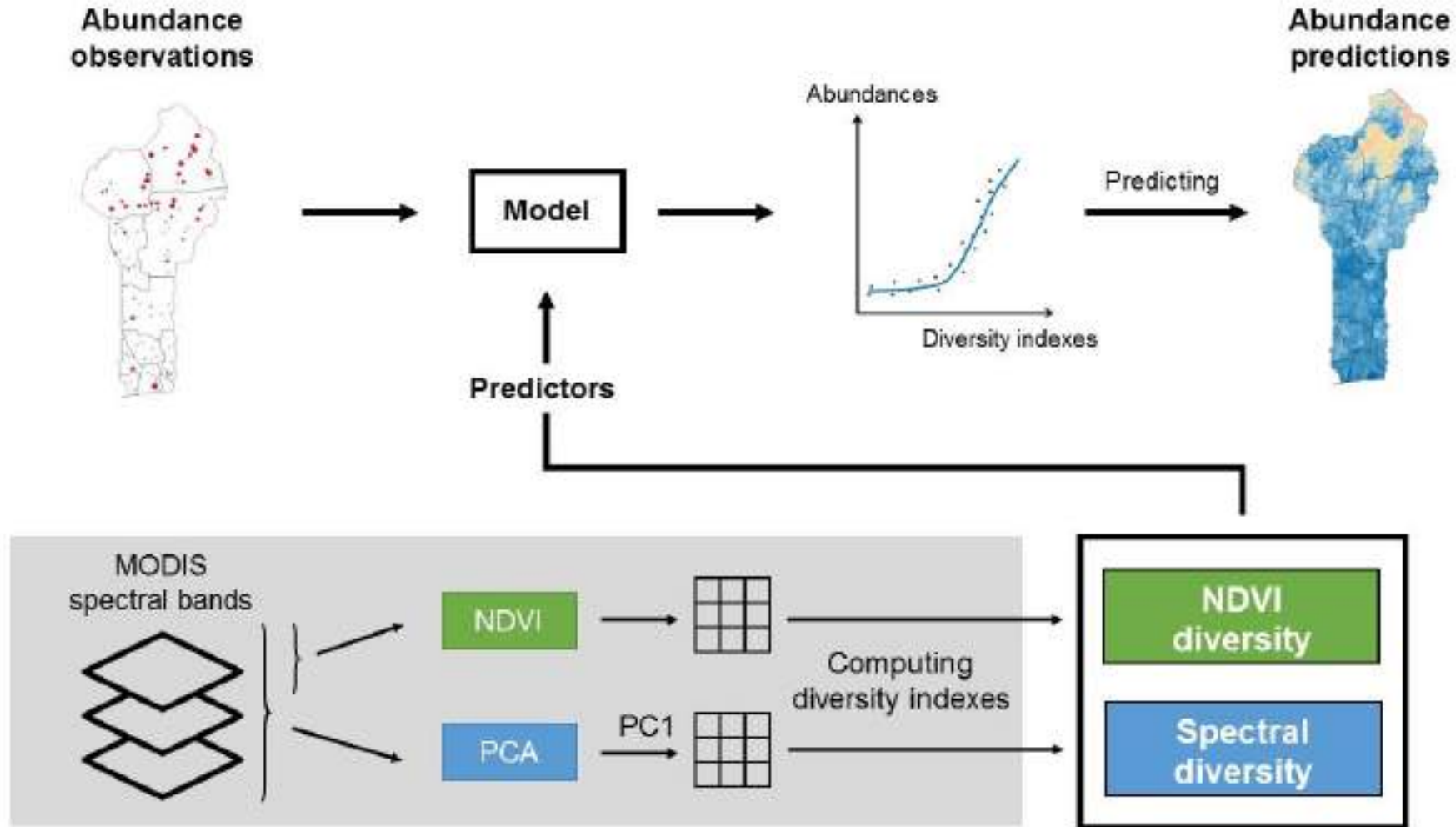
**2 years
Follow-up
Outcomes**

- Secondary data follow-up : acute events
- Primary data follow-up : repete baseline
- Machine learning modeling to assess the risk for chronic diseases
- Cross-sectional association with changes in the baseline

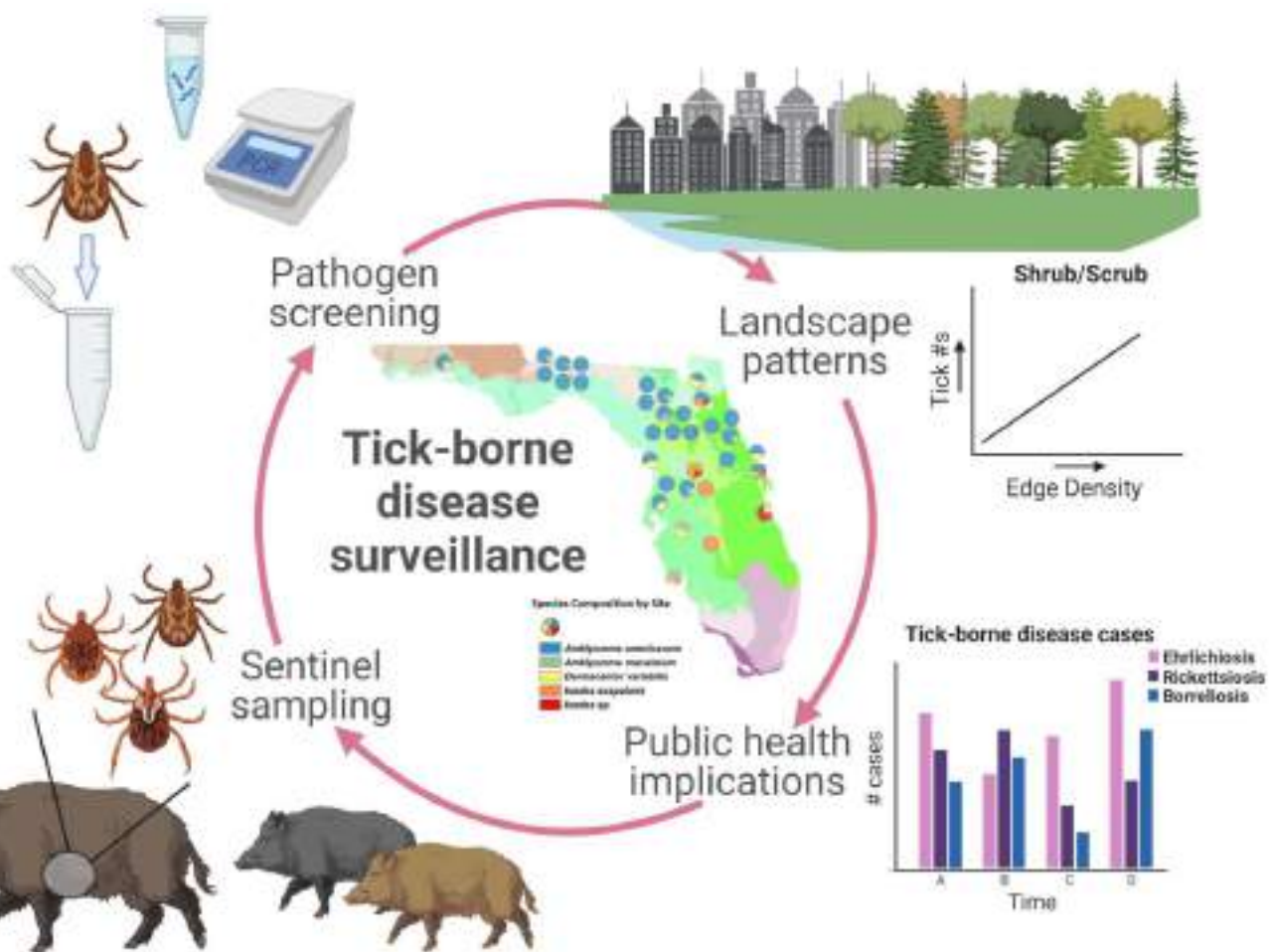
Clinical Biomonitoring of Tickborne Diseases

- Self-assessment survey for screening
- Biomonitoring and creation of a biorepository dedicated to tickborn samples
- Geotracking for observation and classification of biodiversity risk factor for tick species
- Drones for tick sampling





Near-field Tickborne Dragging and Sampling





«**Health professionals** must be powerful advocates for both restoring biodiversity and tackling climate change for the good of health. **Political leaders** must recognise both the severe threats to health from the planetary crisis as well as the benefits that can flow to health from tackling the crisis»