European Union Reference Laboratory for Parasites
Unit of Foodborne and Neglected Parasitic Diseases
Department of Infectious Diseases
ISTITUTO SUPERIORE DI SANITÀ

20th Workshop of the National Reference Laboratories for Parasites
28-29 October 2025

POCCHIARI room
(Lecture theatre; Viale Regina Elena 299)
Department of Infectious Diseases
ISTITUTO SUPERIORE DI SANITÀ

One Health and Parasites

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WHO Collaborating Centre for Diagnosis of Intestinal Helminths and Protozoa

Dipartimento Medicina Veterinaria Produzioni Animali

Centro Regionale Monitoraggio Parassitosi
CREMOPAR

SOIPA
Società Italiana di Parassitologia

ITALIAN NETWORK on Neglected Tropical Diseases
IN-NTD

We support the Sustainable Development Goals

Outline

- One Health in a multi-actor perspective
- One Health and Parasitic Diseases
- Geospatial Health and Artificial Intelligence
- Case Studies
  - ✓ *Echinococcus granulosus (ECHINO-SAFE-MED Project)*
  - ✓ *Fasciola hepatica* and ticks *(PREPARE4VBD Project)*

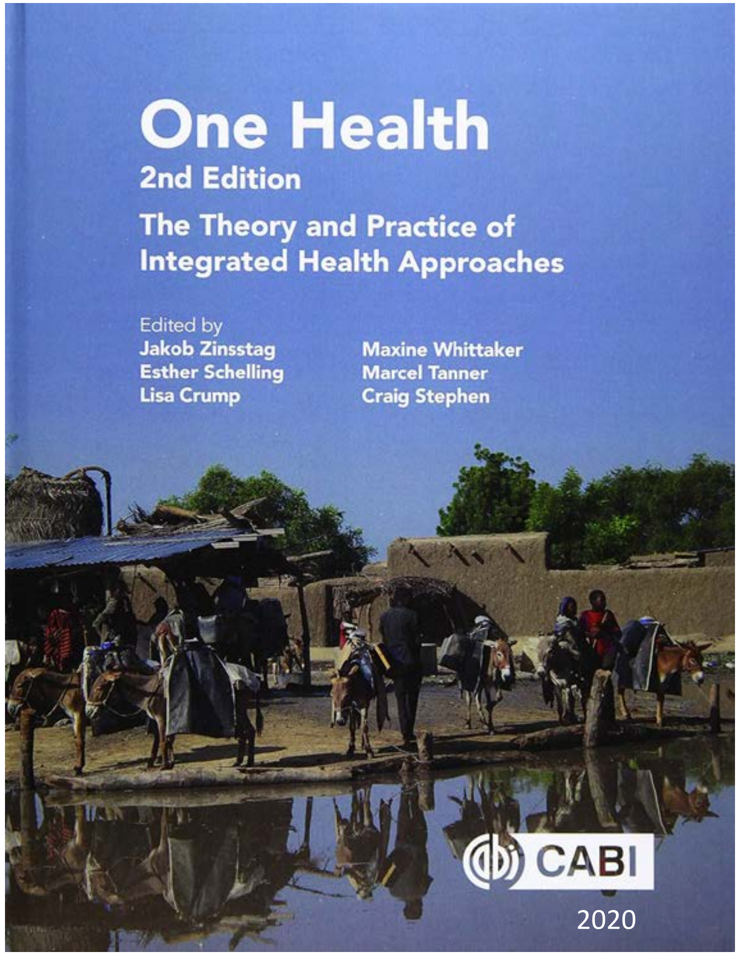
UNIVERSITY OF NAPLES FEDERICO II

SCHOOL OF AGRICULTURAL SCIENCES AND VETERINARY MEDICINE

DEPARTMENT OF AGRICULTURE SCIENCES

Department of Veterinary Medicine and Animal Production

The mission of the **Department** is to transfer advanced knowledge in the field of veterinary medicine, animal production, food safety and public health in line with concepts of **One Health** and innovative and precision technologies



Box 2.3. Summary of theoretical issues of One Health.

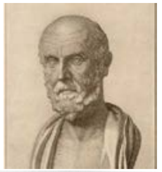
One Health can be defined as any added value in terms of health of humans and animals, financial savings or environmental services achievable by the cooperation of human and veterinary medicine when compared to the concepts of approaches of the two medicines working separately.

- One Health inevitably sheds light on the human–animal relationship and bond. It should reflect on the normative aspects (values) of the human–animal relationship with emphasis on improving animal protection and welfare in an inter-cultural context.
- One Health studies declare the perspective, i.e. the social, cultural and religious background, from which the human–animal relationship is seen. Improving animal welfare remains a permanent challenge to any effort and ethical aspiration of One Health.
- One Health engages with the public in a transdisciplinary way, considering all forms of academic and non-academic knowledge for practical problem solving at the animal–human interface. The strongest leverage of One Health can actually be observed when it is applied to practical societal problem solving.
- One Health approaches are embedded into ecohealth conceptual thinking, which are further expanded to ‘Health in Social-Ecological Systems’ (HSES) addressing complex issues of human–environment systems.

One Health from ancient times…

The concept of **One Health** can be traced back to ancient civilizations such as Egypt and Mesopotamia. The **Papyrus of Kahun** (ca. **1800 BC**) documents concerns with both **human and animal diseases**, indicating an early awareness of interconnected health.

One Health from ancient times…



The bridging of human and animal health in the **Greek and Roman** periods was recorded by **Hippocrates and Galen**.

Giovanni Lancisi (Rome, 1654-1720) **pioneered public health preventive measures by restricting the movement of cattle**. He correlated the presence of mosquitoes and the prevalence of malaria.

The French and the German schools led by **Robert Koch** (Hannover, 1843-1910), joining in the new fields of bacteriology and immunology, identified many **new bacteria in animals and humans**.

1840 - **Rudolf Virchow** coined the term **zoonosis (***Trichinella*, cysticercosis) *“between animal and human medicine there is no dividing line, nor should there be”.*

1873 - Sir **William Osler** was the first to use the term **One Medicine** in the English literature.

2008 - **Calvin W. Schwabe** reintroduced the **One Health** concept in the book *Veterinary Medicine and Human Health.*

The One Health (OH) Way of Thinking

- Promotes an interdisciplinary, cross-sectoral approach to addressing complex issues
- Fosters a nimble, proactive, and flexible way of working
- Focuses on the surveillance, monitoring, prevention, control, and mitigation of emerging diseases
- Recognizes the interconnections between animal, human, and ecosystem health

Multi-disciplinary

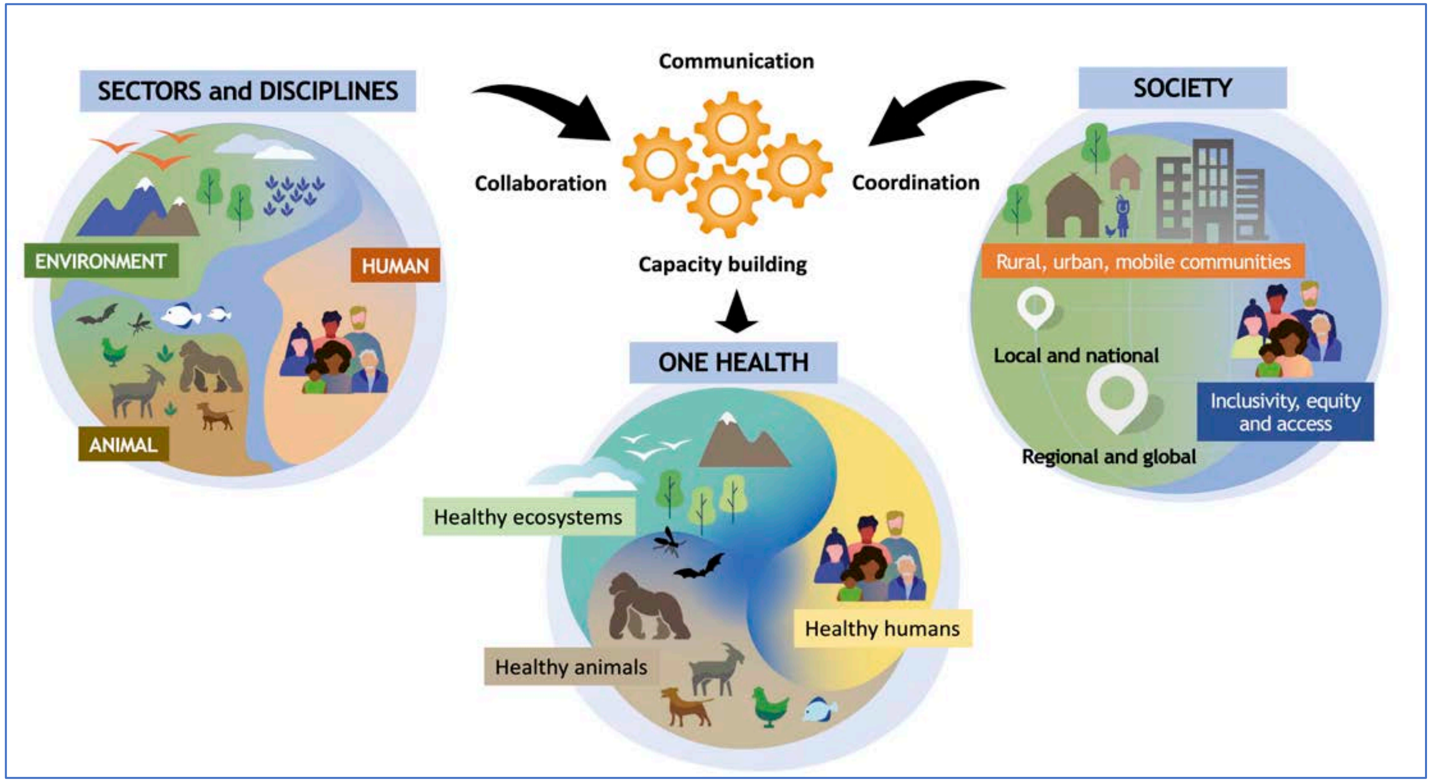
Multi-sectoral

Multi-stakeholder

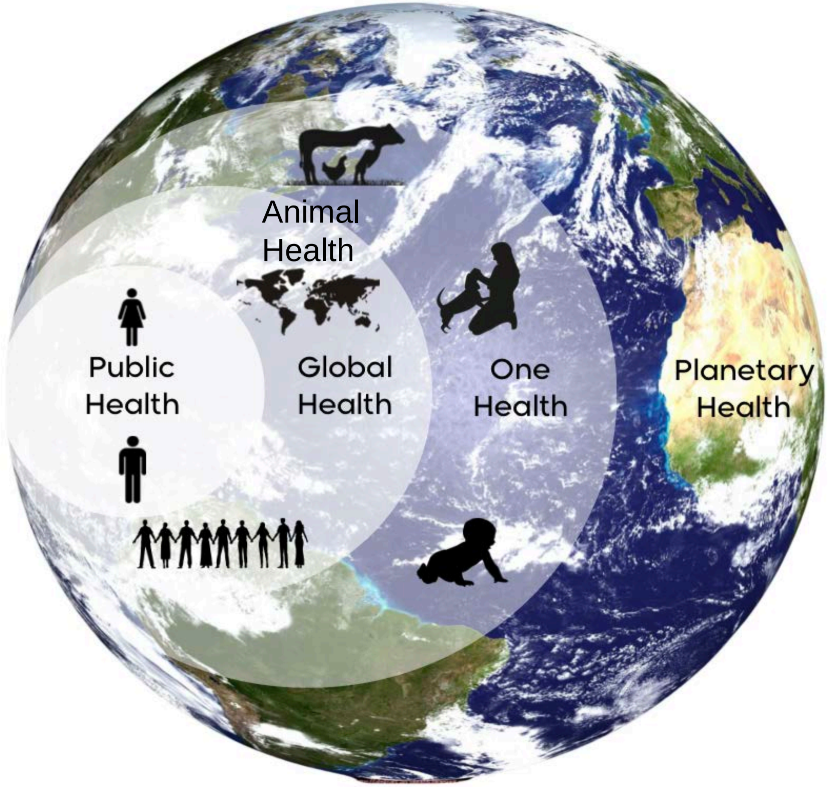
Multi-dimensional

One Health: from Approach to Action

One Health in the 21st century is faced with global challenges and transitions, including climate and planetary health crises, drug resistance, social inequalities, war and conflicts, as well as the burden of diseases.



https://www.who.int/multi-media/details/one-health-definition



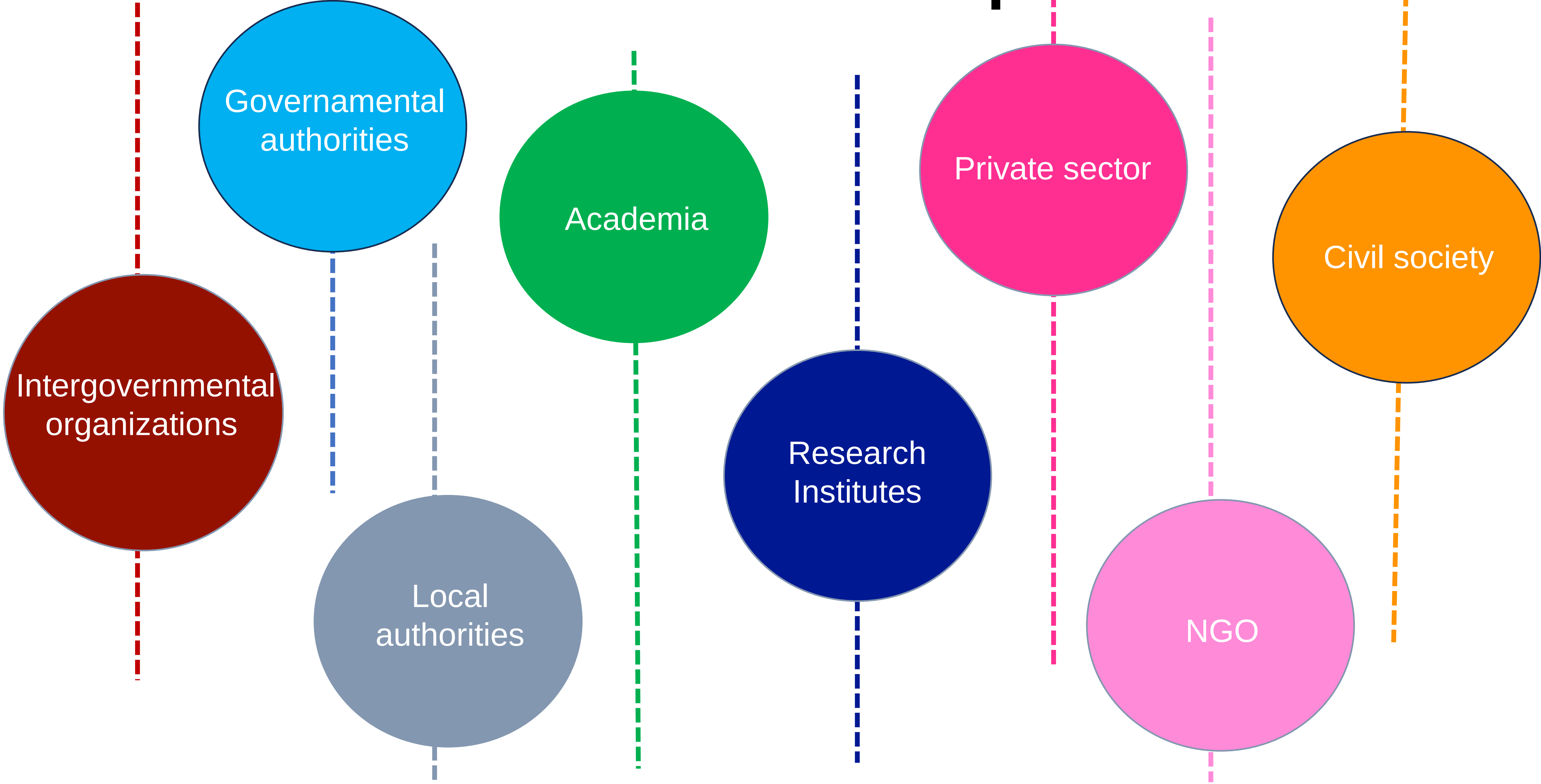
One Health, Global Health and **Planetary Health**

One Health in Action

Community of Practice

Groups of people who share a concern or a **passion for something** they do and learn how to do it better as they **interact regularly** (Lave and Wenger, 1991, 1996)

Stakeholder map



One Health and Parasites: a multi-actor perspective

Intergovernmental organizations
- WHO
- FAO
- WOAH
- UNEP

Local Authorities
- Healthcare services
- Local Health Authorities

Private sector
- Pharmaceutical companies
- Diagnostics companies
- Private laboratories

Civil society
- Local communities
- School-aged children
- Citizens

Governamental authorities
- MoH
- MoE
- MoR
- WHOCC

Academia
- Faculty of Medicine
- Clinicians
- Parasitologists
- Pathologists
- Epidemiologists
- Statisticans

Research Institutes
- National Ref Labs

NGO
- NTD-NGO Network (NNN)

World Health Organization | World Organisation for Animal Health (Founded as OIE) | Food and Agriculture Organization of the United Nations | UN environment programme

Quadripartite engagement at the human-animal-ecosystem interface

Pathways of change by the Quadripartite

Pathway 1. Policy, legislation, advocacy, and financing
Pathway 2. Organisational development, implementation and sectoral integration
Pathway 3. Data, evidence and knowledge

https://www.who.int/publications/i/item/9789240059139

One Health and Veterinary Medicine

Key role in detecting and preventing:

- Zoonotic diseases
- Natural and intentional toxicant exposures (e.g., bioterrorism)

Strategically positioned through:

- Direct contact with domestic and wild animals
- Access to efficient diagnostic systems
- Collaboration with regulatory networks in:
  - Animal health
  - Food safety
  - Public health

One Health: emerging issues are bringing us together

Shared Challenges:

- Zoonotic disease threats
- Food safety risks

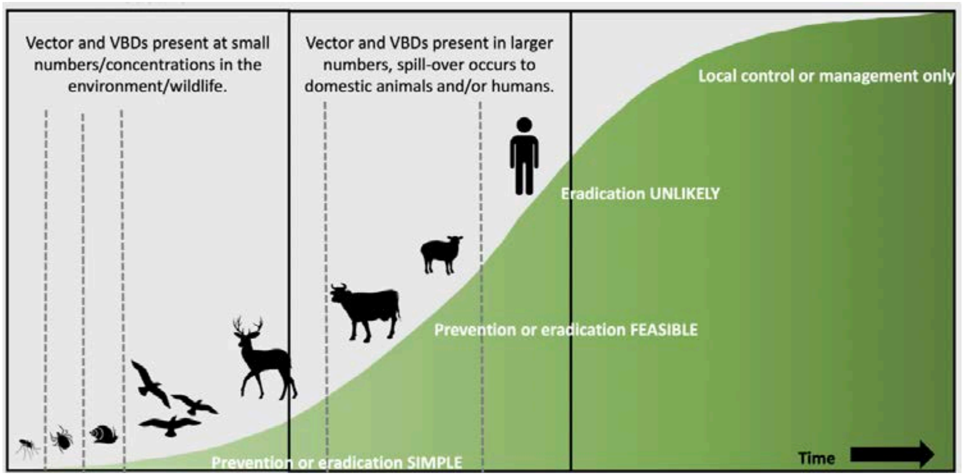
Public interest concerns:

- Animal health, welfare and productivity
- Antimicrobial use in agriculture
- Land and water protection in rural areas

Additional Drivers of Change:

- Evolving environmental, societal, and policy landscapes

On average, a new emerging disease is identified every eight months, with the majority involving multiple species. **Approximately 75% of these emerging diseases are zoonotic**, i.e. transmitted between animals and humans.



OH - Challenges

Databases and **resources** to support information sharing and action in line with a One Health approach

Identification and showcasing of best practice examples for One Health implementation

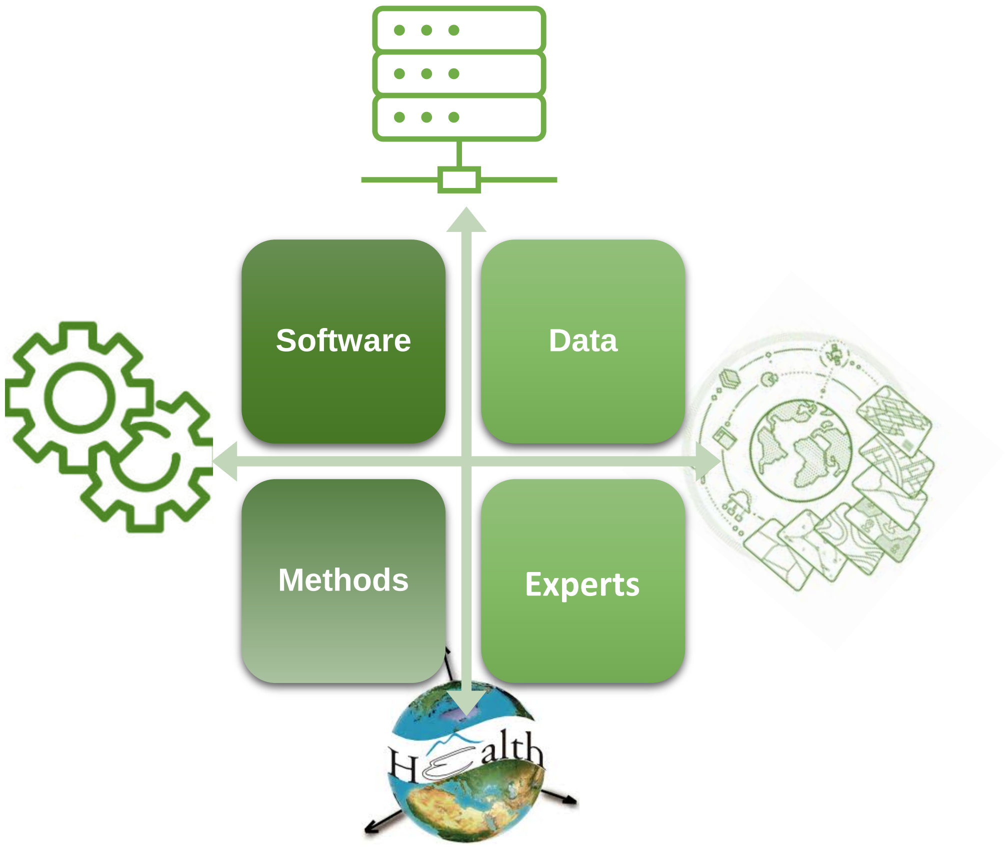
A model for an **integrated One Health surveillance system**

A more complete understanding of the **drivers of spillover of zoonotic diseases**

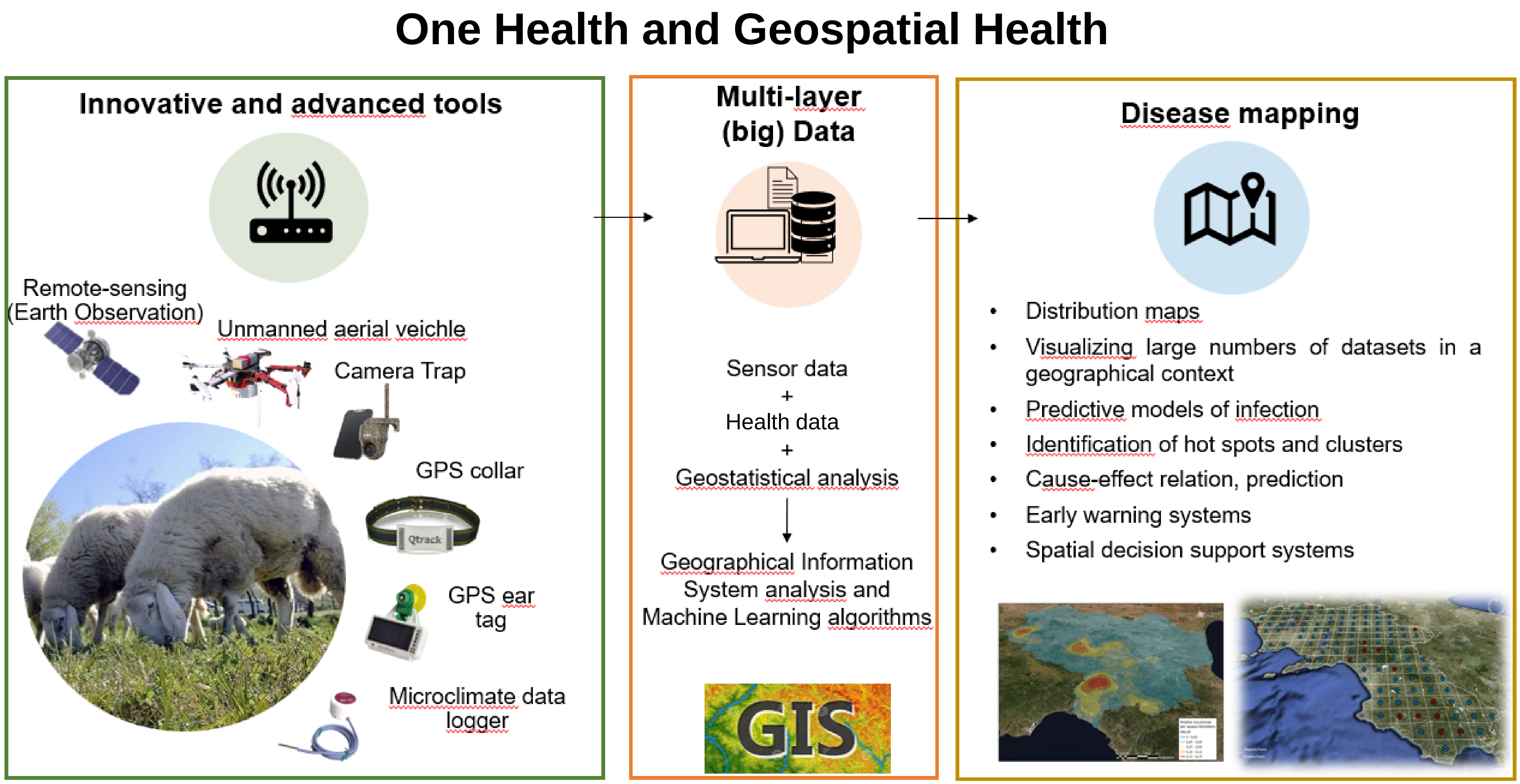
A **standardized approach** for assessing risks of spillover of pathogens between different animal populations and humans

Methods for identifying and reducing spillover risks and spread of zoonotic diseases in ways that minimize trade-offs and maximize co-benefits

One Health applies to a range of methodologies



Geospatial Health: from distribution maps to sophisticated models, geospatial artificial intelligence and digital health


One Health and Geospatial Health
Innovative and advanced tools
Remote-sensing
(Earth Observation)
Unmanned aerial veichle
Camera Trap
GPS collar
Qtrack
GPS ear
tag
Microclimate data
logger
Multi-layer
(big) Data
Sensor data
+
Health data
+
Geostatistical analysis
Geographical Information
System analysis and
Machine Learning algorithms
GIS
Disease mapping
Distribution maps
Visualizing large numbers of datasets in a geographical context
Predictive models of infection
Identification of hot spots and clusters
Cause-effect relation, prediction
Early warning systems
Spatial decision support systems

Unmanned Aerial Vehicles (UAV = Drones) in Parasitology:
capturing habitats suitable for parasites and vectors

Detail of the ground's surface (~2–10 cm resolution). Individual water body features can be readily identified and mapped along side with ancillary information.

SPACE
&
TIME

Detailed ecological and environmental data at high spatio-temporal resolution

Hardy A, Adv Par, 2024

Artificial intelligence (AI) and machine learning (ML) are reshaping One health research and practice

Epidemiology and Disease Forecasting

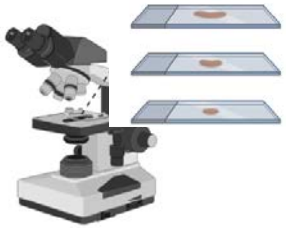
Combines climate sensing, epidemiological history

- Handling big data
- Early warning systems
- Aid in better preparedness

Drug Discovery

New target identification, novel drug and drug repurposing

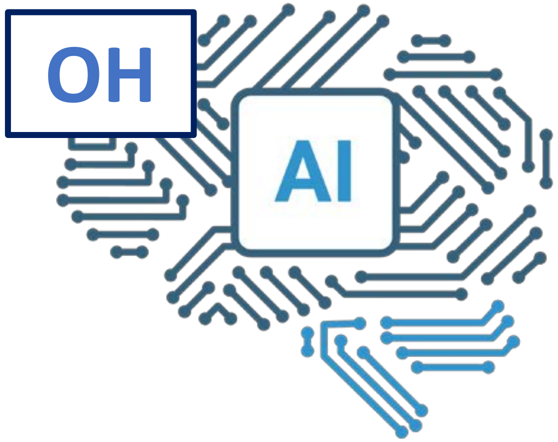
- Rapid screening of targets and compounds
- Higher efficiency and accuracy

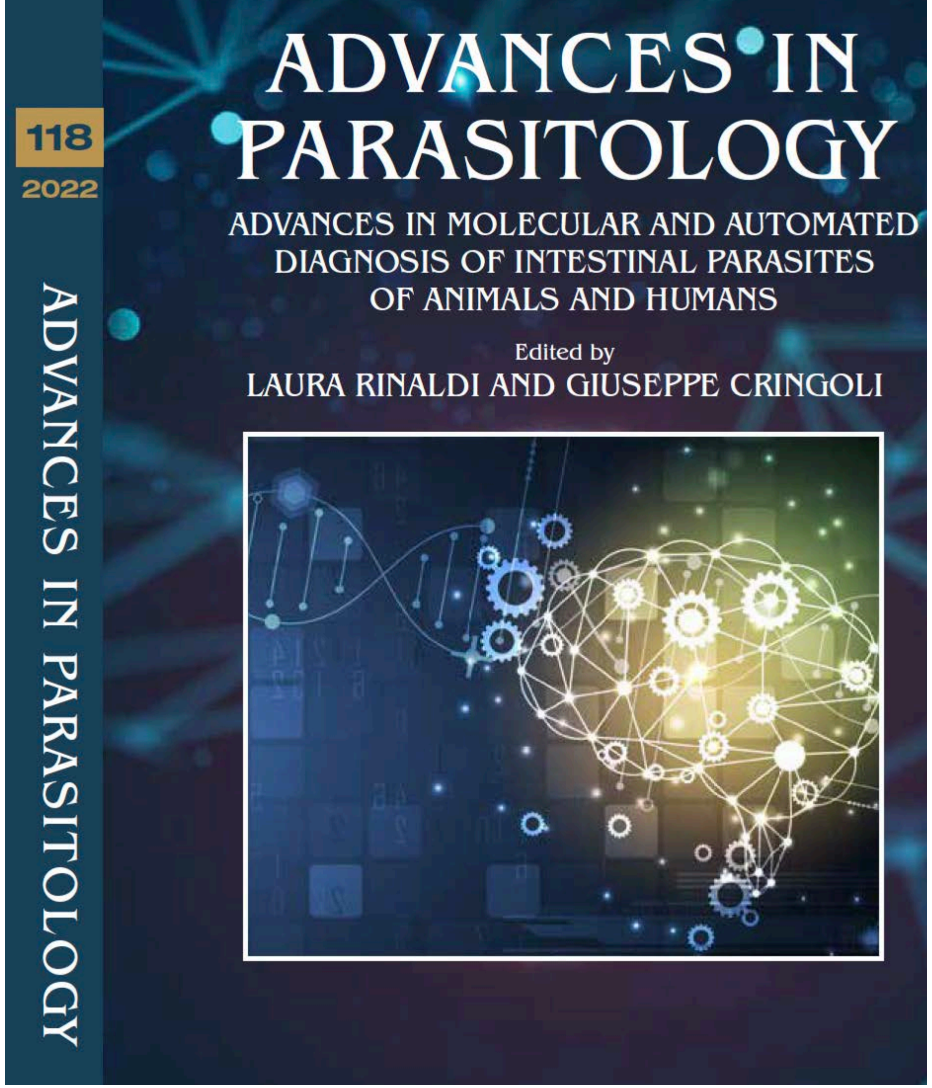


Diagnostics

Machine Learning and Deep Learning algorithms
to train large datasets in microscopy image analysis

- Higher sensitivity and specificity
- Smartphone application
- Implementation at resource poor setting





High throughput diagnostics - e.g. molecular/proteome platforms and automated systems for **parasite egg counts based on AI** – will improve diagnosis of parasitic infections.

Trends in Parasitology

July 2024, Vol. 40, No. 7 https://doi.org/10.1016/j.pt.2024.05.005

CellPress

Review

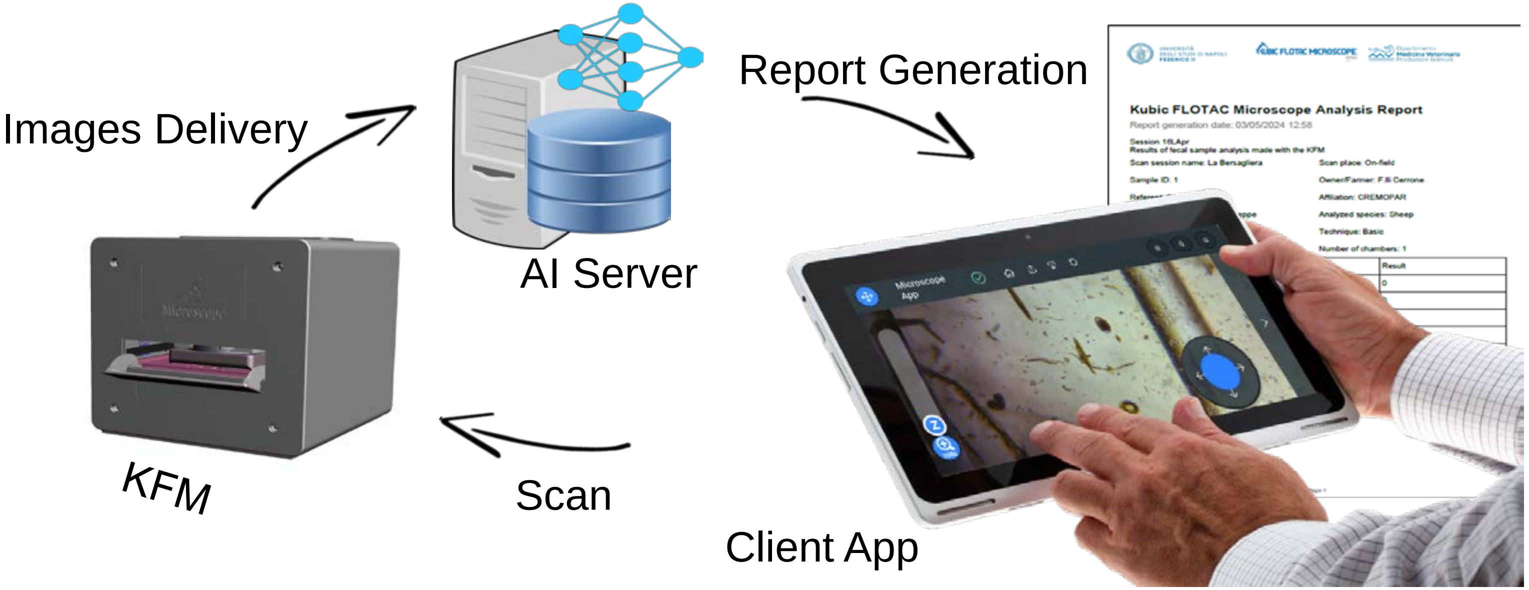
AI-powered microscopy image analysis for parasitology: integrating human expertise

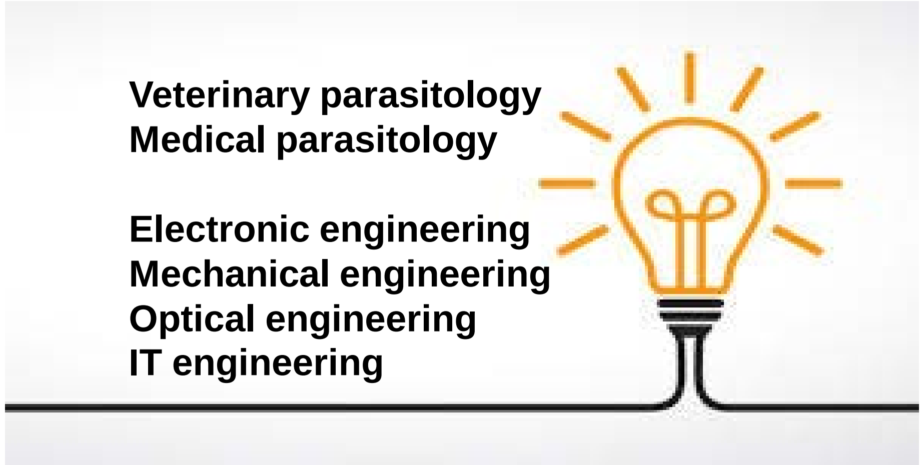
Ruijun Feng[1,2], Sen Li[1], and Yang Zhang[1,*]

*Supervised learning **depends on parasitologists** to label parasitic stages and instruct the deep learning (DL) models. The neglect of human expert knowledge from parasitologists hinders them from achieving optimal performance.*

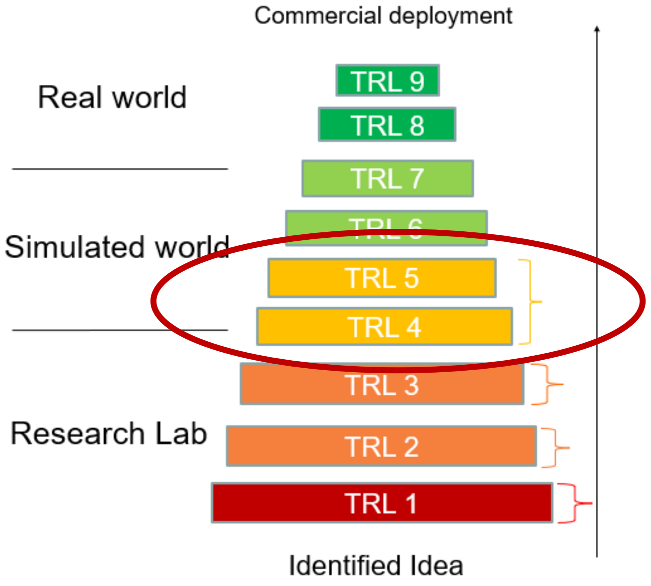
*The integration of **quantitative and qualitative knowledge from parasitologists** plays a pivotal role in refining the performance of DL models.*

Technological innovations and digital transition: from smartphone-assisted diagnosis to Artificial Intelligence





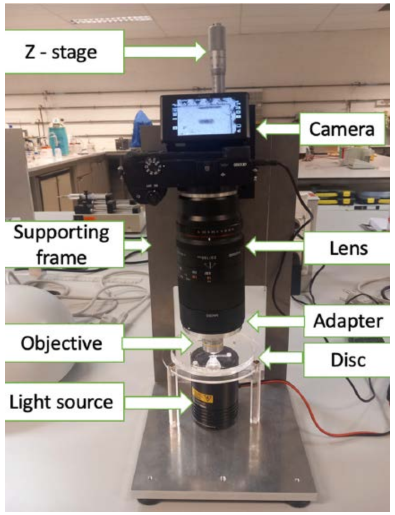
Technology Readiness Level (TRL) of automated copromicroscopic techniques based on AI



PROTOTYPE

5 TECHNOLOGY VALIDATED IN RELEVANT ENVIRONMENT - LARGE SCALE PROTOTYPE

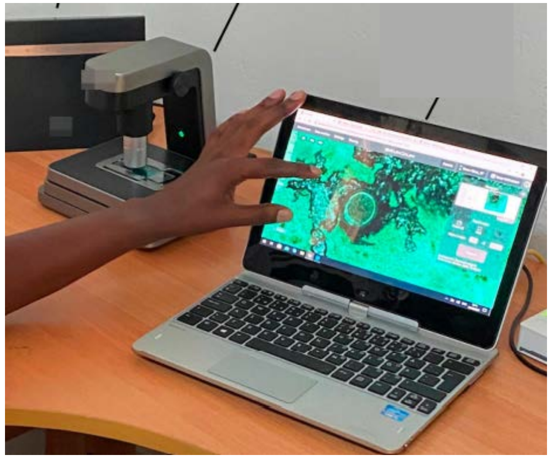
4 TECHNOLOGY VALIDATED IN LAB – SMALL SCALE PROTOTYPE



Lab-on-disk platform
(Sukas et al., Micromachines, 2019; Misko et al., Micromachines, 2023)

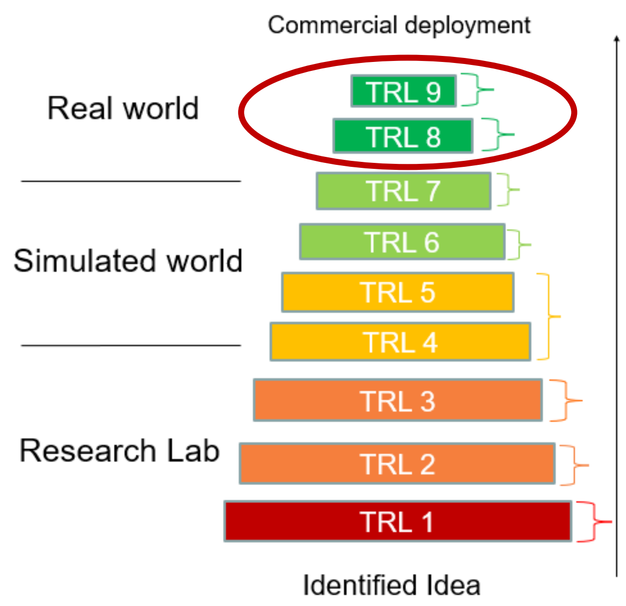
Automated Diagnosis of Intestinal Parasites (DAPI)
(Inacio et al., Pathogens, 2020; Inacio et al., Front Vet Sci, 2021)

Kubic FLOTAC Microscope (KFM)
(Cringoli et al., Parasitology, 2021; Capuozzo et al., Front Artif Intell, 2024)



Digital diagnostic system for STHs
(Lundin et al., PLoS Negl Trop Dis, 2024)

Technology Readiness Level (TRL) of automated copromicroscopic techniques based on AI



Human parasitology

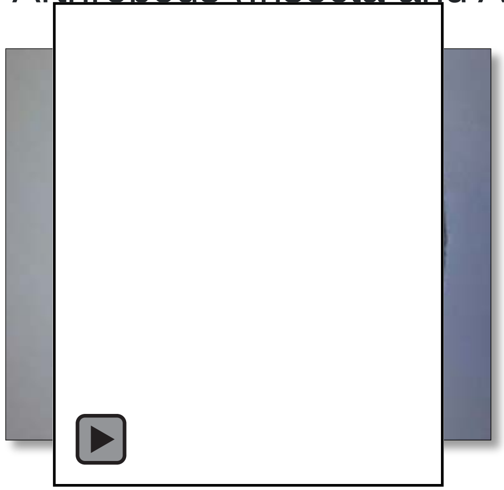
FIRMER

Veterinary parasitology

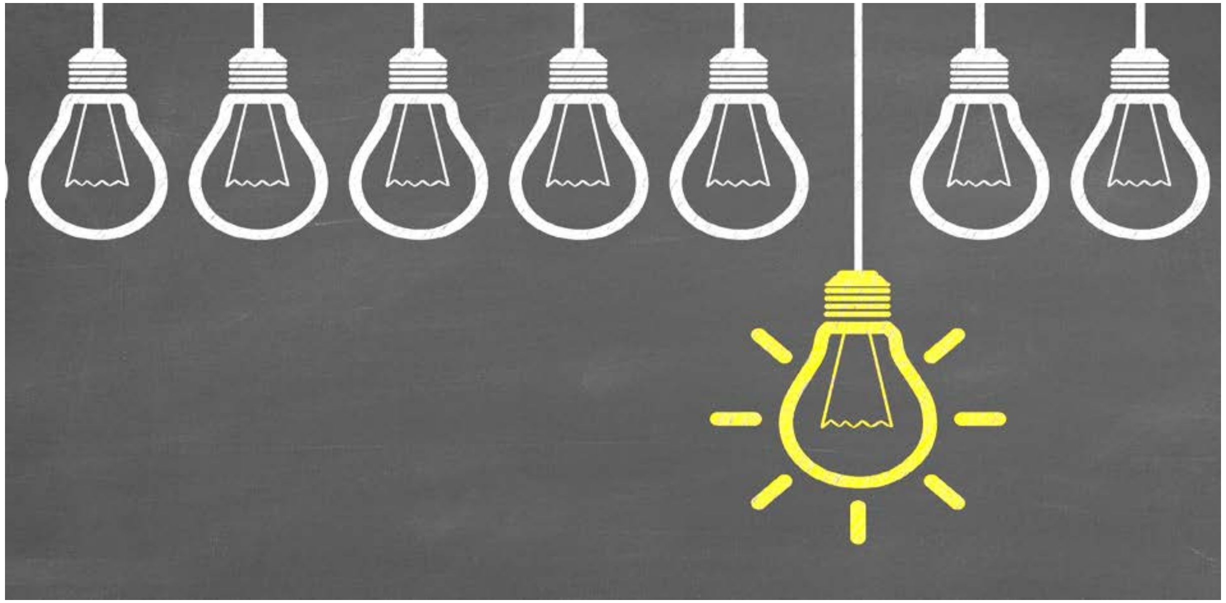
The Wonderful World of PARASITES

Ötzi - the Iceman

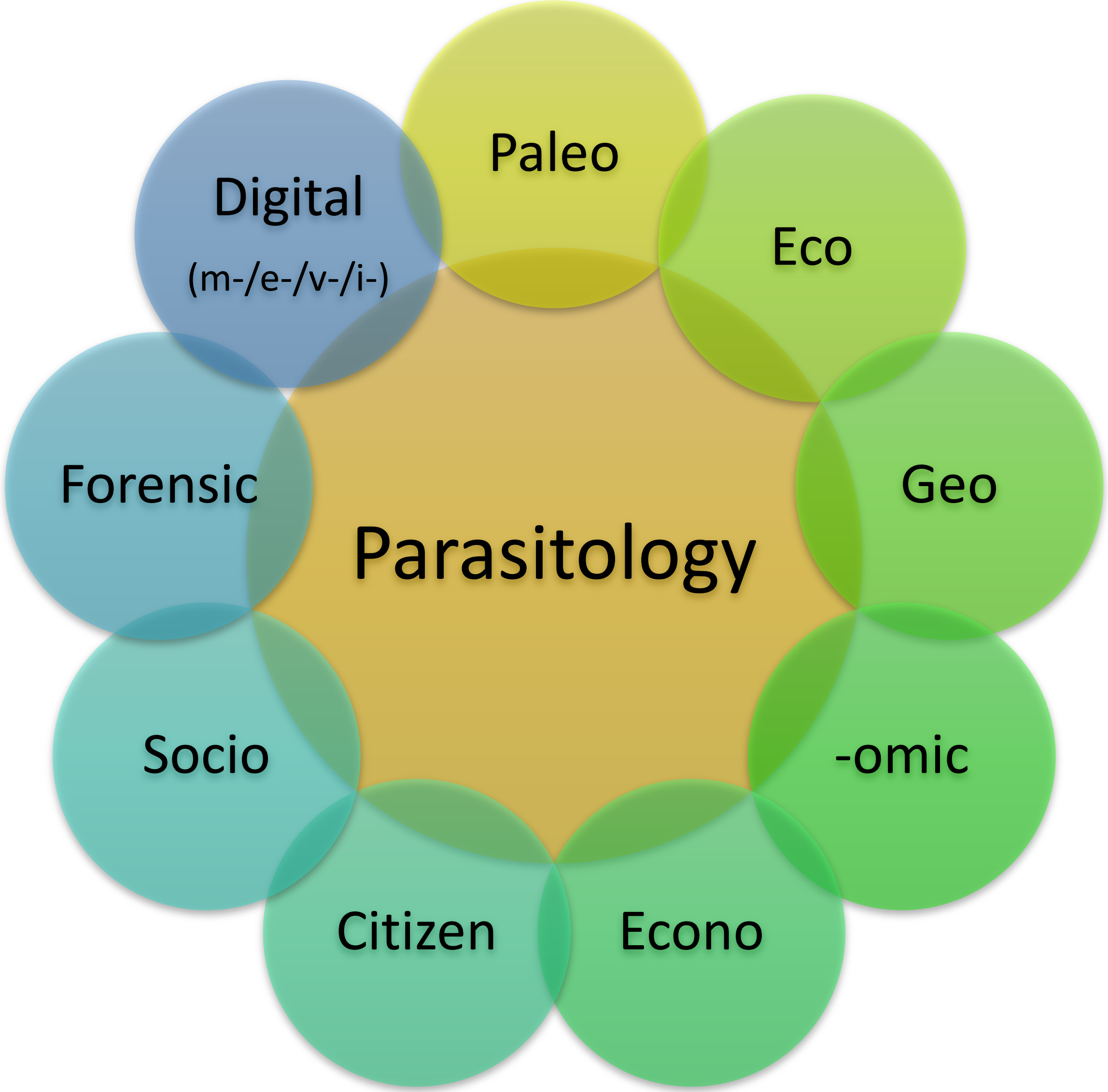
Protozoa, Helminths (Nematoda, Trematoda, Cestoda), Arthropods (Insecta and Aracnida)



PARASITOLOGY



Proactive synergies between public health and other disciplines (e.g., ecology, geoinformatics, information technology, genomics, proteomics, bioinformatics, social and economic sciences, etc.)



The 2030 agenda of parasitology is exciting, challenging and globally relevant (Stothard et al., Parasitology, 2018).

Parasitic diseases and zoonosis

Wildlife

Companion animals

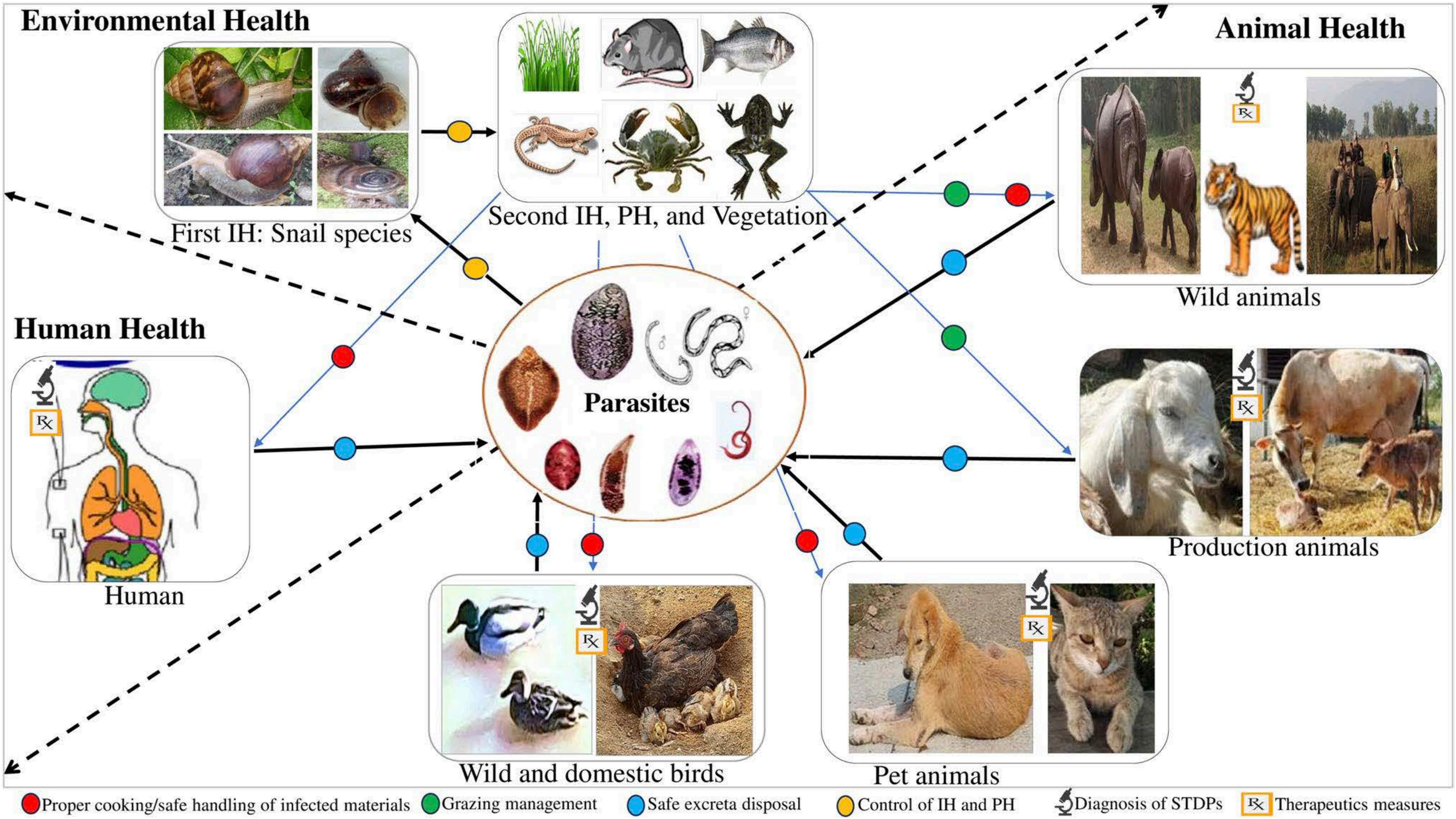
Livestock

Multiple routes of transmission to human and animal hosts, for example through food (meat, fish, fruit, vegetables), water, soil, vectors (snails, insects, ticks)

Some parasites are specific for humans and animal species some other are zoonotic (can infect both animals and humans)

Zoonosis
ζῷον (zōion) → *animal*
νόσος (nosos) → *disease*

Antropozoonosis
ἄνθρωπος (anthrōpos) → *human*
ζῷον (zōion) → *animal*
νόσος (nosos) → *disease*



Environmental Health
Animal Health
Human Health
First IH: Snail species
Second IH, PH, and Vegetation
Wild animals
Production animals
Parasites
Human
Wild and domestic birds
Pet animals
Rx
Proper cooking/safe handling of infected materials
Grazing management
Safe excreta disposal
Control of IH and PH
Diagnosis of STDPs
Therapeutics measures

One Health and Parasitic diseases

NEGLECTED TROPICAL DISEASES : most of them caused by parasites

Helminth NTDs:
- Taeniasis/Cysticercosis
- Guinea worm disease
- Echinococcosis
- Foodborne trematodiases
- Lymphatic filariasis
- Soil-transmitted helminthiases
- Schistosomiasis
- Onchocerciasis

Protozoan NTDs:
- Chagas Disease
- Leishmaniasis
- Human African Trypanosomiasis

Fungal NTDs:
- Mycetoma, chromoblastomycosis and other deep mycoses

Viral NTDs:
- Rabies
- Dengue & Chikungunya

Bacterial NTDs:
- Buruli Ulcer
- Leprosy
- Trachoma
- Yaws
- Noma

Non-infectious diseases or conditions:
- Snakebite envenoming

Ectoparasitic NTDs:
- Scabies and other ectoparasites

One Health case study:
ECHINOCOCCUS GRANULOSUS (Cystic Echinococcosis)

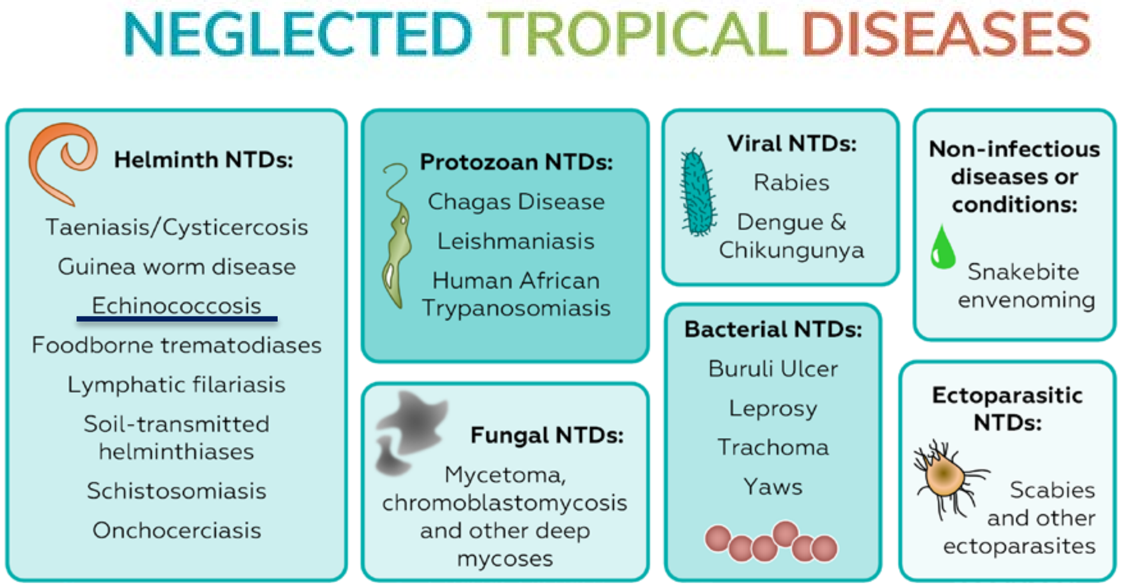
World Health Organization

World Organisation for Animal Health
Founded as OIE

Food and Agriculture Organization of the United Nations

efsa
European Food Safety Authority

Small tapeworm (Cestoda)

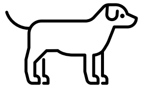


CE is one of 21 NTDs which are included in the WHO's (2021–2030) roadmap

…but still neglected and undereported by national health systems…

Echinococcus granulosus:

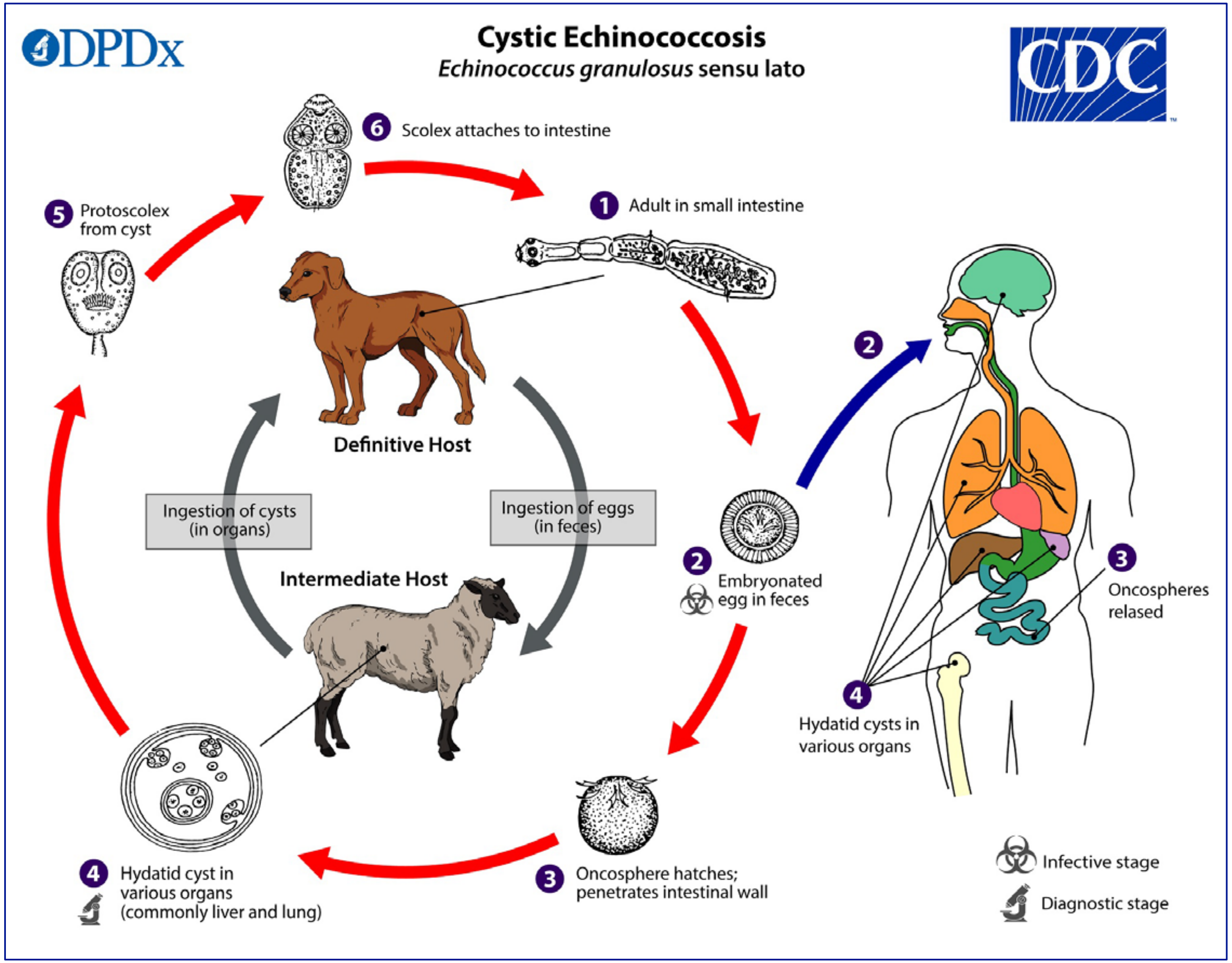
a multi-host parasite

Definitive hosts = canids 


Adult and egg of *E. granulosus*

Intermediate hosts = ruminants, pigs, equids, human


Hydatid cysts



Impact of CE on human health

- Annual global burden at **19,300 deaths**
- Approximately **871,000 disability-adjusted life years** (DALYs)

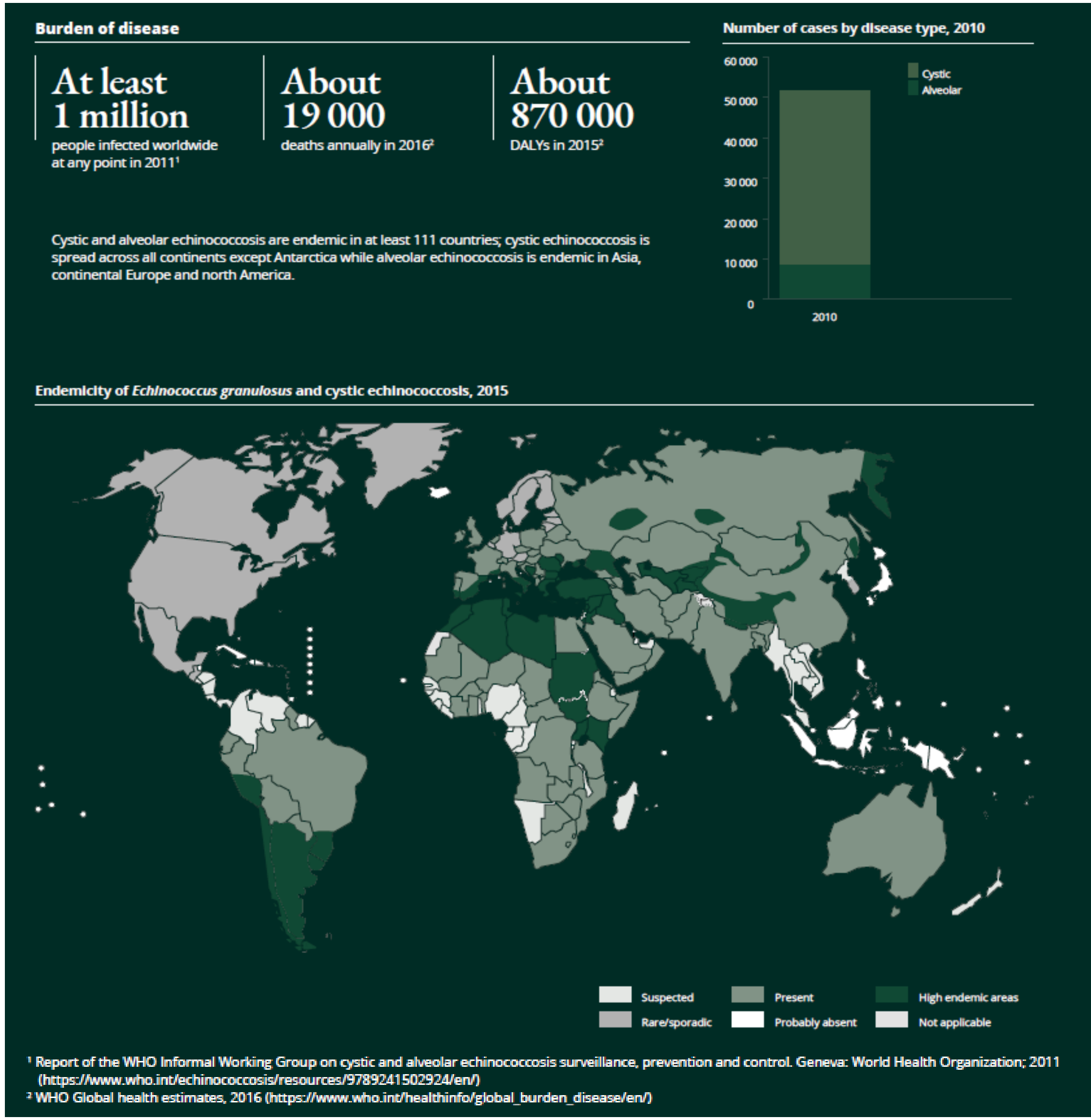
Impact of CE on the livestock industry

- Quality of **meat**, **milk** and **wool** affected
- Reduced **birth rate**
- Delayed **performance** and **growth**
- Post-mortem rejections of **infected organs** at slaughtering

Impact of CE on global economy

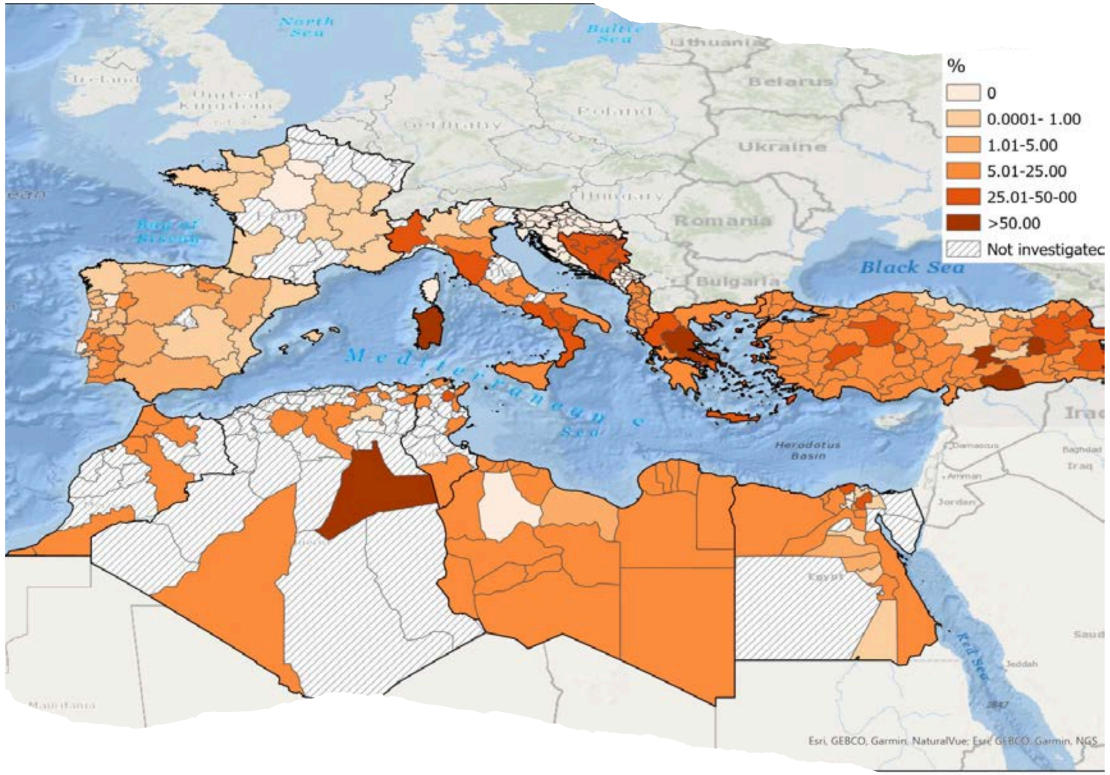
- The total **annual cost** of CE is estimated at **3 billion US dollars**, including costs to humans and livestock

(WHO, 2020, 2021)



Cystic Echinococcosis has a worldwide distribution with **high prevalence in** communities where pastoral activities predominate, as **the Mediterranean areas**

CE in intermediate hosts (ruminants)



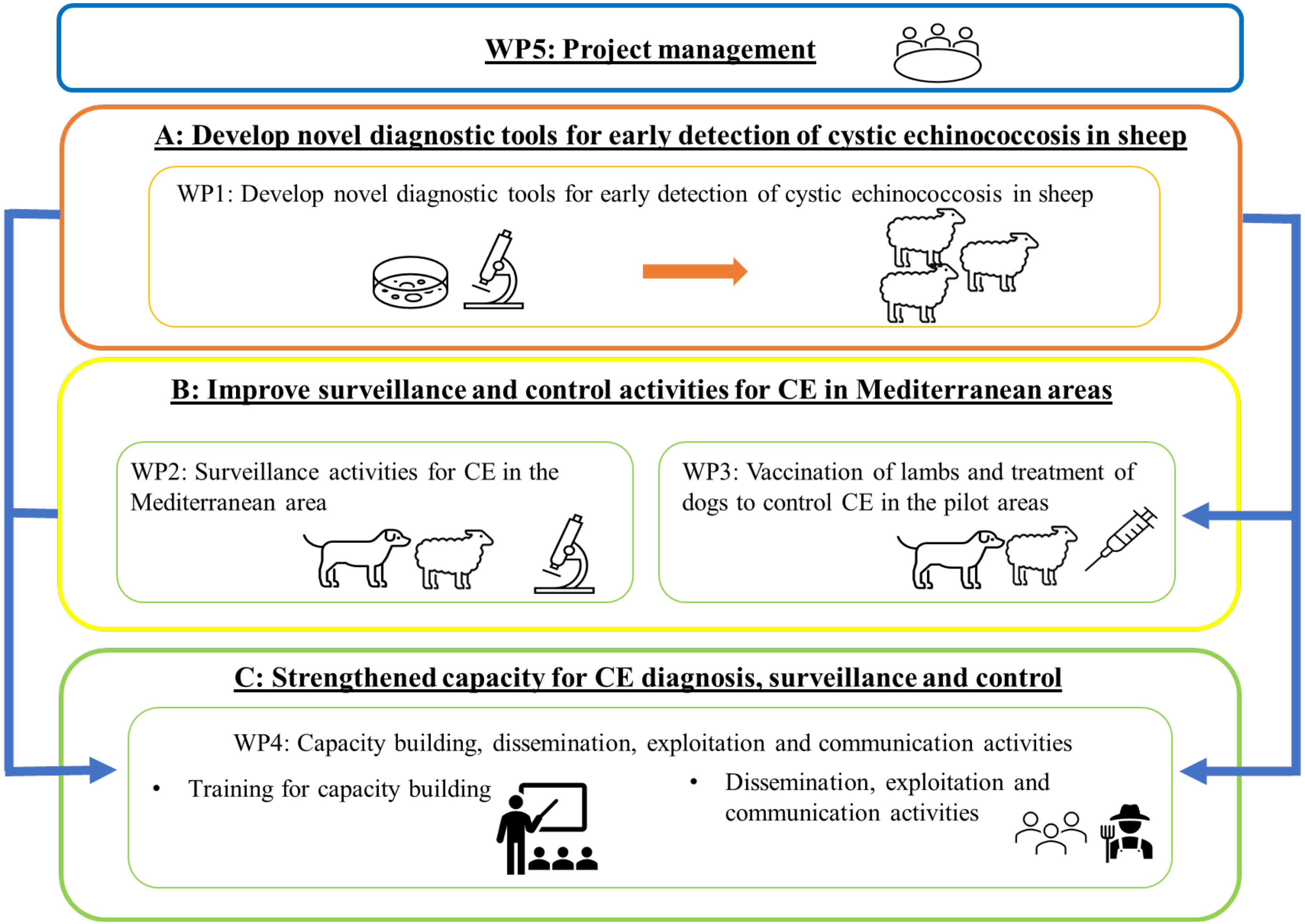
PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

ECHINO SAFE MED

New sustainable tools and innovative actions to control cystic **ECHINO**coccosis in sheep farms in the **MED**iterranean area: improvement of diagnosis and **SAFE**ty in response to climatic changes

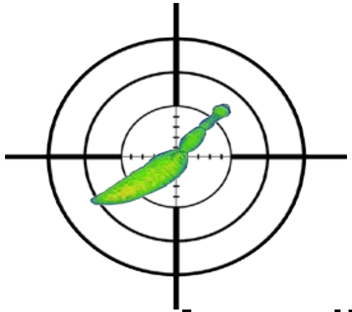
Consortium: partners from Europe (IT, FR, GR) and northern Africa (ALG, TUN)

ECHINO-SAFE-MED: PERT diagram



Multi-disciplinary and multi-actor intervention strategies

Problem setting *vs* Problem solving

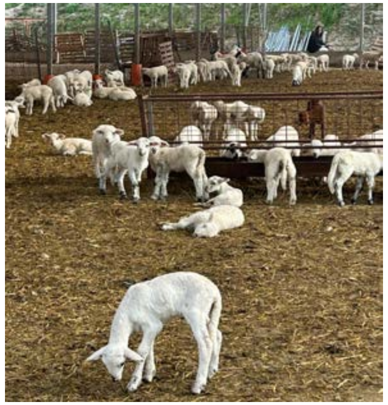


➧**Planning, Attack**, Consolidation, Maintenance

Control *vs* elimination *vs* eradication

One Health

Preparatory → Research → Actions → Impact….



ITALY

ALGERIA

GREECE

TUNISIA

Multi-country

Global problems that requires lo**cal** solutions

GLOCAL global local

Substantial variability in intervention implementation and outcomes across the Mediterranean area

Farm(er)s, financial resources, social factors, health systems, regulation, policies…

Practices towards CE prevention

- 97.7% have **shepherd dogs** in the farm
- 43.8% **treat regularly** the dogs
- 21.0% **slaughter** livestock at **home**
- 53.0% provide **uncooked** animal **viscera** for their dogs
- 44.6% ignore that CE can cause **harm** to **human** health
- 51.6% are not aware that **livestock** animals could get **infected**
- 36.9% are not aware about the **behaviours** increasing the **risk** of infection

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journal homepage: www.elsevier.com/locate/actatropica

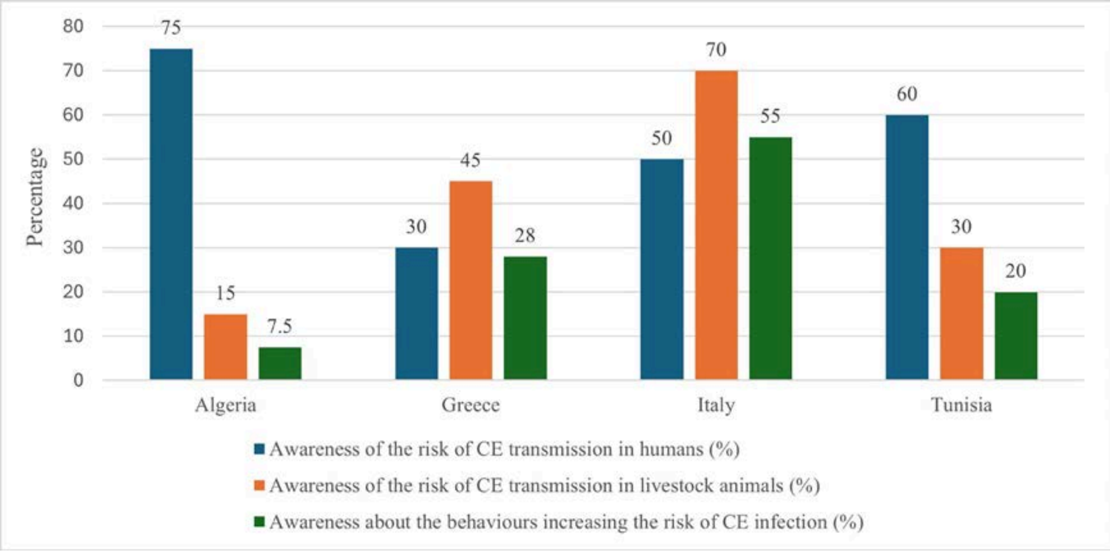
ELSEVIER

Epidemiological update of cystic echinococcosis in livestock and assessment of practices related to its control in the Mediterranean area

Martina Nocerino [a], Paola Pepe [a,*], Elena Ciccone [a,b], Maria Paola Maurelli [a,b], Antonio Bosco [a,b], Franck Boué [c], Gérald Umhang [c], Samia Lahmar [d], Yousra Said [d], Smaragda Sotiraki [e], Panagiota Ligda [e], AbdElkarim Laatamna [f], Nassiba Reghaissia [g], Giorgio Saralli [h], Vincenzo Musella [i], Maria Chiara Alterisio [a], Giuseppe Piegari [a], Laura Rinaldi [a,b]

Knowledge and awareness of CE

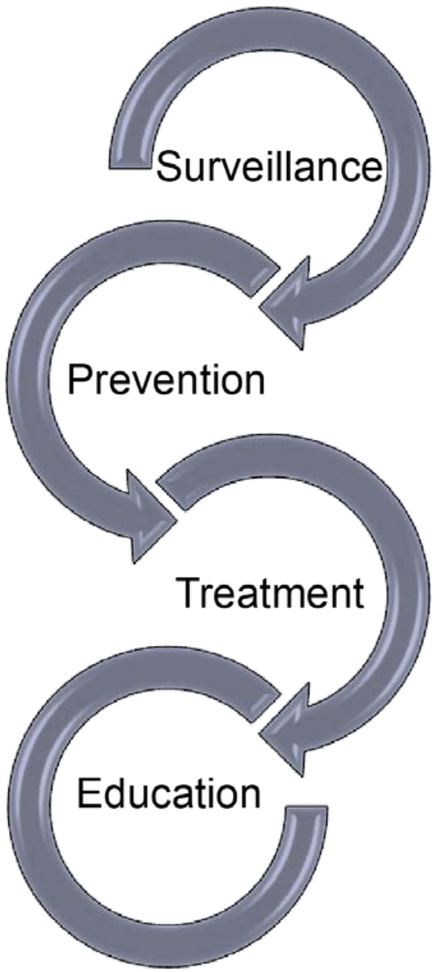
- 44.5% do not know that CE can cause **harm** to **human health** and are **not aware** of how humans can be **infected**
- 51.6% are not aware that **livestock animals** could also get **infected** and act as **carrier** for the **parasite** causing CE
- **Low awareness** of the **behaviours** that increase the **risk** of CE infection emerged (36.9%)

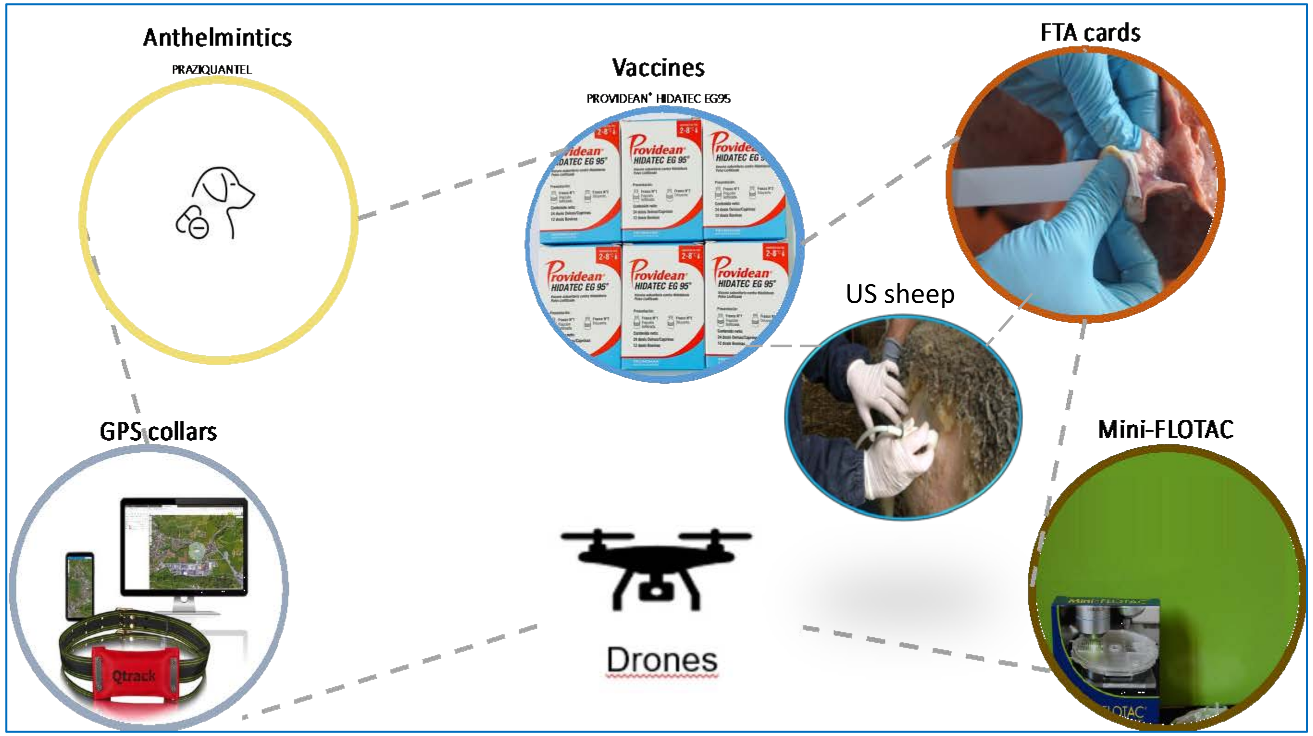


One Health into Action: act on dogs and sheep to prevent CE transmission to humans

One Health into Action: act on dogs and sheep to prevent CE transmission to humans

Integrated Approach
One health multidisciplinary and multi-institution efforts





Cringoli et al., Vet Parasitol, 2021; Ciccone et al., Parasitology, 2024; Nocerino et al., Parasit Vectors, 2024; Nocerino et al., Acta Trop, 2024

Veterinary Parasitology 340 (2025) 110610

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Veterinary Parasitology

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Effectiveness of ultrasound in sheep as a monitoring tool for the long-term control of cystic echinococcosis

Beatrice Mercaldo, Maria Chiara Alterisio, Antonio Bosco, Antonio Di Loria, Elena Ciccone, Sergio Esposito, Laura Rinaldi, Paolo Ciaramella*, Jacopo Guccione

A B S T R A C T

This study aimed to evaluate the effectiveness of ultrasound (US) in sheep compared with the necropsy (gold standard) as an *in-vivo* monitoring tool used in a long-term control program of cystic echinococcosis (CE). The study involved 10-randomly-selected farms, divided into a Treated-Group (TG, n = 5, receiving a control protocol for CE) and a Control-Group (CG, n = 5, no protocol), enrolled over 6-years in an endemic area of southern Italy. All sheep of ten farms destined for slaughter underwent liver and lung US followed by necropsy, during the study period. From a total of 1'175 sheep, 50.0 % (593/1'175) belonged to the TG and 49.5 % (582/1'175) to the CG were enrolled. Overall, the US showed a Sensitivity (SE) of 87.9 %, a Specificity (SP) of 72.3 % as well as a positive- (PPV) and negative-predictive-value (NPV), and Accuracy of 74.4 %, 86.7 %, and 79.7 %, respectively. A moderate Cohen's Kappa-Coefficient (K=0.599) were also detected between the two techniques. The generalised linear mixed model showed that distribution ($p < 0.001$) and type of lesion ($p < 0.001$) significantly influence the US performance. The higher SP and PPV in CG likely result from a greater disease prevalence and presence of older lesions; the higher NPV in TG might reflect the beneficial effects of the control program and lower disease exposure. Although technical and logistical challenges have to be addressed for its use, a US conscious integration into continuous surveillance program might promote the early *in vivo* identification of infected farms, limiting necropsy dependence for CE monitoring.

Ultrasound in sheep

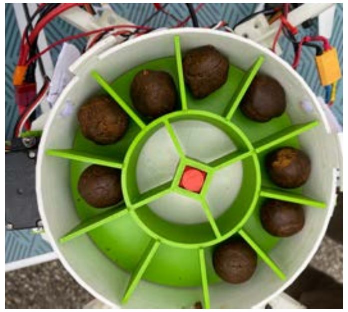
Delivery of anthelmintic PZQ baits using Drones

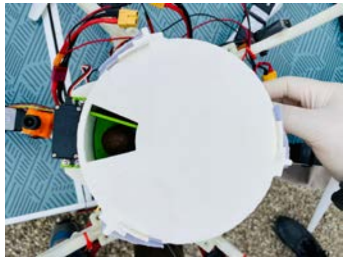
Delivering praziquantel-laced baits to treat **not owned (i.e. stray) dogs**

GIS e digital mapping

Unmanned Aerial Veichle

Camera Trap





Two companies for the **EG95 vaccine** in the four pilot countries

Tecnovax Sanidad Animal

Buenos Aires, Argentina

TECNOVAX Sanidad Animal	**PROVIDEAN® HIDATEC EG95**

MCI Santé Animale

Mohammadia, Morocco

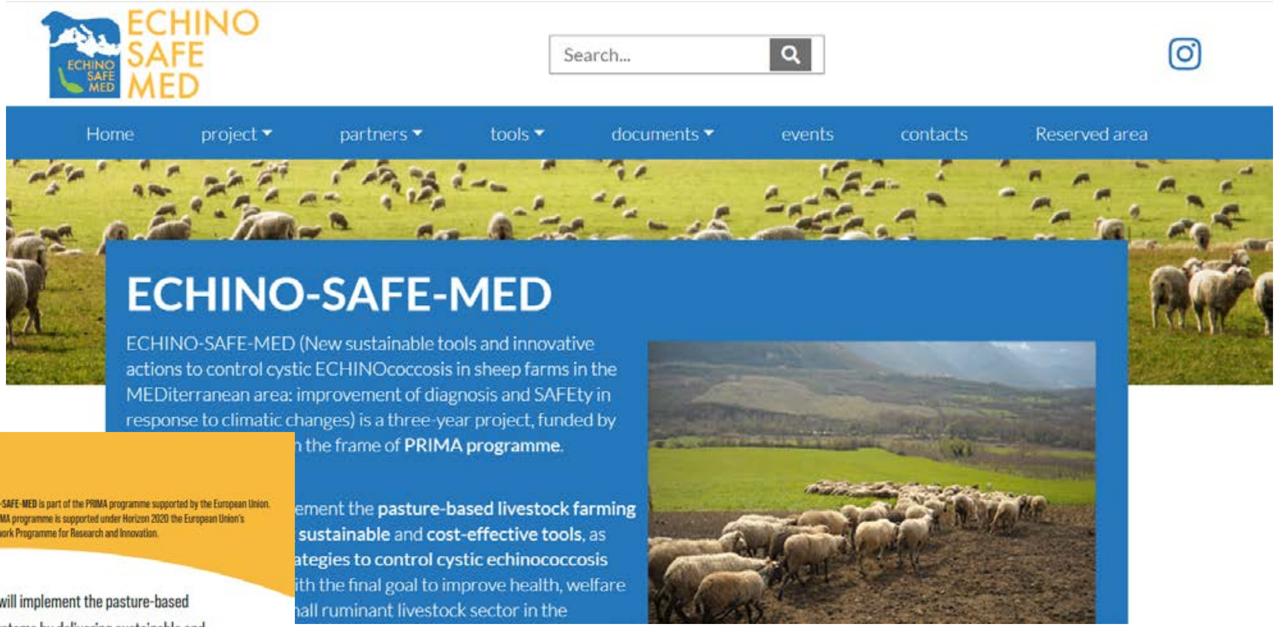
COMBIVAX EG95

Injectable emulsion

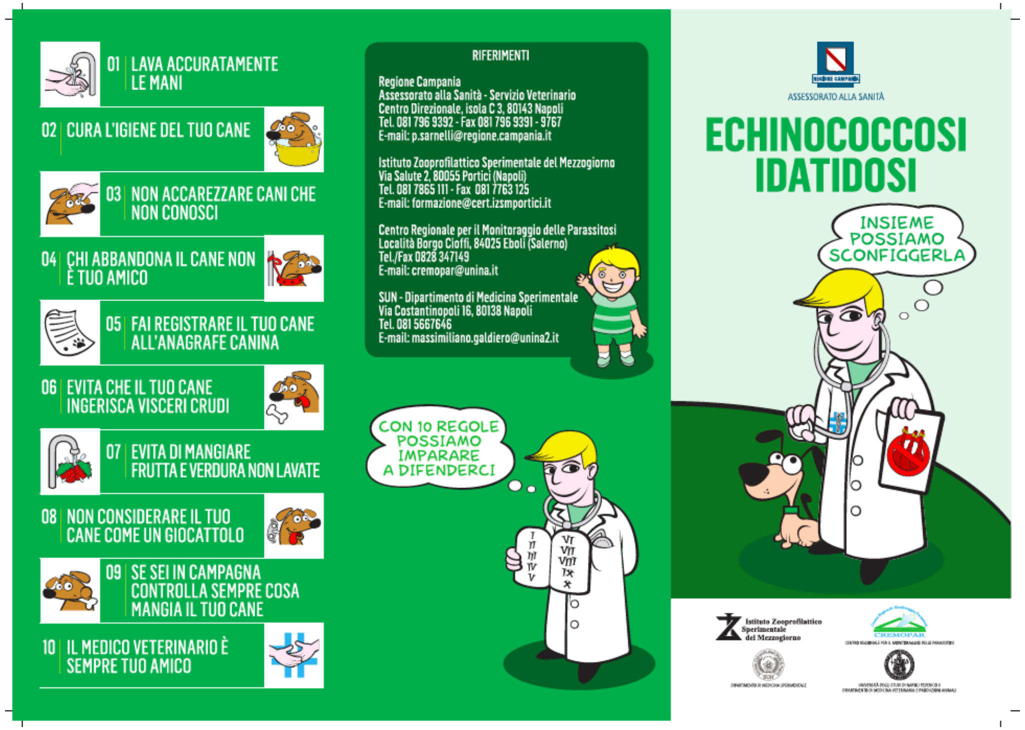
Marshall Lightowlers (University of Melbourne – Australia)

DISSEMINATION, EXPLOITATION AND COMMUNICATION ACTIVITIES

Website and instagram page

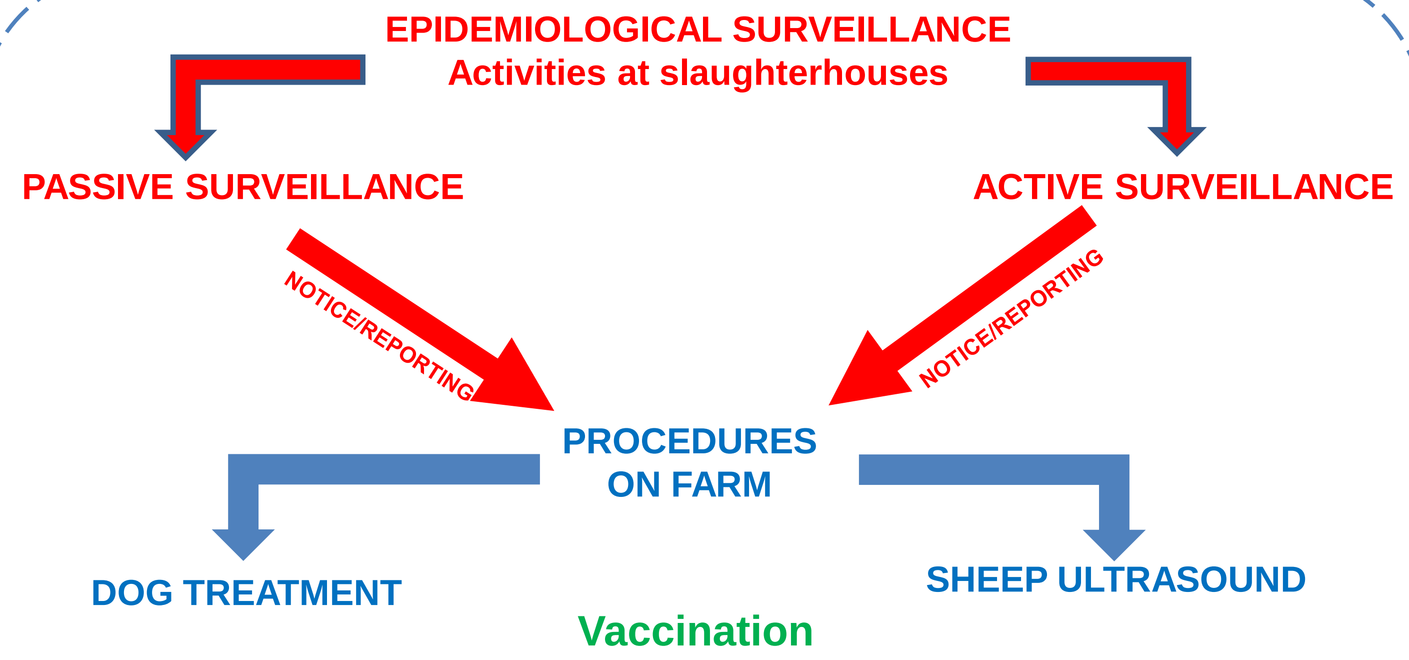


https://www.echinosafemed.com/



One Health Advocacy and Policy

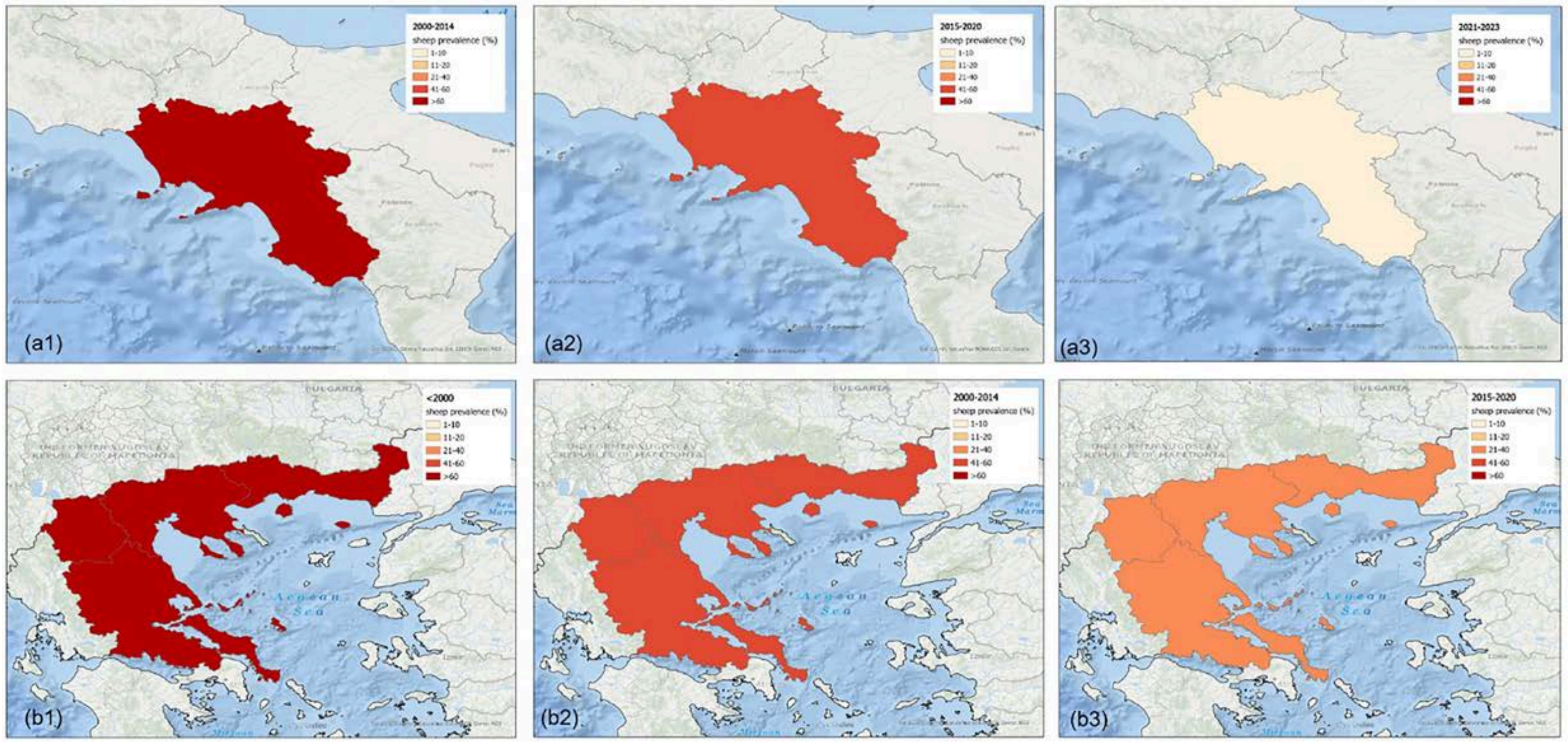
Without a **structured and coordinated control programme,** supported both **politically and financially** by national (or regional) health authorities, success is unlikely to be significant and sustainable



The control of *E. granulosus* in animals officially included as a mandatory task in the regional policies of the veterinary services

Cringoli et al., Vet Parasitol, 2021; Ciccone et al., Parasitology, 2024; Nocerino et al., Parasit Vectors, 2024; Nocerino et al., Acta Trop, 2024

Intervention strategies against cystic echinococcosis in the Mediterranean area: from research to action using a multi-actor approach



Region	before 2000	2000-2014	2015-2020	2021-2023	References
Campania (Italy)		63.1%	52.2%	9.7%	Rinaldi et al. 2008; Cringoli et al. 2021; Rinaldi et al. 2023 personal communication
Central Greece, Macedonia, Thessaly, Thrace (Greece)	61.0%	52.0%	37.4%		Sotiraki et al. 2003; Christodoulopoulos et al. 2008; Kantzoura et al. 2013; Chaligiannis et al. 2015; Founta et al. 2016

Decreasing trend in the prevalence of CE in sheep in southern Italy (Campania region) and in central and northern Greece over a 20-year period.

Year	No. of lambs vaccinated (EG95)	No. of dogs treated (PZQ)	No. sheep pos/ No. of sheep analysed
2022	395	93	90/1133
2023	447	214	109/805
2024	1978	398	75/3133
2025	1004	511	42/1078

Nocerino et al. 2024 Acta tropica

CE in intermediate hosts (humans) in Europe

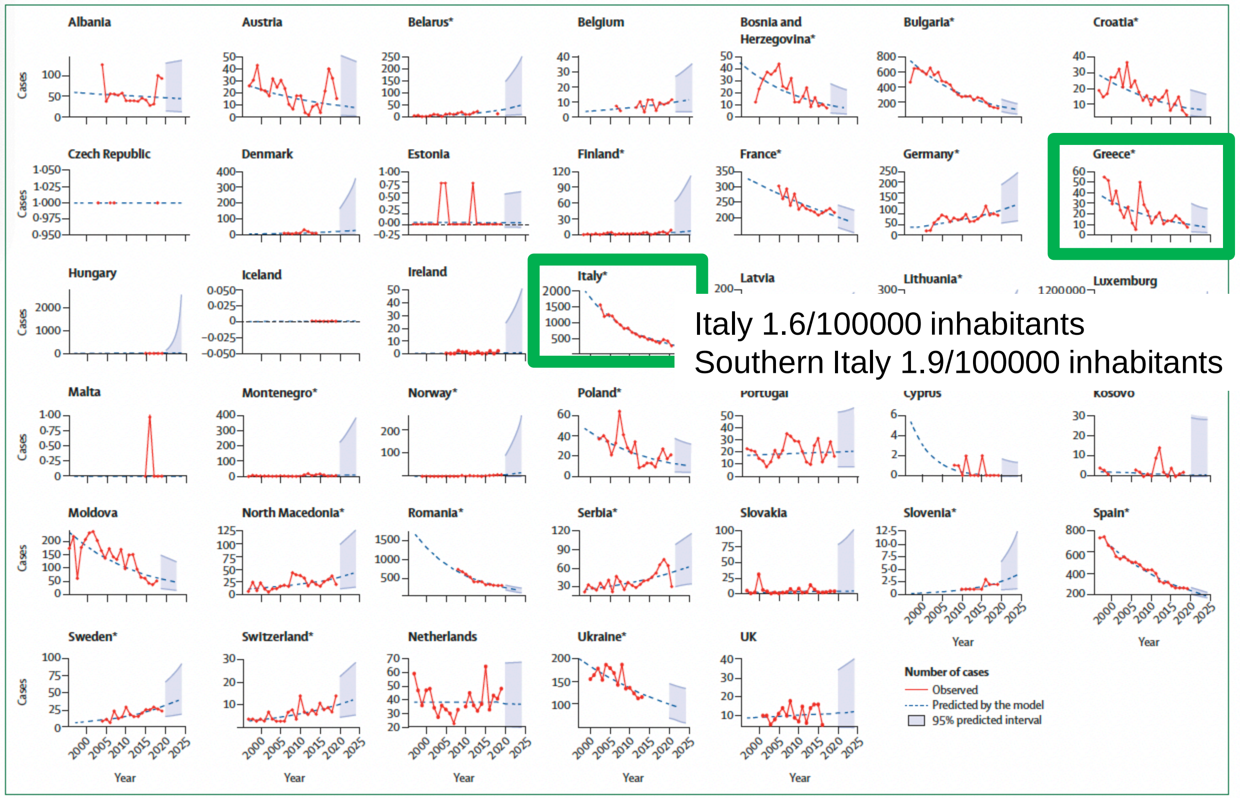


Figure 4: Time-trend analysis of the number of human cystic echinococcosis cases at the country level (observed cases and predicted cases for the years 2020–24)
*Significant time trend (p<0·05).

*…Such a decrease in some European countries could be due to the increasing hygiene, the rural-to-urban migration at a national level, a decrease in sheep populations, an increase in intensive farming, and the **implementation of national control programmes**……*

Lancet Infect Dis 2023; 23: e95–107
Published Online November 22, 2022 https://doi.org/10.1016/ S1473-3099(22)00638-7

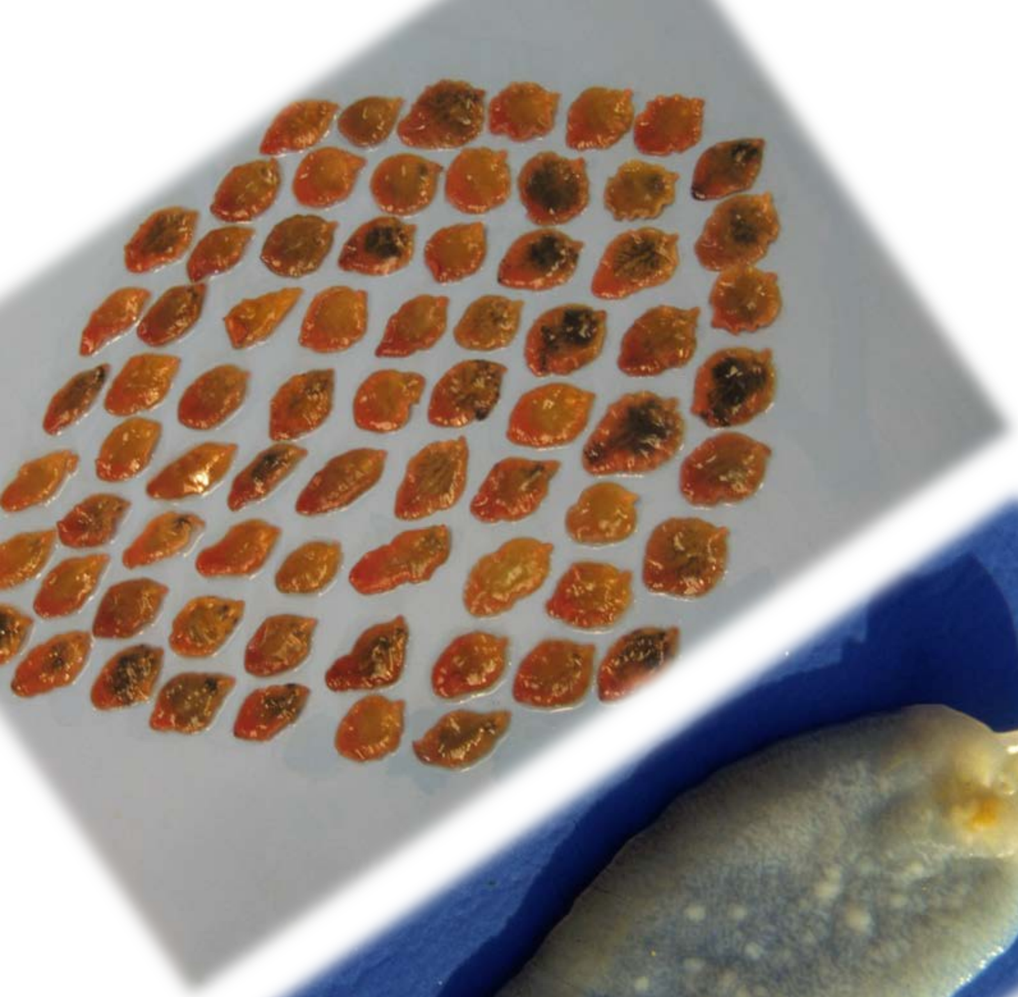
Unveiling the incidences and trends of the neglected zoonosis cystic echinococcosis in Europe: a systematic review from the MEmE project

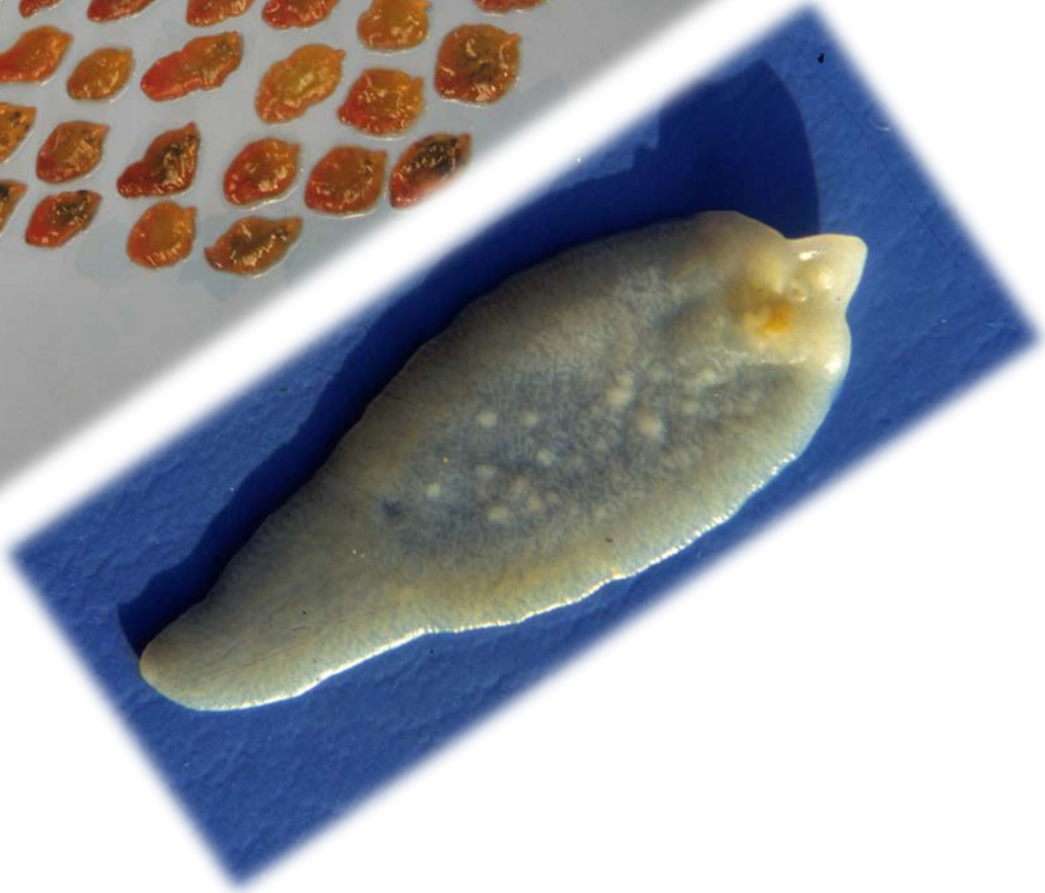
Adriano Casulli et al.

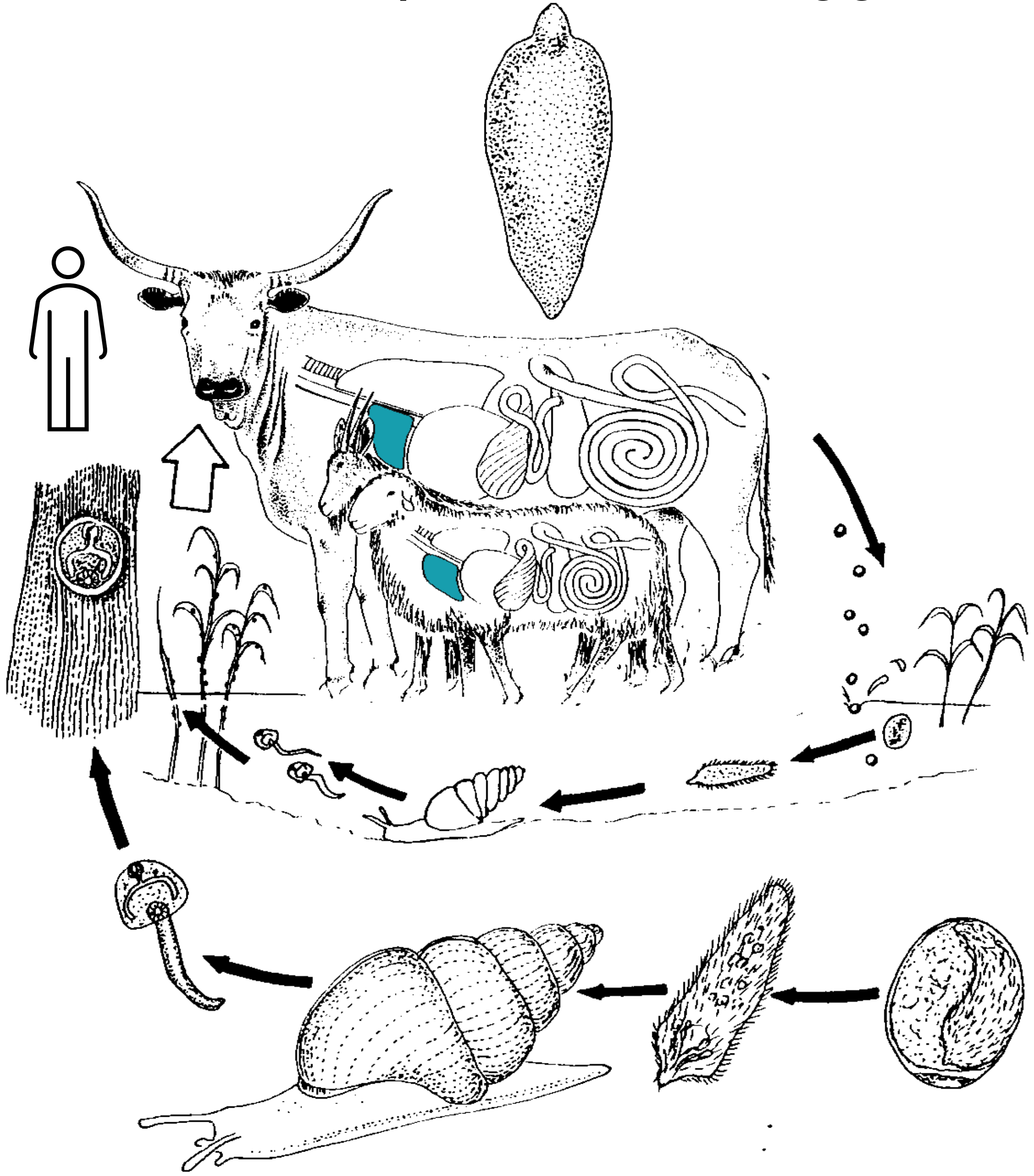
Key messages

- This study aims to shed light on the unrecognised incidence of cystic echinococcosis in Europe, unveiling its epidemiological effect by providing a quantitative measure of number, incidence, and trends of human cases documented within the period 1997–2021
- Since human cystic echinococcosis cases are generally under-reported and data have uncertainty (partly due to misdiagnosis), data provided in this study should be considered as a conservative estimate of the real impact of this zoonotic infection historically occurring in Europe
- For the years 2017–19, we identified a total number of cystic echinococcosis cases four-fold higher than for The European Surveillance System (TESSy) data
- Decreasing trends have been recorded in most southern Mediterranean and some eastern European countries, where cystic echinococcosis has traditionally been highly prevalent
- Increasing trends have been identified in some eastern and southeastern European countries but, unexpectedly, also in most non-endemic countries of northern and western Europe
- Based on incidence and trends from 2017–19, the current epicentre of cystic echinococcosis in Europe is represented by the Balkan Peninsula
- Cystic echinococcosis in Europe remains a relevant public health issue and findings from this study should be used to support the planning of surveillance and control programmes in Europe according to the WHO 2021–2030 roadmap for neglected tropical diseases

The Liver flukes: *Fasciola hepatica* and *Fasciola gigantica*







Trends in Parasitology | **Parasite of the Month**

Fasciola hepatica

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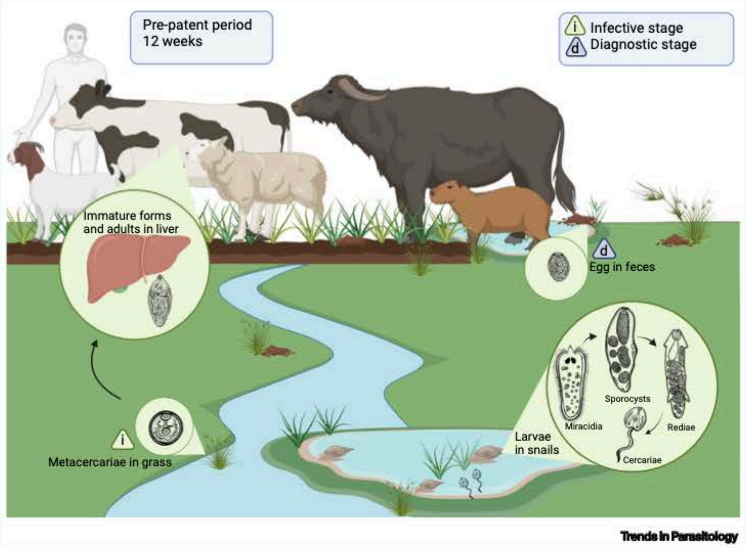
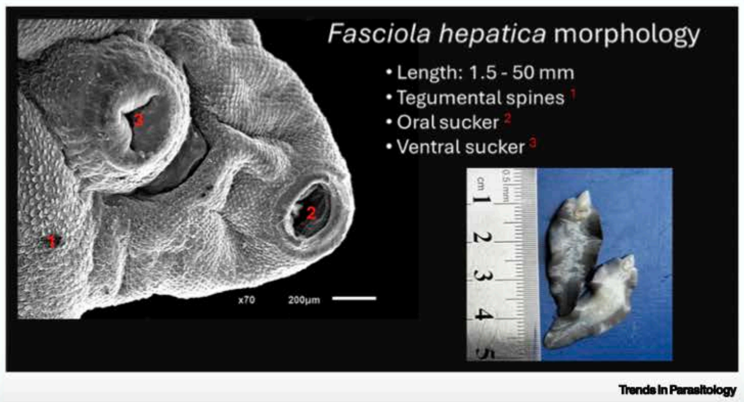


The liver fluke, *Fasciola hepatica*, is a trematode parasite that infects domestic livestock, wildlife, and humans across every continent, except Antarctica. It has an indirect life cycle, using Lymnaeidae snails as intermediate hosts. Definitive hosts become infected by ingesting metacercariae in food or water. Environmental factors (e.g., temperature, rainfall) are crucial for survival of snails and metacercaria, and for transmission. The World Health Organization lists fasciolosis as a neglected tropical disease, with an estimate of 2.4 million people infected worldwide. Globally, the economic impact of fasciolosis on livestock production nears US$3 billion/year. Production losses include decreased milk, wool, and meat production, liver discard at slaughter, and mortality. Treatment of human and animal infections rely on anthelmintic chemotherapy; however, resistance to various drugs has been reported worldwide. New therapies based on novel drug classes, and vaccines, are warranted.



KEY FACTS:
Main definitive hosts: cattle, sheep, goat, water buffalo, humans, and wildlife; intermediate hosts: Lymnaeidae snails.

Treatment of humans and livestock relies on chemotherapy, and control of infection in livestock relies on various management strategies to reduce risk of infection.

Resistance of *F. hepatica* to triclabendazole has been reported worldwide, posing great concern due to the lack of efficacious alternative drugs for the treatment of humans.

DISEASE FACTS:
Definitive hosts become infected after ingestion of metacercariae in contaminated food or water.

The acute phase of fasciolosis is associated with migration of immature stages through the hepatic parenchyma, causing extensive tissue damage and hemorrhage. The chronic phase is associated with the presence of adults in biliary ducts causing liver fibrosis, blood loss, and inflammation.

Diagnosis can be achieved through the microscopic detection of *F. hepatica* eggs in feces using sedimentation techniques, and immunodiagnostic and DNA-based molecular techniques using the host's biofluids (e.g., blood, serum, feces).

There have been promising studies on new drug development and *F. hepatica* antigenic molecules for vaccine development; however, these are not commercially available.

TAXONOMY AND CLASSIFICATION:
PHYLUM: Platyhelminthes
CLASS: Trematoda
SUBCLASS: Digenea
FAMILY: Fasciolidae
GENUS: *Fasciola* (Linnaeus, 1758)
SPECIES: *F. hepatica* (Linnaeus, 1758)

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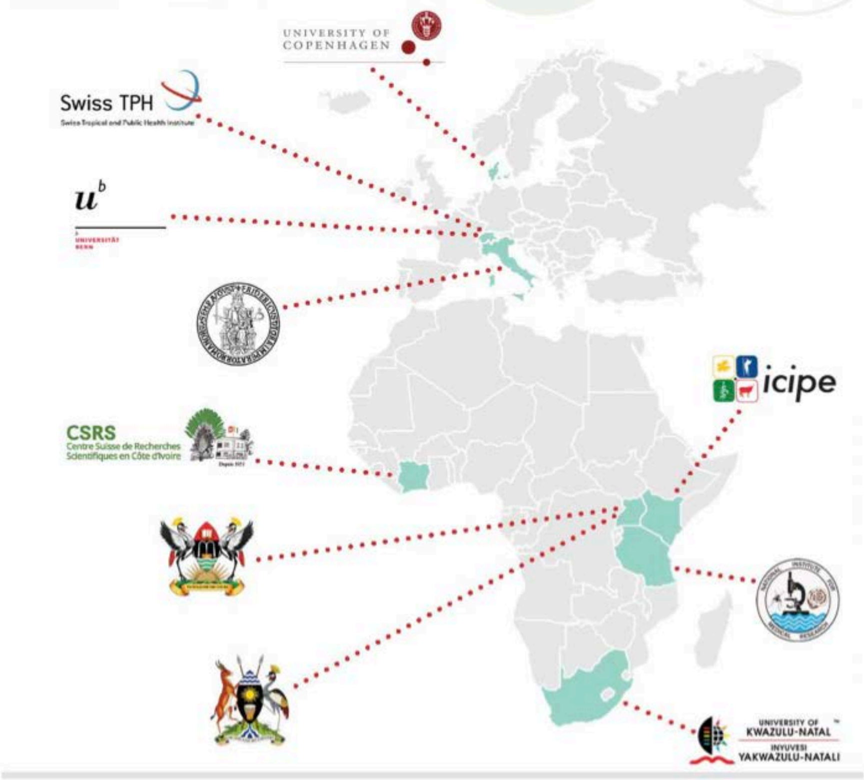
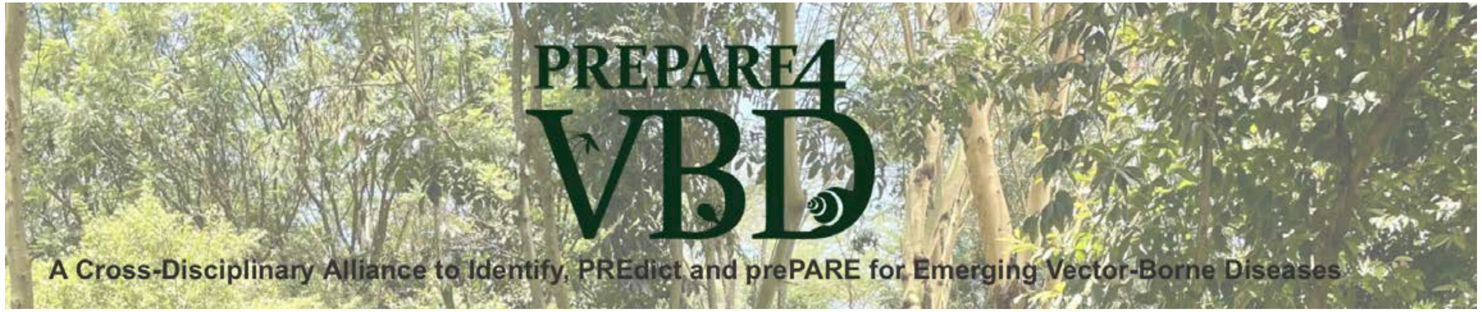
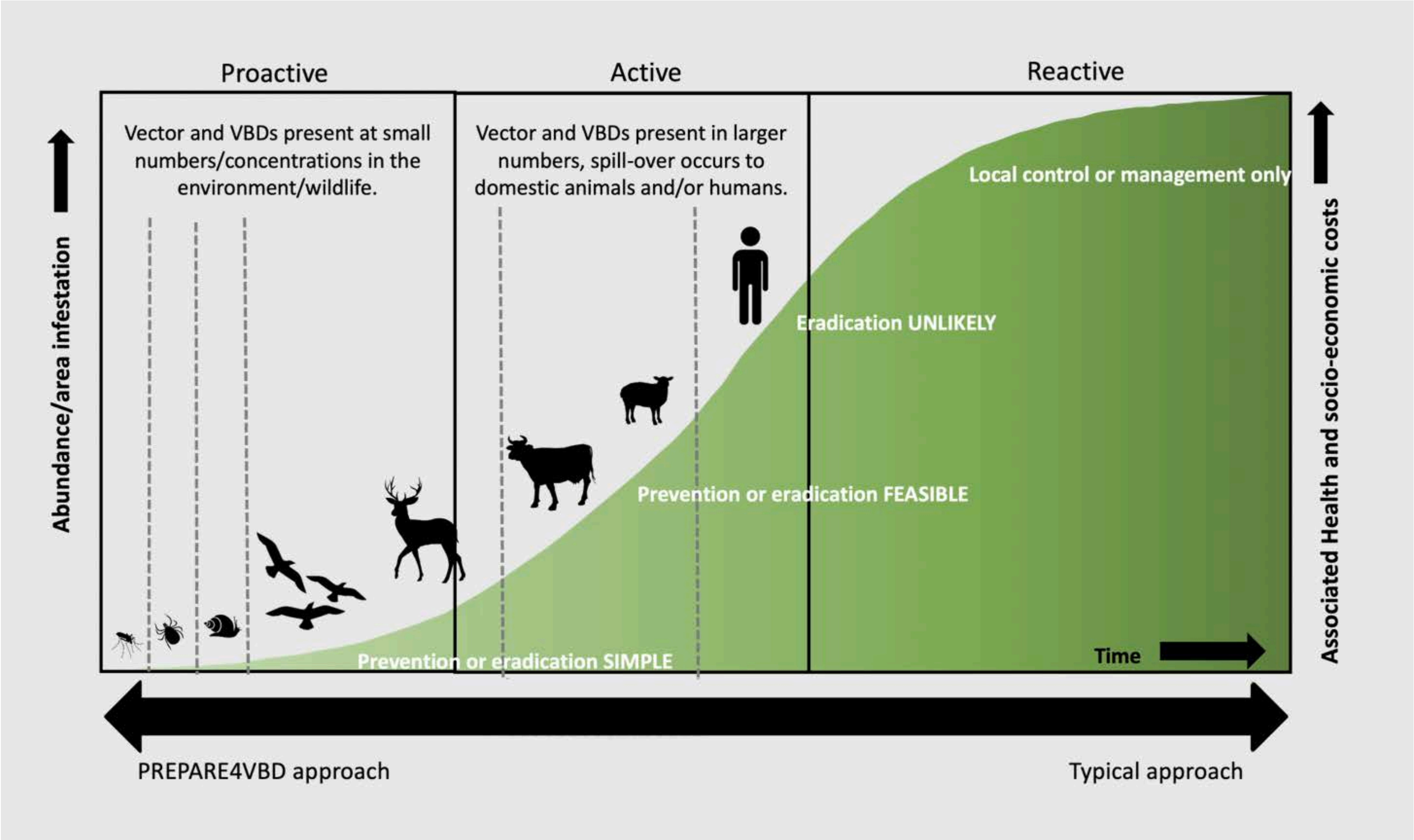
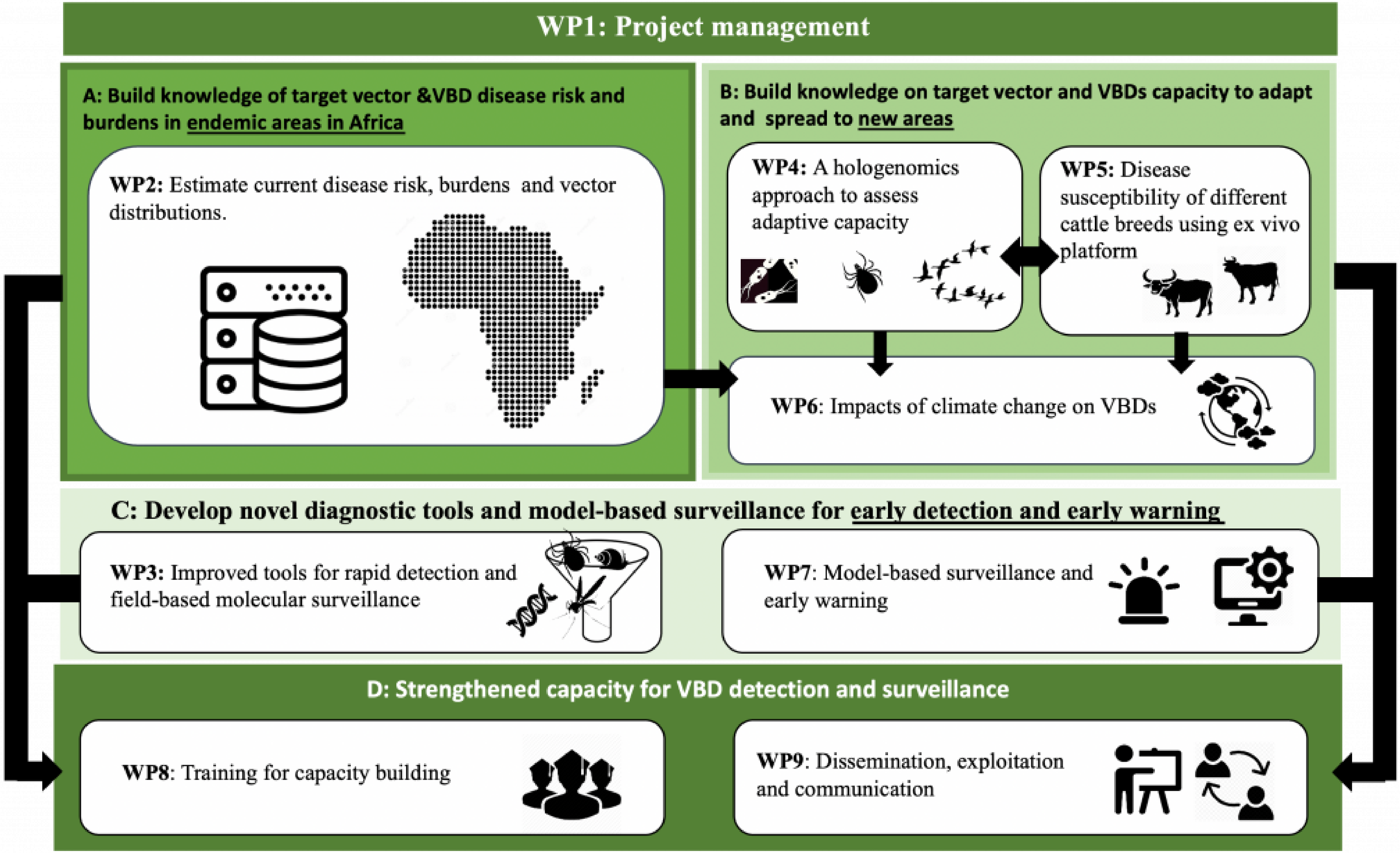
The PREPARE4VBD Consortium





Preparing Africa and Europe for a new era of invasive vectors and emerging zoonotic vector-borne diseases under climate change and globalization




WP1: Project management
A: Build knowledge of target vector &VBD disease risk and burdens in endemic areas in Africa
WP2: Estimate current disease risk, burdens and vector distributions.
B: Build knowledge on target vector and VBDs capacity to adapt and spread to new areas
WP4: A hologenomics approach to assess adaptive capacity
WP5: Disease susceptibility of different cattle breeds using ex vivo platform
WP6: Impacts of climate change on VBDs
C: Develop novel diagnostic tools and model-based surveillance for early detection and early warning
WP3: Improved tools for rapid detection and field-based molecular surveillance
WP7: Model-based surveillance and early warning
D: Strengthened capacity for VBD detection and surveillance
WP8: Training for capacity building
WP9: Dissemination, exploitation and communication


Habitats suitable for snails (*Galba truncatula*) and cattle
Field activities in South Italy, November 2023

Field activities in South Africa, October 2022

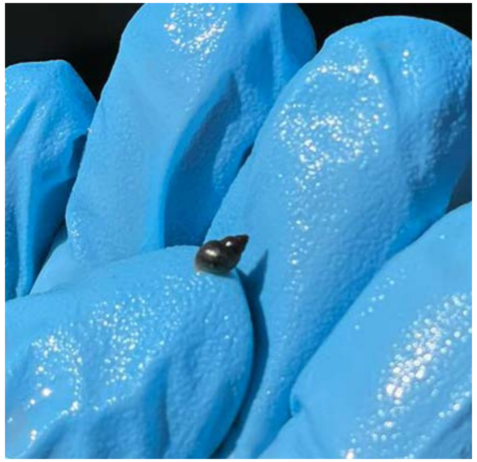
Field activities in Italy, May 2023

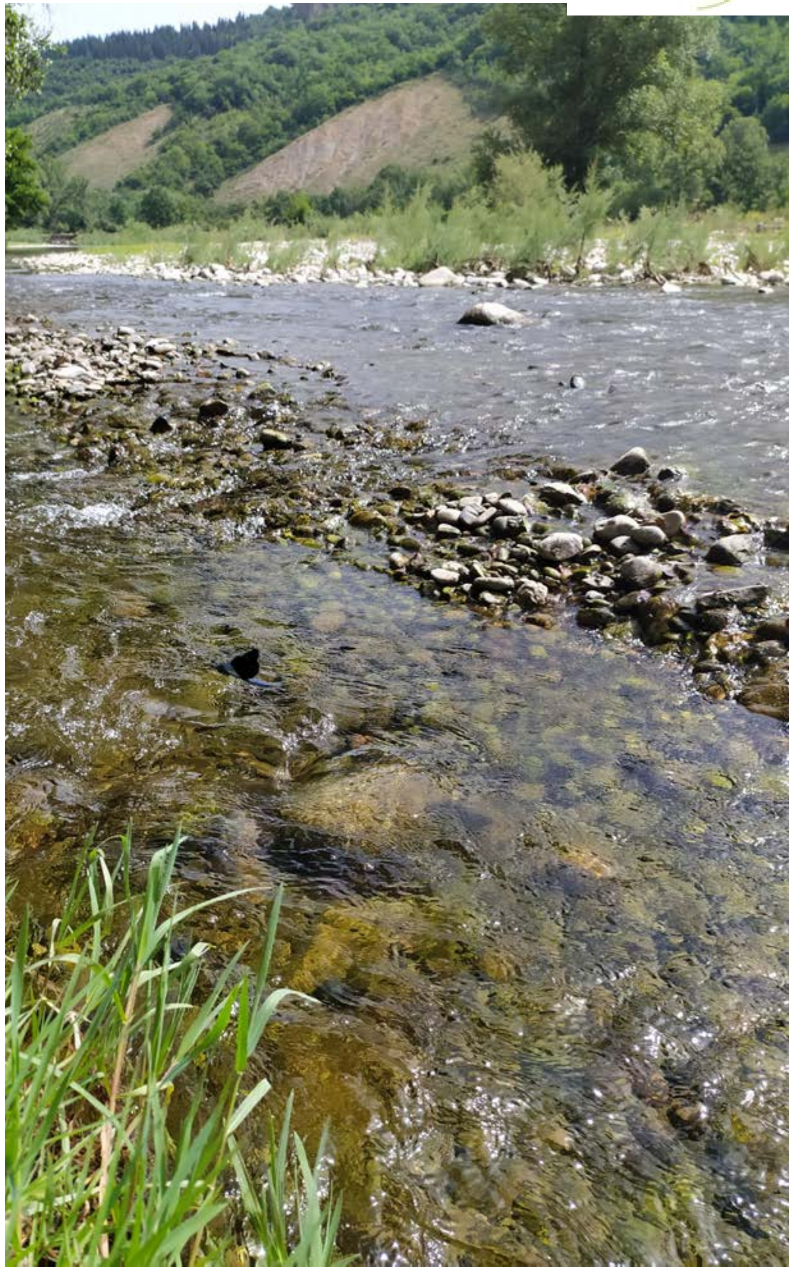
Liver flukes in animals and humans: stool samples

Italy

Liver flukes in the environment: snails and water

Italy





UAV (Drones) in Parasitology: longitudinal studies for habitat capturing

GPS coordinates: 40.9083, 15.5367

Longitudinal studies on the temporal and micro-spatial distribution of Lymnaeidae snails intermediate host of liver flukes

The approaches to image analysis vary in sophistication and range from manual to technology-supported digitization and the use of supervised machine learning and artificial intelligence classifiers

Charlier et al., Parasites & Vectors, 2014
Ciuca et al., submitted

PREPARE4VBD

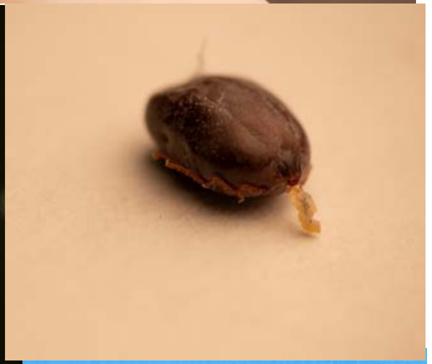
Horizon 2020
European Union Funding
for Research & Innovation

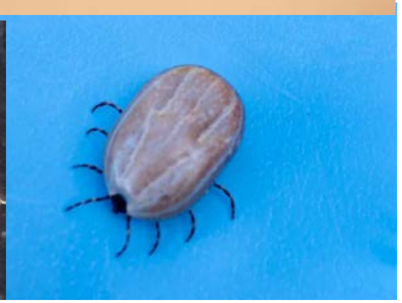
Liver flukes in the environment: snails, water and e-DNA

Galba truncatula

Ticks on the animals and in the environment

European Ticks in Italy: Environment and Animal Hosts





African Ticks in Kenya: Animal Hosts

The local community perspective

South Africa

Dipping with ectoparasiticides for tick control

The importance of dissemination and communication: engadgement of local communities

Annual meeting
October 2022
South Africa

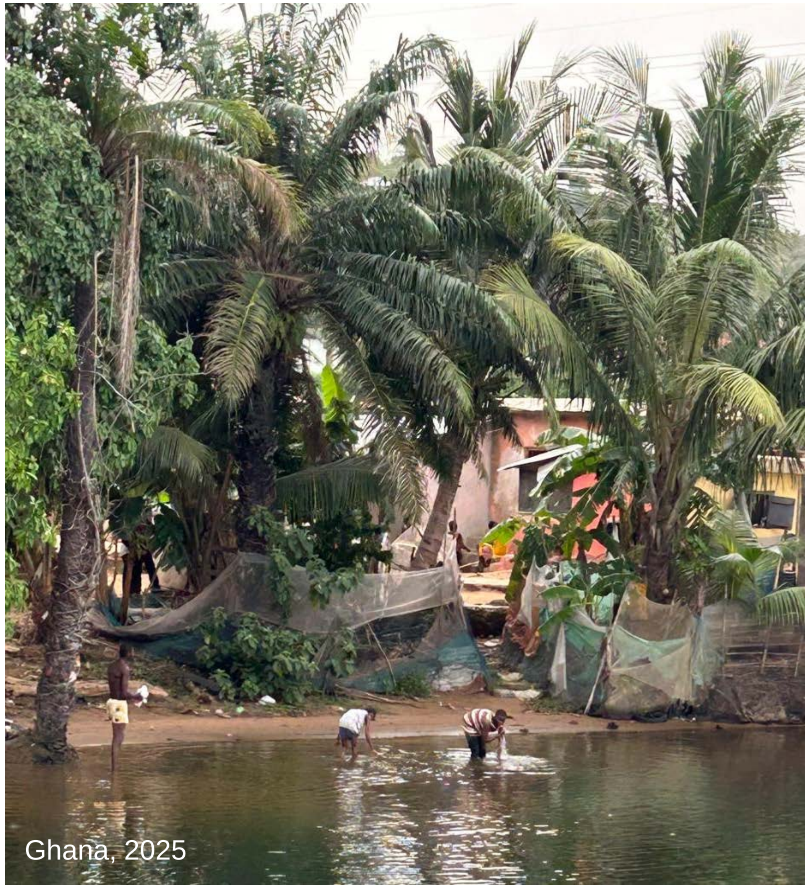
Children engagement

Performance explaining the tick life cycle

One Health

Rod of Moses

Monte Nebo (Jordan), 2023



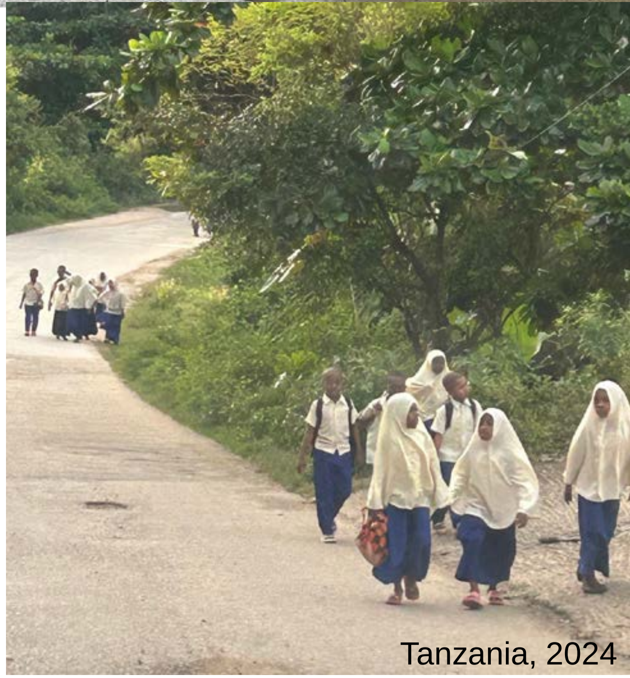
Ghana, 2025

Uganda, 2025

Tanzania, 2025

If you want to go fast, go alone. If you want to go far, go together (African proverb)

THANK YOU



Tanzania, 2024