Snakebite crisis: Unresolved challenges and opportunities in the digital age

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Image Source: Jacques Van Niekerk

Image source: CIAT
Data Source: WHO (2018)

Image source: Dr. Gabriel Alcoba / MSF
Data Source: WHO (2018)

GLOBAL HEALTH

Africa braced for snakebite crisis

Health specialists warn that stocks of antivenom will run out in 2016.

BY QUIRIN SCHIERMEIER

Rural Africa is facing a resurgence of a persistent plague that rarely makes headlines: snakebite.

By June next year, stockpiles of the antivenom that is most effective against Africa's vipers, mambas and cobras are expected to run out because the only company that makes the medicine has stopped production. With no adequate replacement in sight, the death toll from bites is set to rise, specialists warned at a tropical-medicine congress last week in Basel, Switzerland.

"We're dealing with a neglected health crisis that is turning into a tragedy for Africa," says Gabriel Alcoba, a medical adviser with the international humanitarian group Médecins Sans Frontières (MSF; also known as Doctors Without Borders).

Venomous snakes might seem an archaic menace in such a rapidly urbanizing world. Yet by cautious estimates, snakebites kill more than 100,000 people worldwide every year (see 'Death toll') — more, on average, than lose their lives in natural disasters. And survivors often experience permanent physical and mental disabilities.

In 2010, the French drug firm Sanofi Pasteur in Lyon ceased production of Fav-Afrique, an antibody serum that reduces the quantity of venom circulating in the blood of a snakebite victim. Made from the purified plasma of horses previously injected with small quantities of snake venom, the serum neutralizes the venom of many of Africa's most dangerous snakes.

The deadly carpet viper (*Echis ocellatus*).

PAUL STARosta/corbis

The antidote has saved many people from bites by deadly species such as the carpet viper (*Echis ocellatus*), common in West Africa, and the black mamba (*Dendroaspis polylepis*), found across the sub-Saharan region. But the high costs — US$250–500 per person — and a supply shortage mean that only about 10% of snakebite victims in Africa get treatment, and the company says that producing the antidote is no longer profitable. Cheaper products by competitors have forced Sanofi Pasteur out of the African market, says Alain Bernal, a company spokesman. Sanofi Pasteur is working to enable the transfer of know-how to companies willing to take over production of Fav-Afrique, he says.

Pharmaceutical companies in South Africa, India, Mexico and Costa Rica are among those marketing cheaper products — some of which work well against snakes in their host nations. But their safety and effectiveness against the large variety of species in Africa have not yet been established in clinical trials. To speed up the process, MSF is offering two of its hospitals in the Central African Republic (CAR) and South Sudan as study sites. But it will take at least two years to validate the products in development, and none is as broadly efficient as Fav-Afrique, Alcoba says.

NEGLECTED THREAT

Although just now becoming critical, Africa's snakebite problem has been smouldering for years, says tropical-medicine specialist David Warrell of the University of Oxford, UK, who consults for the World Health Organization (WHO). Snakebite fatalities have been rising over the past decade in the CAR, Ghana and Chad — in part owing to a failure to train enough medical staff, ignorance from health ministries and "unscrupulous marketing" of inappropriate antivenoms, he says. "War-torn countries have many other problems. But the millions of children, poor farmers and nomadic people at risk of snakebites just don't have the ear of politicians in capital cities."

And according to Warrell, the WHO has done little to help. To improve the safety and

Image Source: Jacques Van Niekerk
Article: *Nature* (2015)

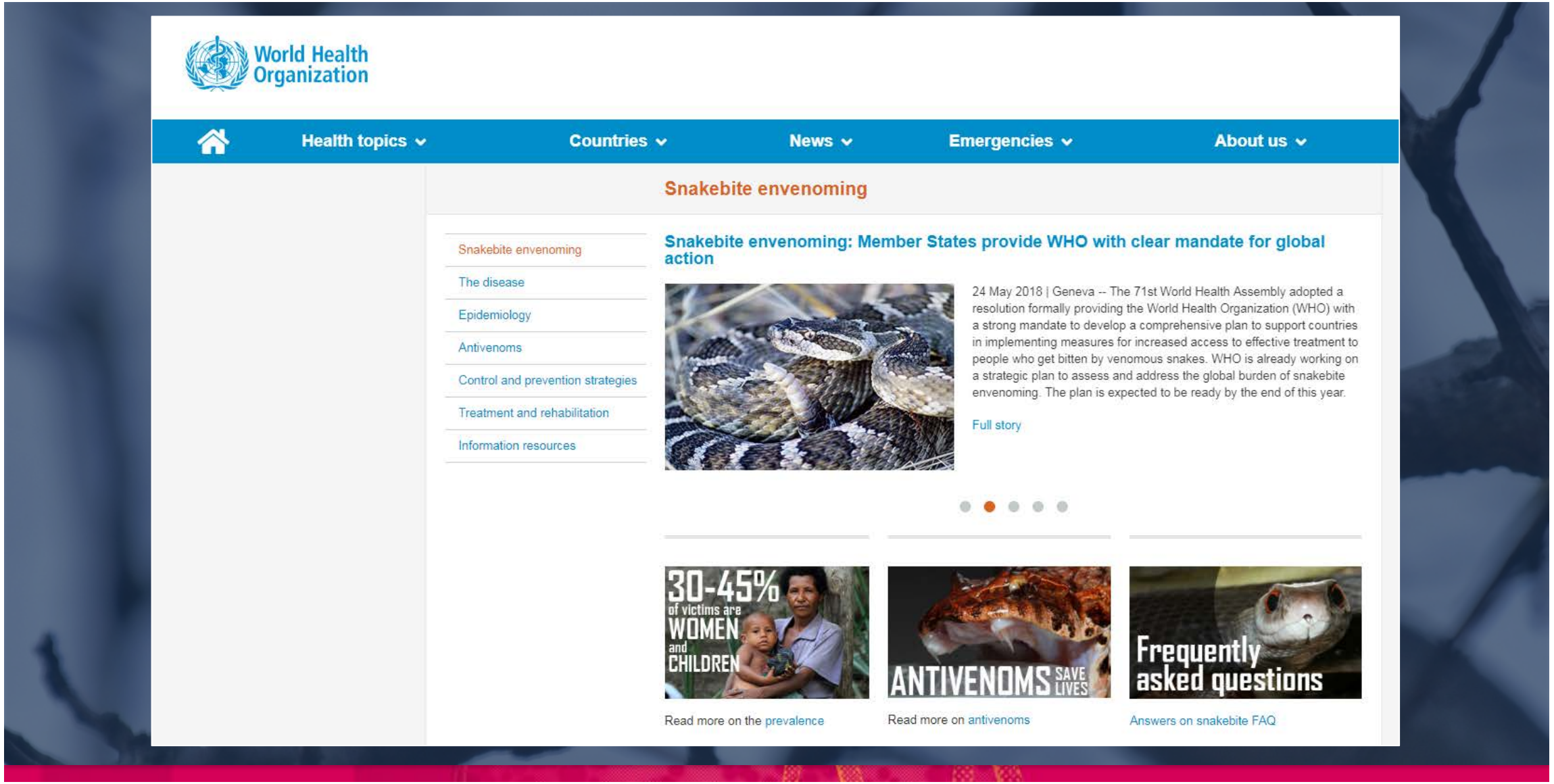

Image Source: Jacques Van Niekerk
Website: WHO

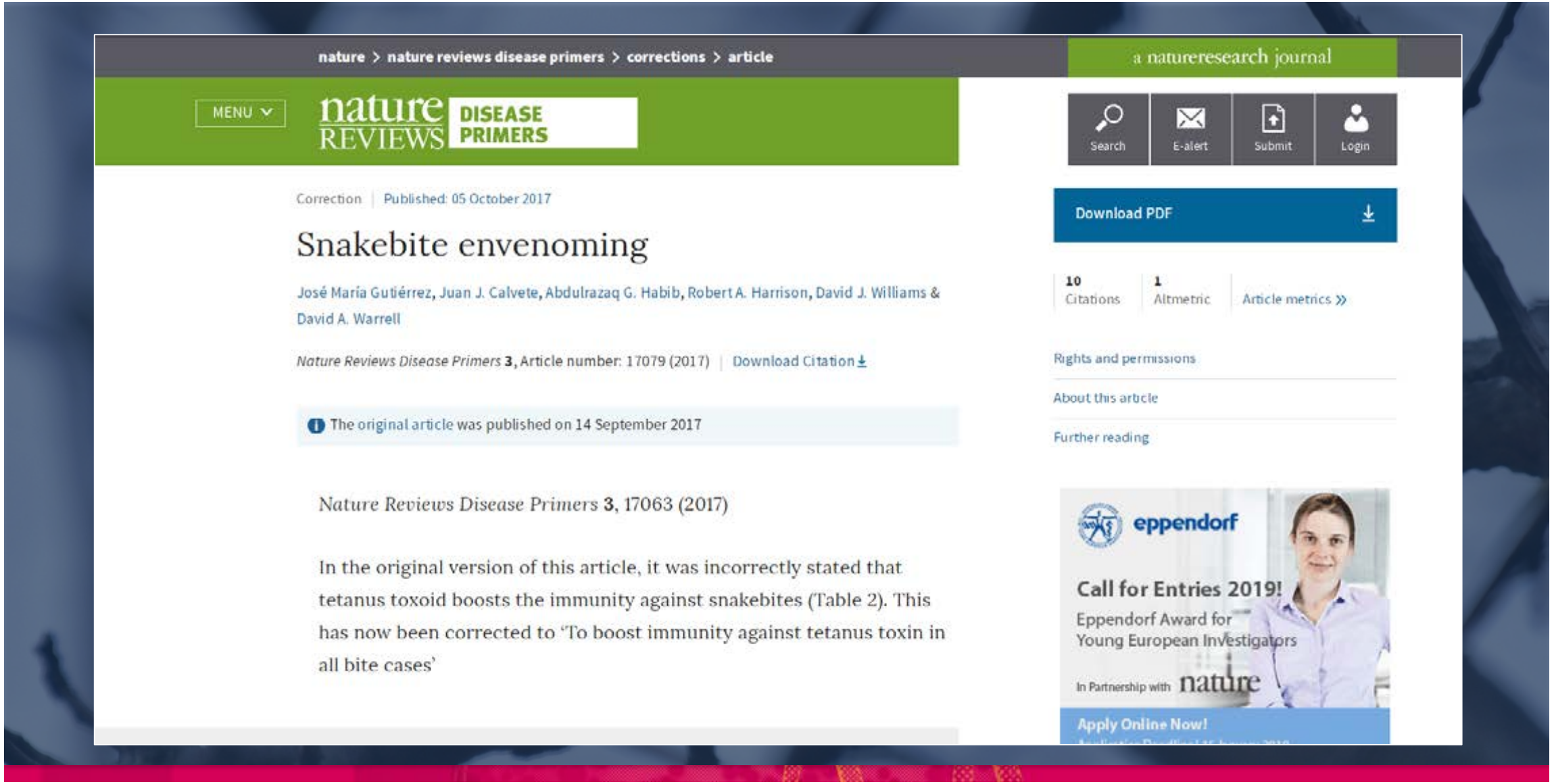

Image Source: Jacques Van Niekerk
Article: *Nature*

Image Source: Jacques Van Niekerk
Article: *The Lancet*

Image Source: Jacques Van Niekerk

Antivenoms: Challenges

- Classic production methods (i.e. «hyper immune equine serum»)
- Side effects (anaphylaxis, pyrogenic, serum sickness)
- Taxa specific, not yet polyvalent (e.g. Pan African, Universal)
- Poor regulatory frameworks, absence of standards, lack of expertise and capacity within national drug control laboratories
- Low confidence in product safety and effectiveness

Image Source: Jacques Van Niekerk

Image Source: Jacques Van Niekerk
Article: Longbottom et al. (2018) *The Lancet*

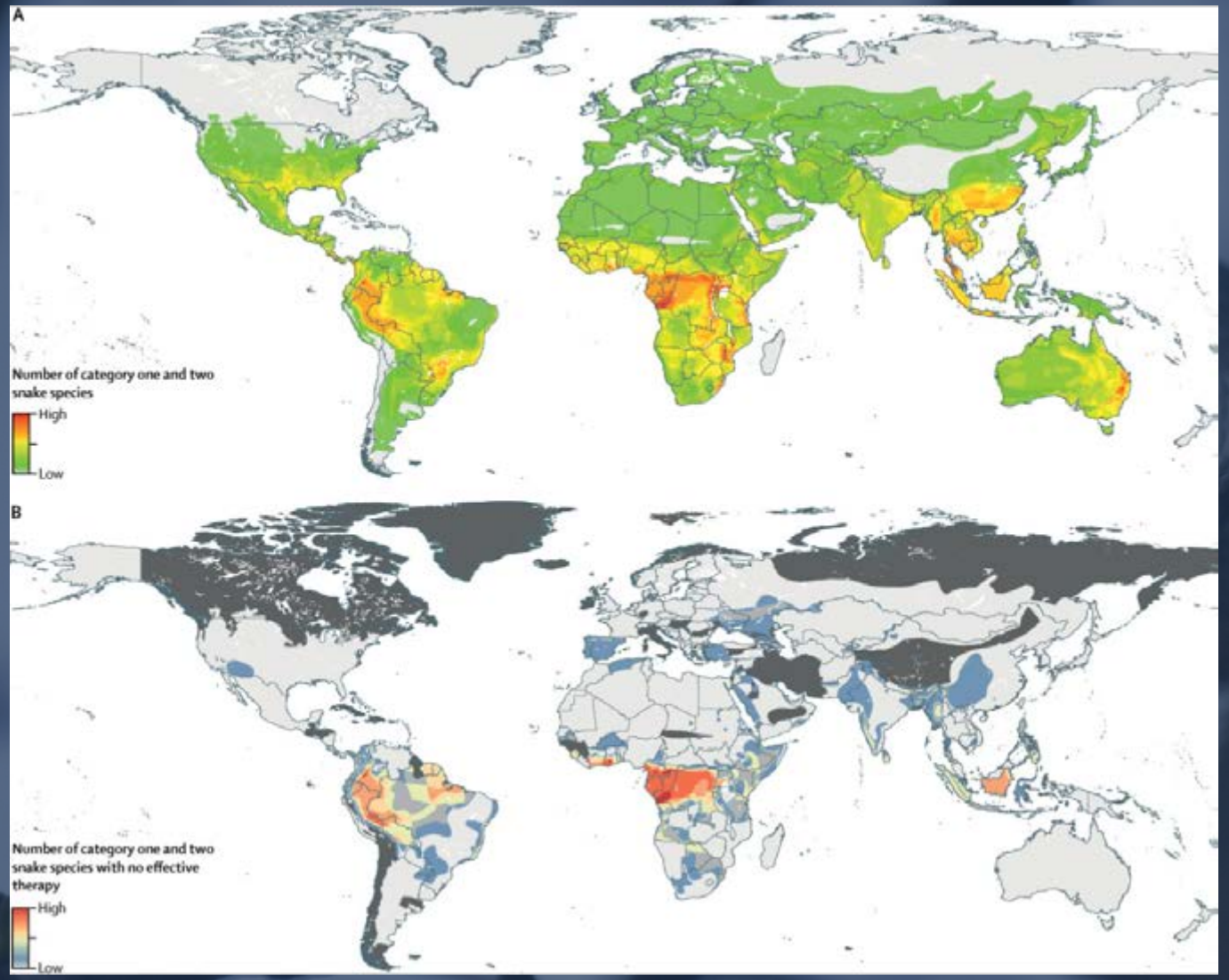

Image Source: Jacques Van Niekerk
Map: Longbottom et al. (2018) *The Lancet*

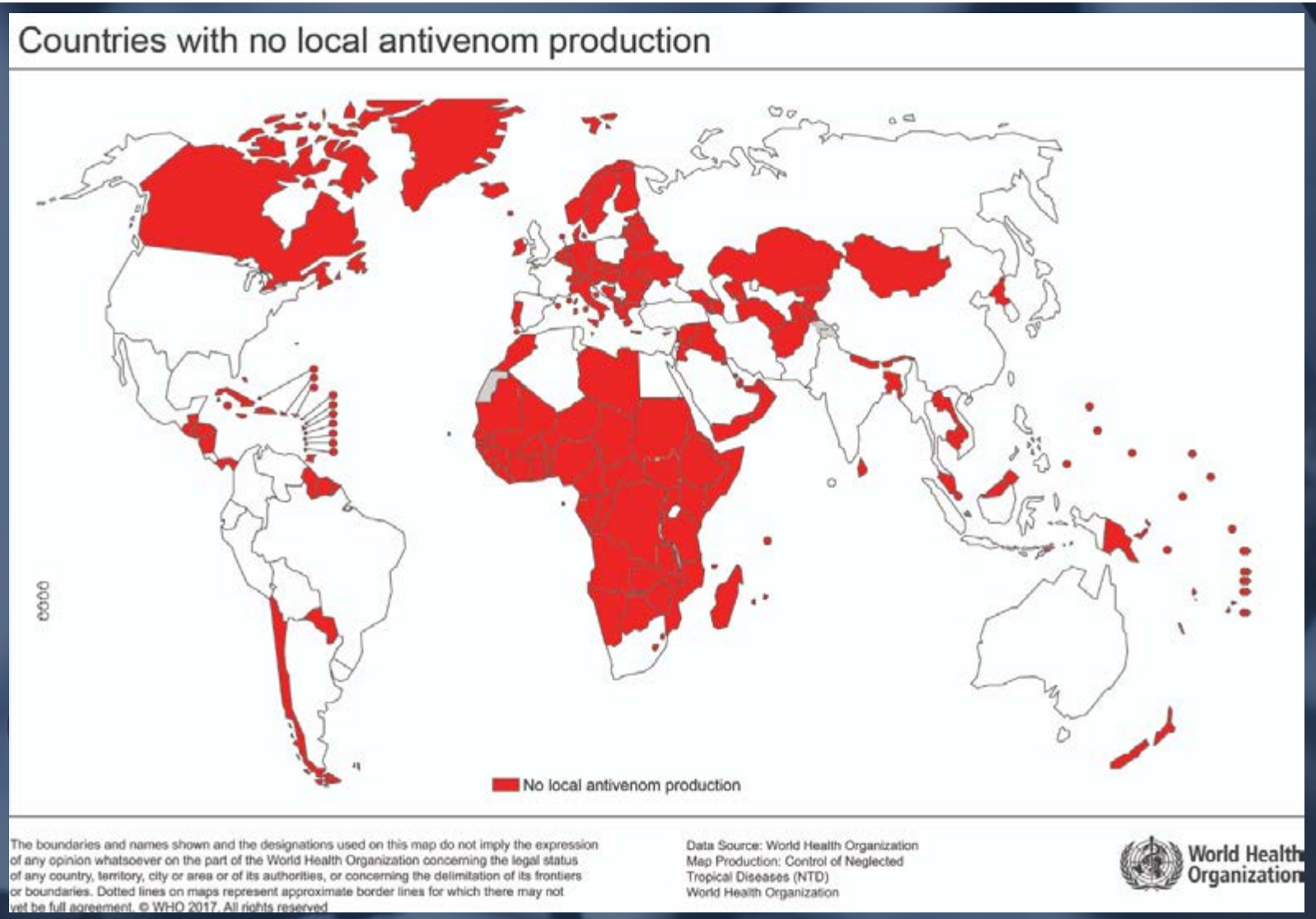

Image Source: Jacques Van Niekerk
Map: WHO

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Need for epidemiological data

- Very few national incidence studies (Sri Lanka, Bangladesh, India)
- Ongoing studies in Nigeria and Kenya (The African Snakebite Research Group: Prof. Habib, Dr. Harrison), and South Soudan (MSF) (but not nation-wide)

Image Source: Jacques Van Niekerk

***SNAKE-BYTE* Project**

Tackling the second deadliest NTD: predicting and reducing the impact of snakebite on human and animal health through interdisciplinary analyses of hotspots and access to care

Started March 2018 for 4 years, Cameroun and Nepal

Image Source: *Snake-Byte Project*

Because snakebite is a data crisis:

- **Primary data collection at the household level: 24'000 households** in a national human-animal health integrated survey in Nepal and Cameroon
- Health and economic indicators (e.g. zDALY)

Image source: Narayan G. Maharjan

One Health approach to snakebite in rural agro-ecosystems

Source: Narayan G. Maharjan

One Health approach to Snakebite - Scoping review on *Snakebite and domestic animals*

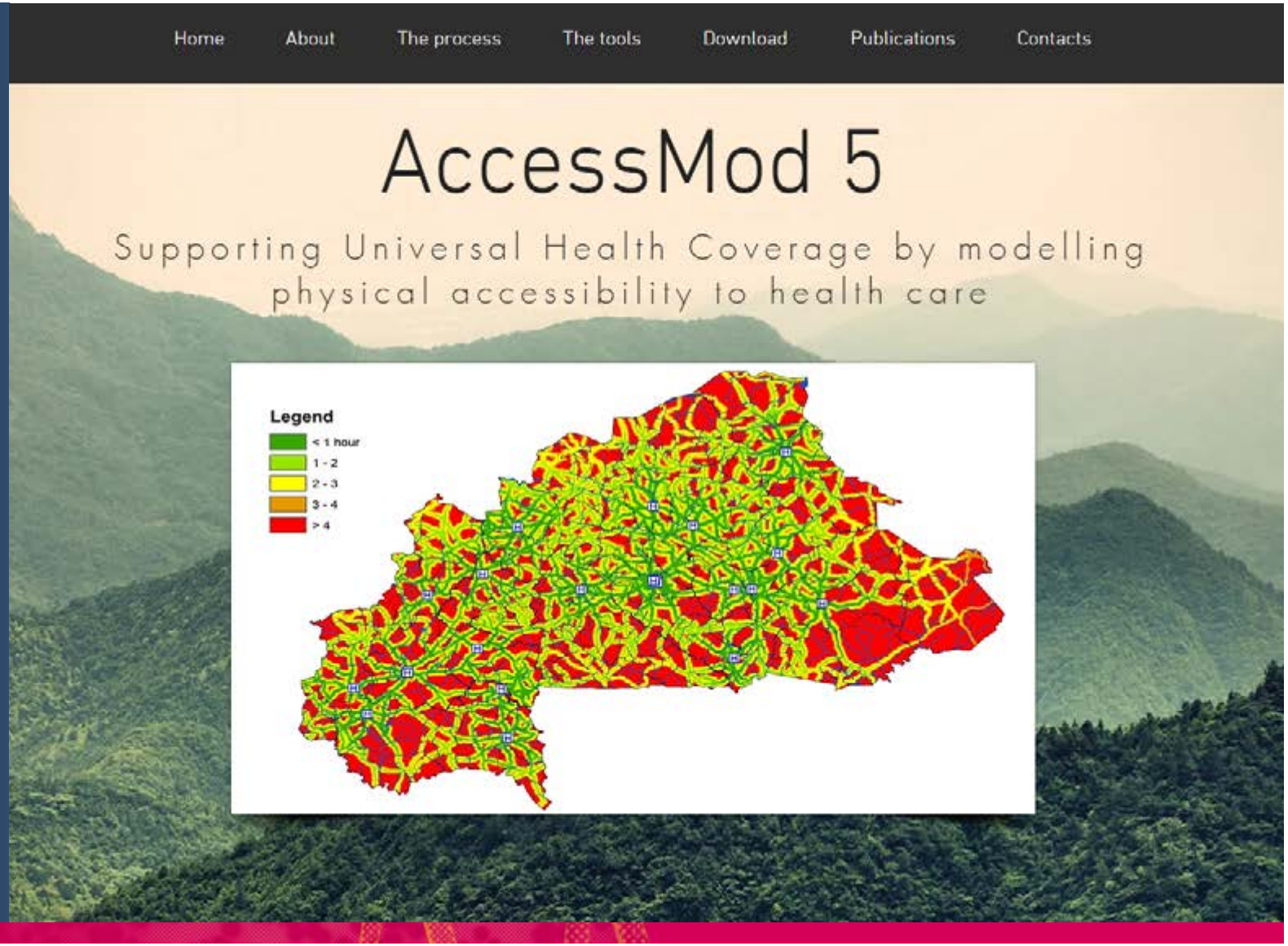
- 143 relevant publications from 1956 to 2016
- 18 animal species affected but a focus on companion animals (e.g. dog, cat) vs livestock
- Death reported in all domestic animal species
- 34 different offending snake species identified (*Vipera*, *Notechis*, *Pseudonaja*, *Bothrops*, *Pseudechis*, *Naja*)

Source: *Dr* M Herrera, Instituto Clodomiro Picado; Narayan G. Maharjan

Modelling physical accessibility to treatment facilities to target population at risk taking into account:

- barriers to movement
- road network
- walking and/or use of motorized vehicle
- population density

Free and open-source WHO tool *AccessMod*



Website: [AccessMod]

New data sources and participatory approaches

Image source: *NatureTTL*

PLOS | NEGLECTED TROPICAL DISEASES

VIEWPOINTS

Participatory approaches and open data on venomous snakes: A neglected opportunity in the global snakebite crisis?

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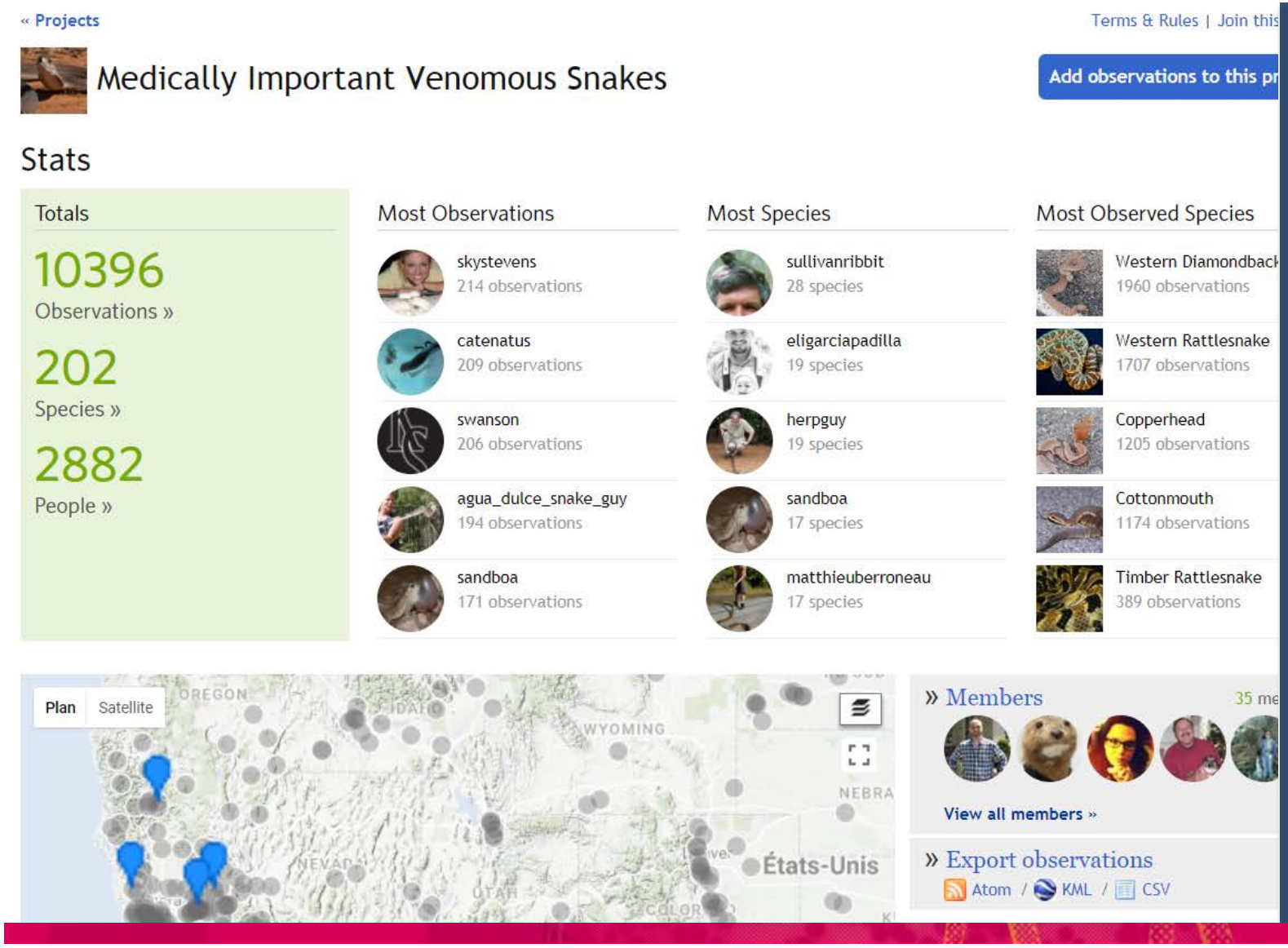
Article: Genevieve et al. (2018), *Plos NTDs*



Open participatory platforms on animal biodiversity such as *INaturalist*

iNaturalist

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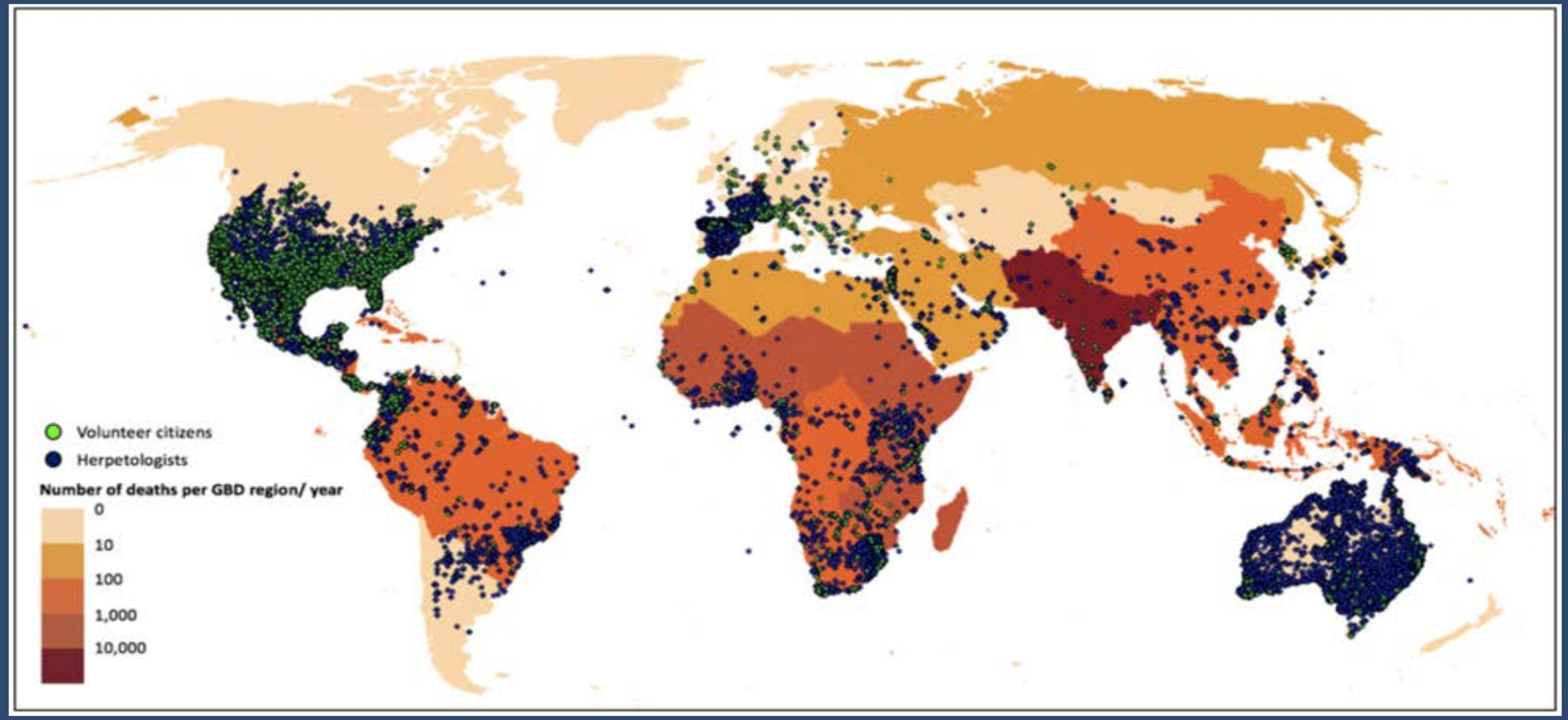
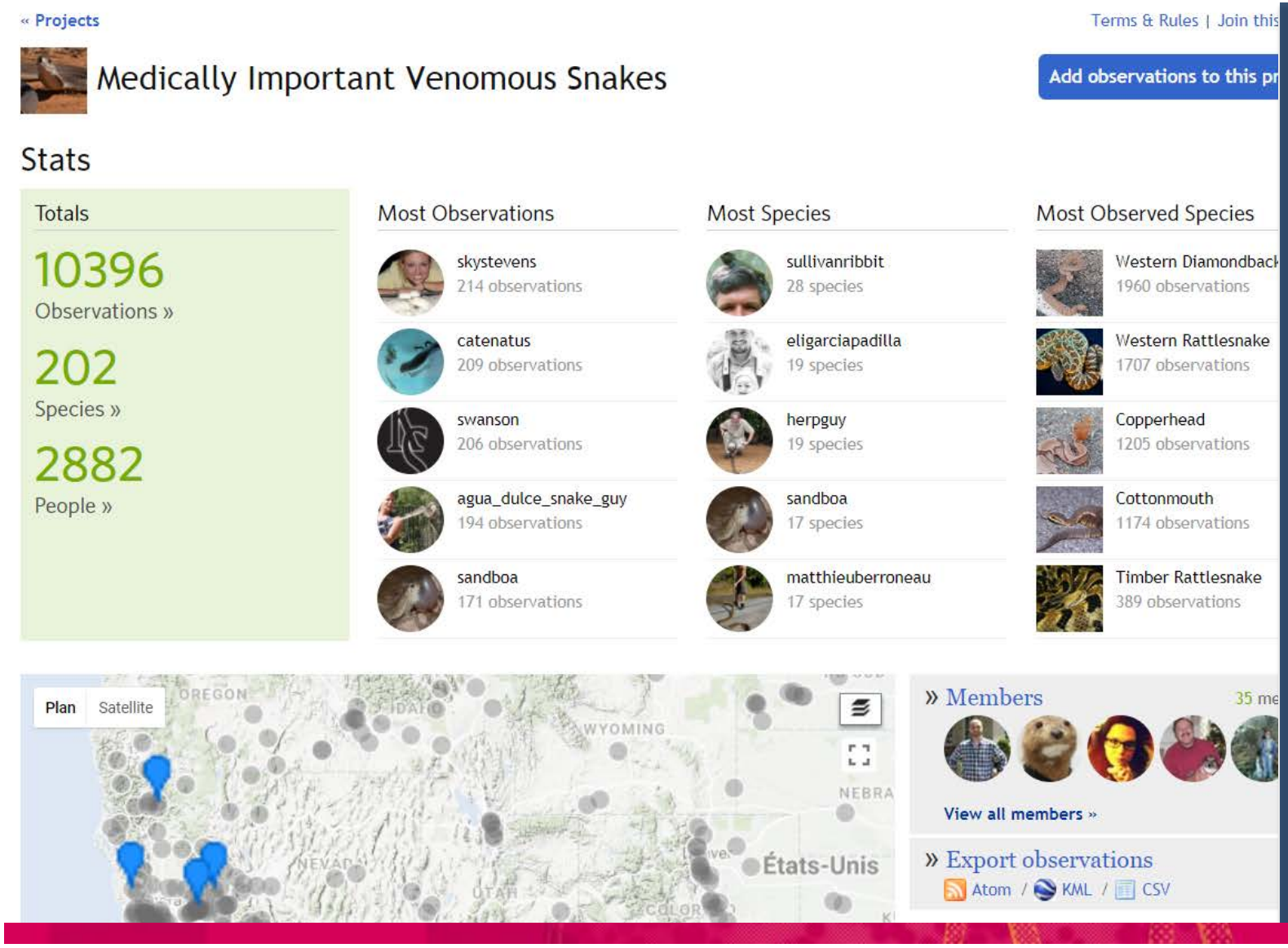
Source: *INaturalist*

First global map of venomous snake distribution based on open data:



Map: Genevieve et al. (2018), *Plos NTDs*



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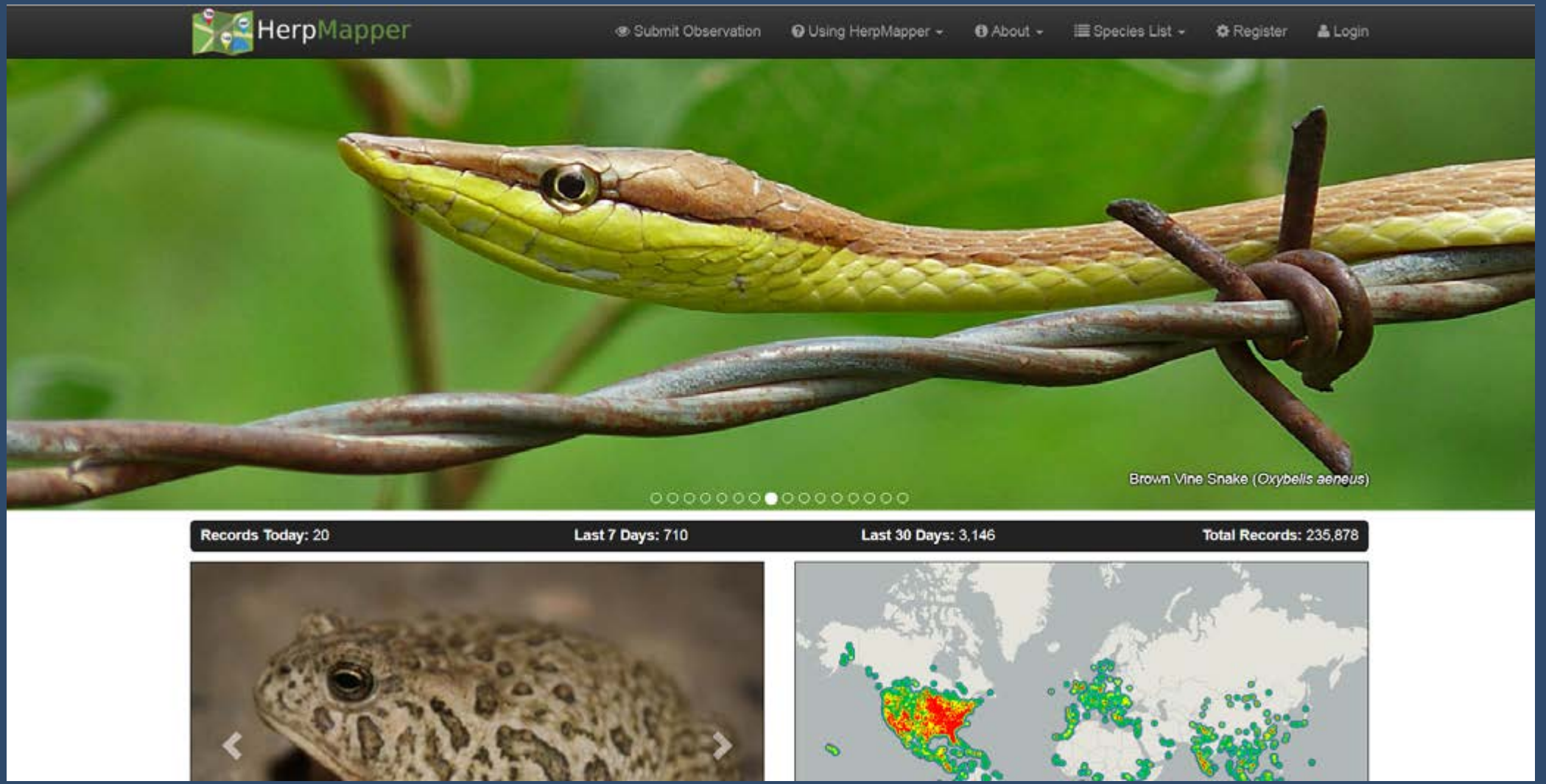
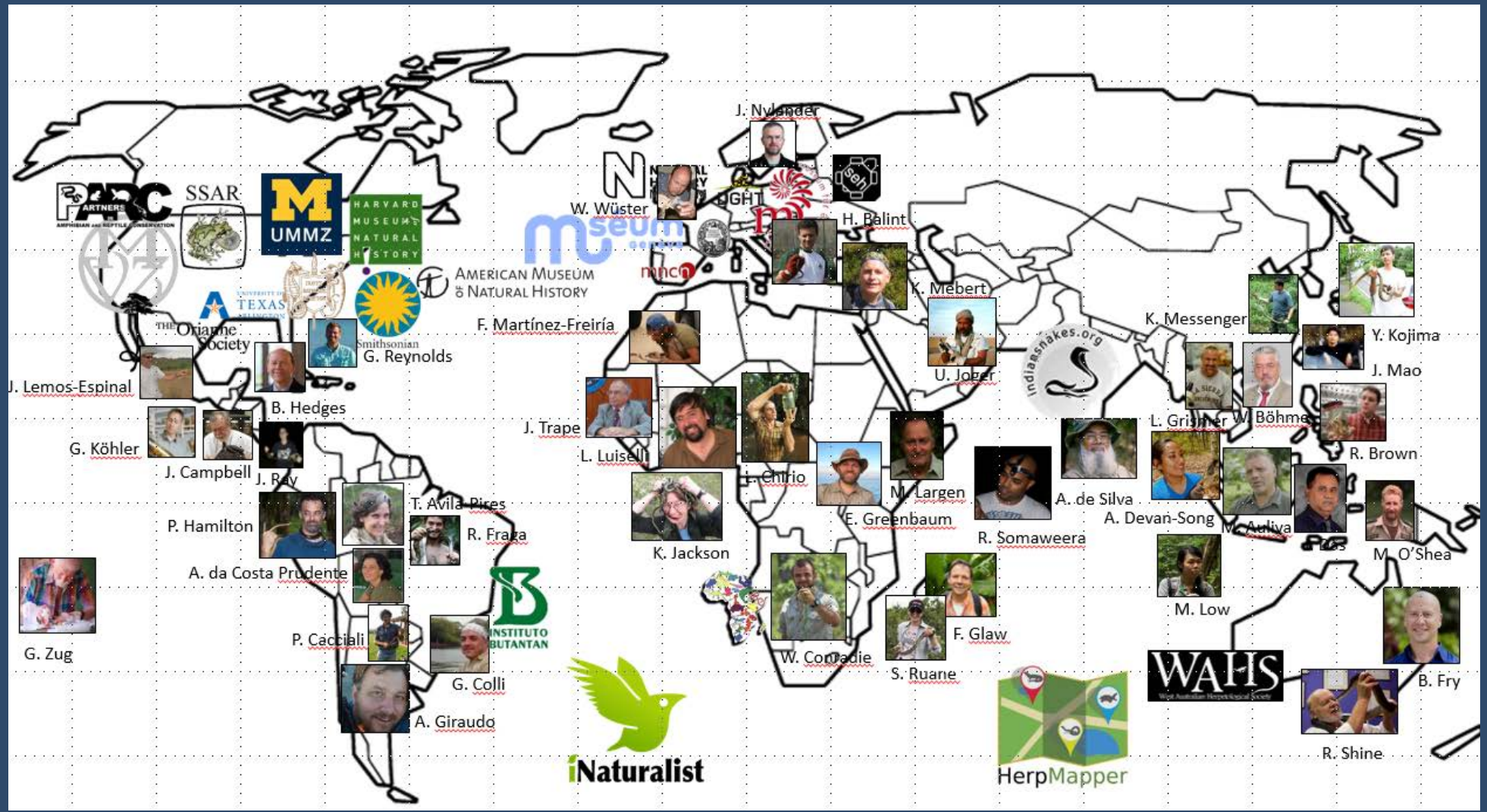


Website: [Herpmapper]

Website: *Indiansnakes.org*

Source: *Facebook*



Map: A. Durso, Institute of Global Health, UNIGE

Largest global and dynamic **open dataset of snake photos**

Image source: *INaturalist*

What is the biting snake?, is it venomous?, what type of venom and what clinical manisfestations to anticipate?

- **Snake identification** is key for **adequate clinical management**
- **Snake identification** is **complex** and health professionals are **not herpetologists**

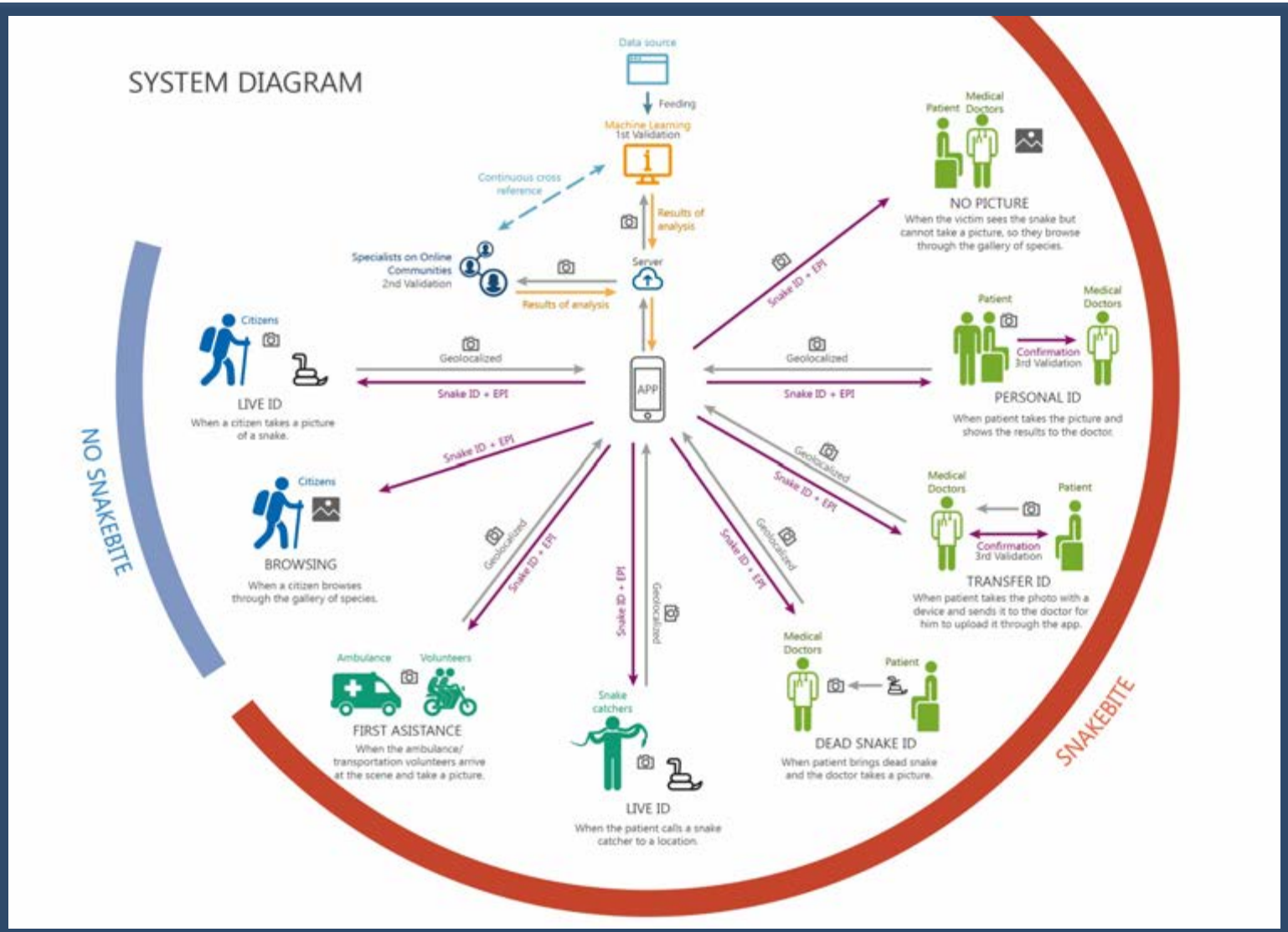
Source: B. Dupont

WHO:

*"Out of more than **3000 species of snakes** in the world, some **600 are venomous** and over **200 are considered to be medically important**"*

Image source: *INaturalist*

Source: *Snapp* team – SDG Summer School 2017, Geneva-Tsinghua Initiative

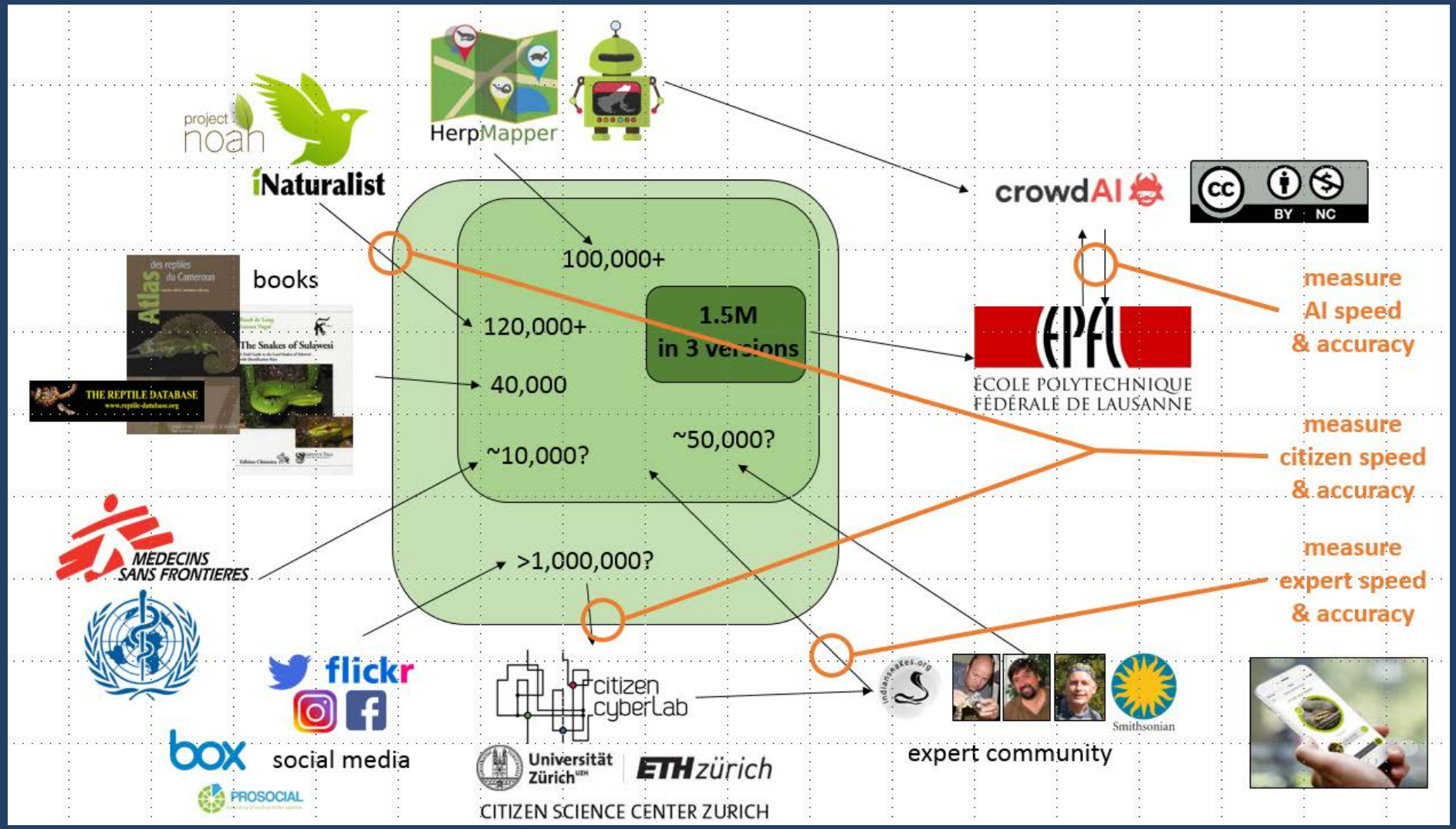


Source: *Snapp* team – SDG Summer School 2017, Geneva-Tsinghua Initiative

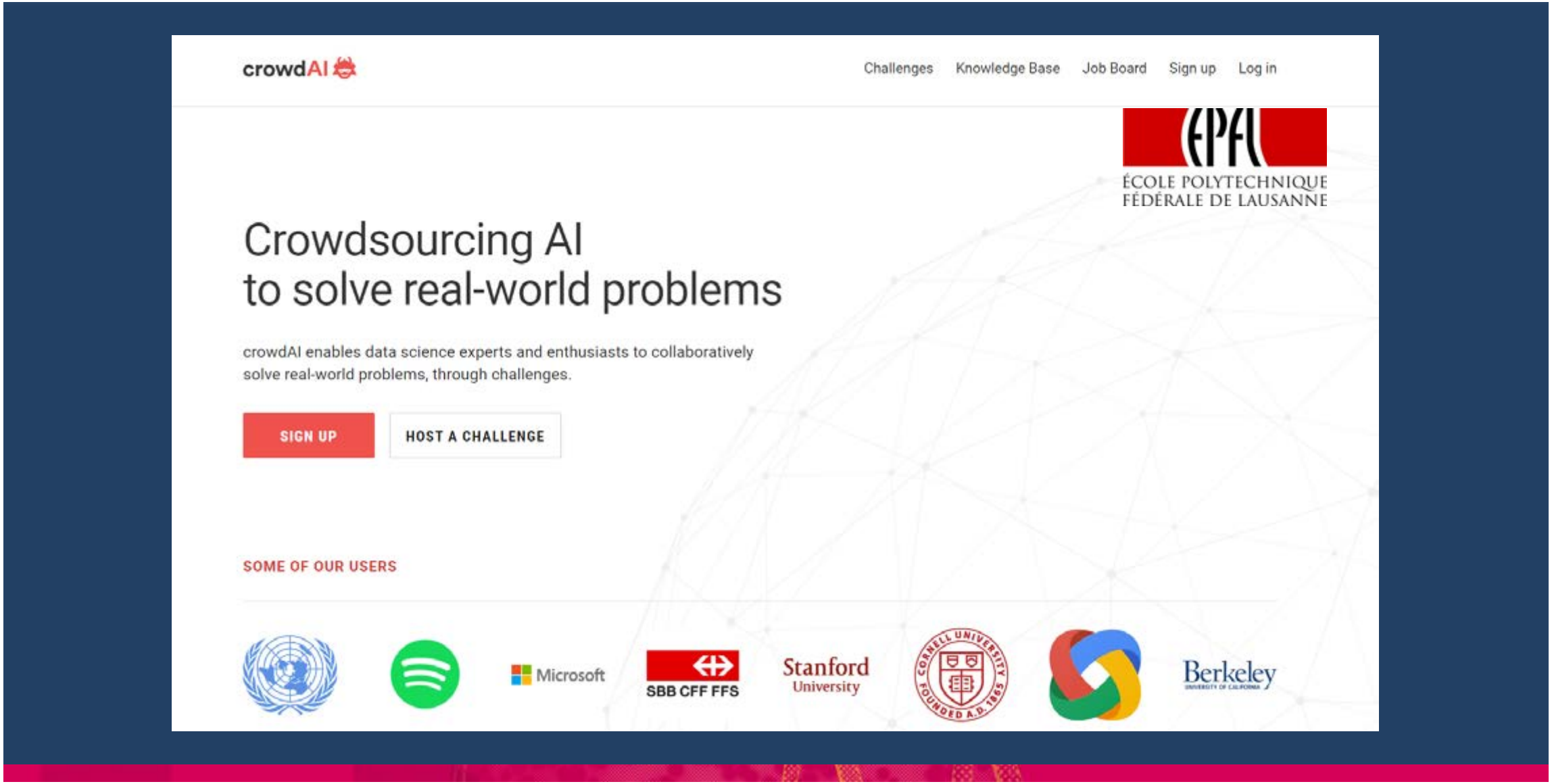
Diversity of possible scenarios:

- Field and clinical scenarios identified with experts and to be tested
- Although not recommended, killing the bitting snake and carrying to the health centre is a common practice in many areas of the world (e.g. Myanmar over 60% of snakebite)

Image source: Kolanaski



Source: Andrew Durso



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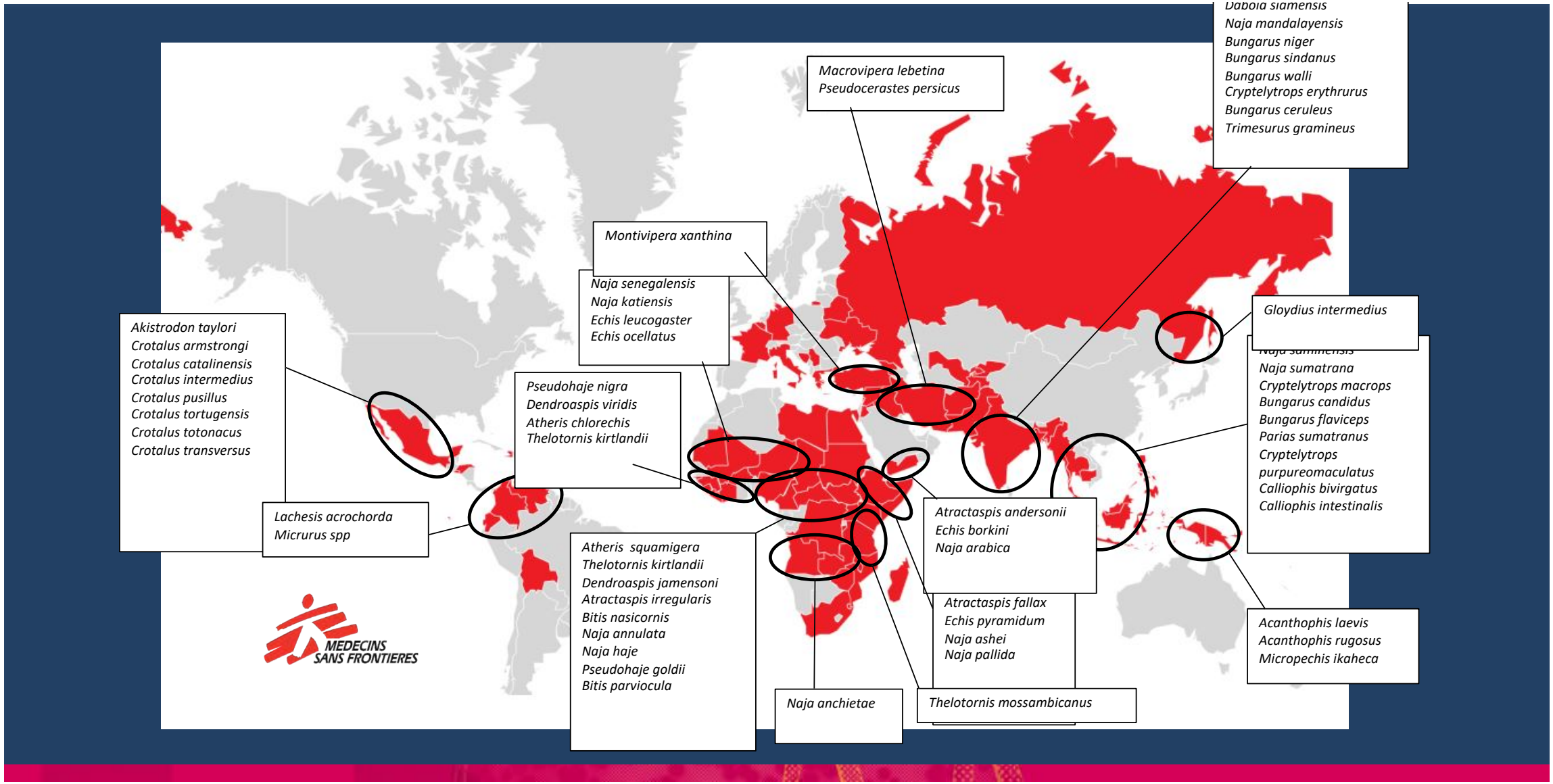

Map: Dr. Gabriel Alcoba

Thank you!
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