Amphibian population declines: where do we go from here?

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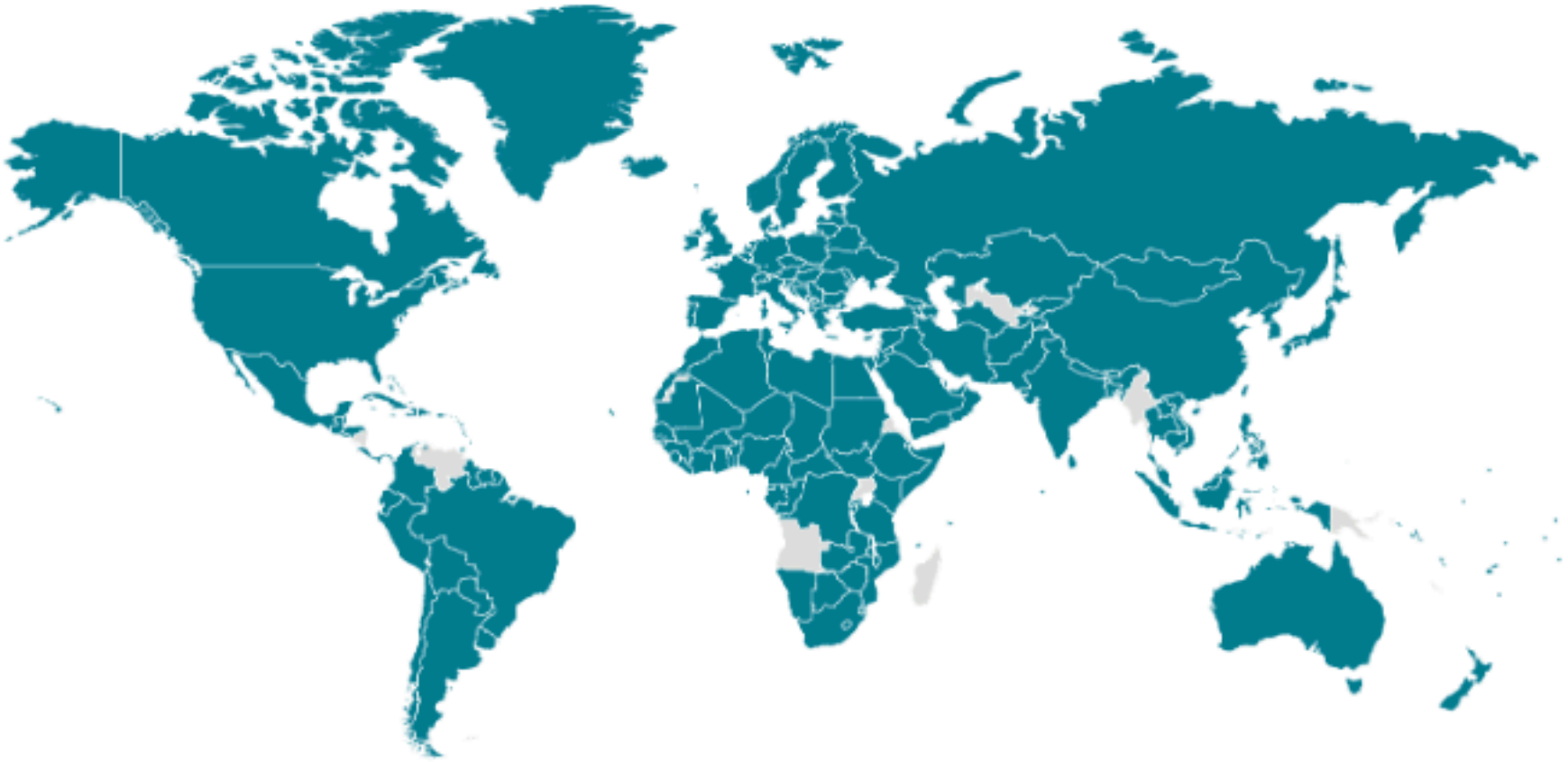
COVID 19: Global Pandemic



CDC; 1 April 2020

Incilius periglenes, Golden toad of Costa Rica

Amphibians: Another Pandemic

- Global Pandemic
- Hundreds of species in decline, 100+ species extinctions
- Impacts on ecosystems: numerous (streams, algae, snakes, insects)
- Loss of biodiversity = loss of ecosystem goods & services

FEATURE

The Insect Apocalypse Is Here

What does it mean for the rest of life on Earth?

Decline of the North American avifauna

Kenneth V. Rosenberg[1,2,*], Adriaan M. Dokter[1], Peter J. Blancher[3], John R. Sauer[4], Adam C. Smith[5], Paul A. Smith[3], Jessica C. Stanton[6], Arvind Panjabi[7], Laura Helft[1], Michael Parr[2], Peter P. Marra[8,†] Science 2019.

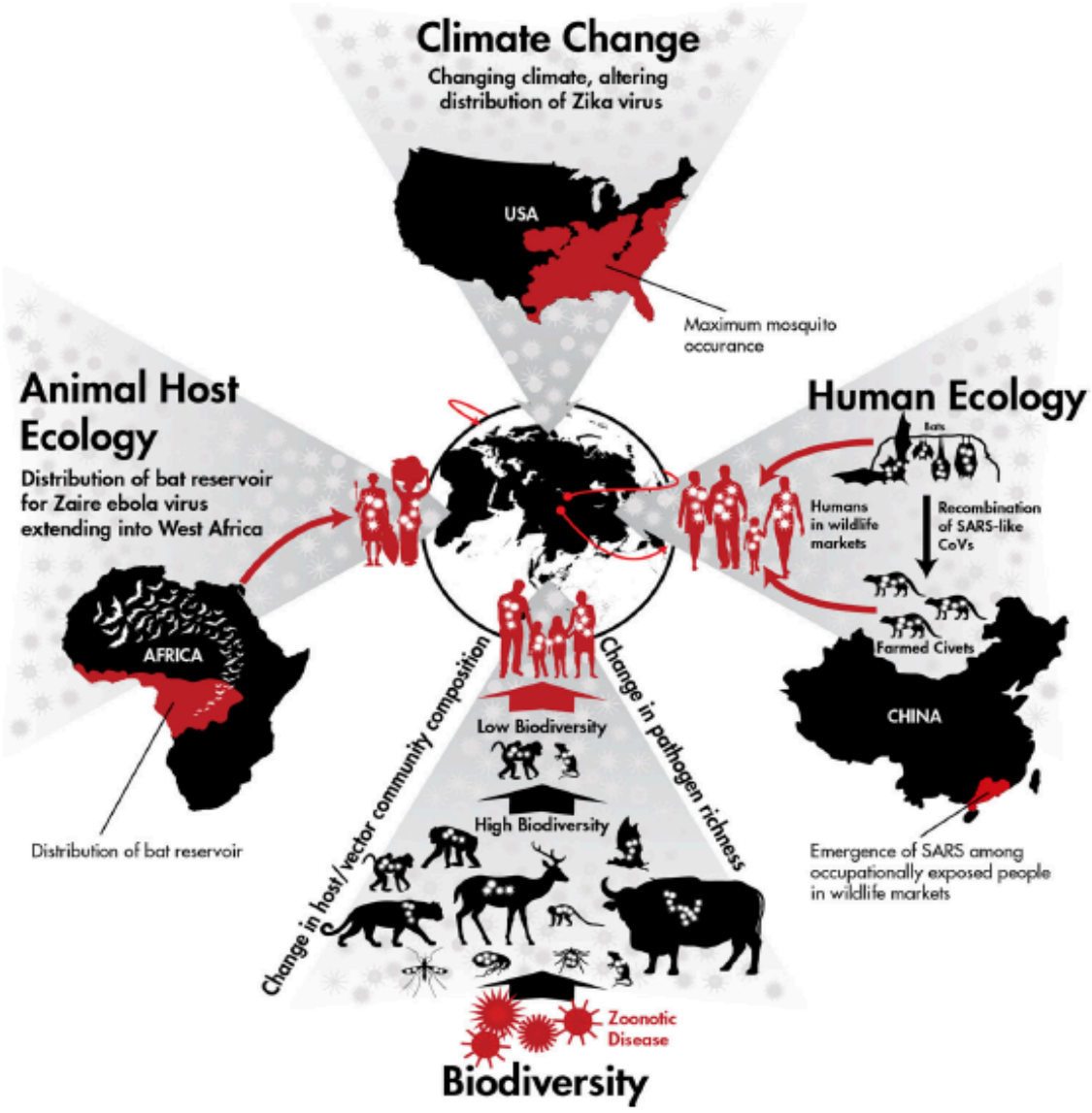
Science as usual is not enough

- Complex, synergistic issues

  Infectious diseases, Energy, Space, IOT, Climate change, GMOs, Cybersecurity, AI
- Cross geopolitical boundaries
- Strong academic skills
  - Breadth & depth of knowledge
  - Strong quantitative skills
  - Innovation, creativity
- Strong Engagement skills
  - Team Science
  - International & Multidisciplinary
  - Communication & public engagement

Grand Challenges in Env. Sci. 2001. Natl Acads. Sci.

OneHealth: a model for coronavirus?



#WeAreAllConnected

Smiley et al. 2020. EcoHealth

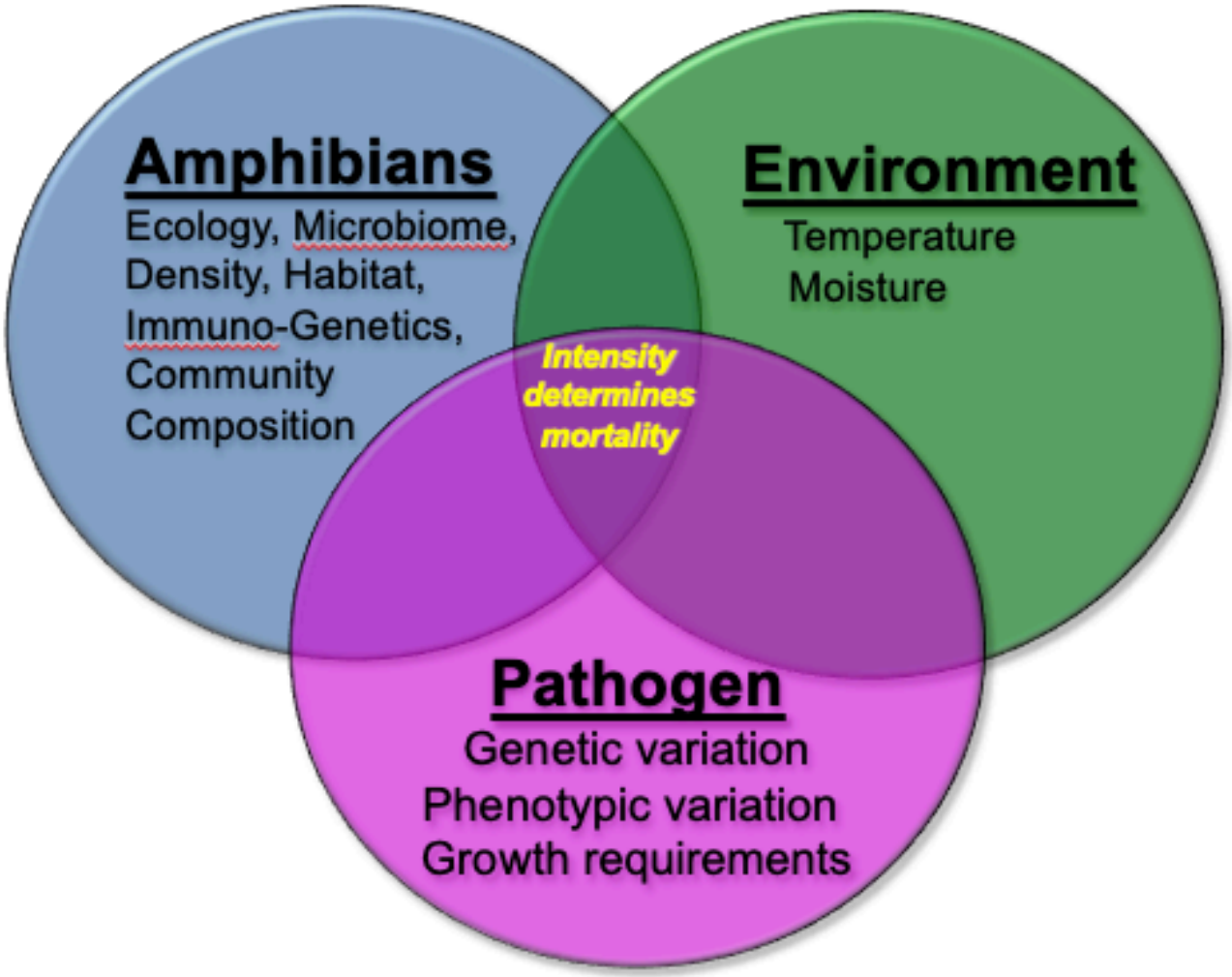
What do we want to do?

- Eliminate chytrid?
- Cure individual frogs?

- Recover amphibian populations?
- Restore ecosystems?

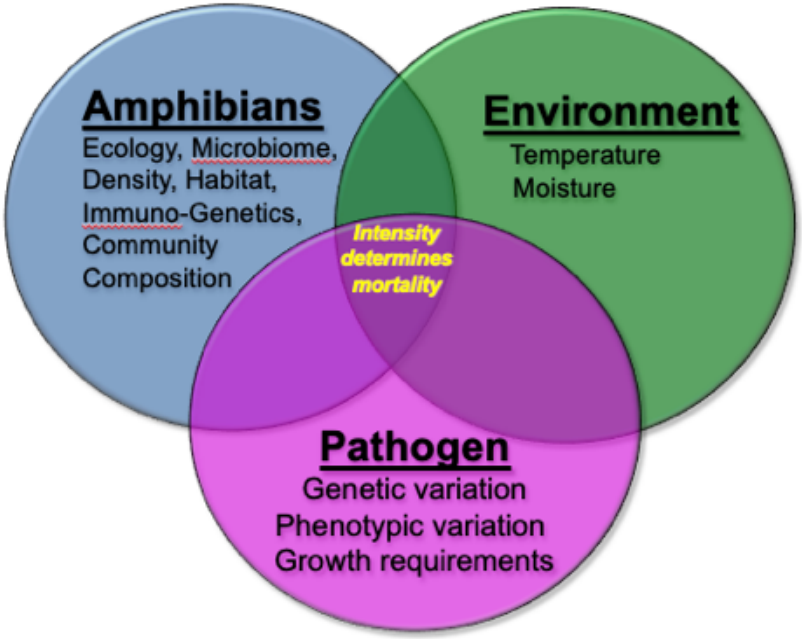
- Stop spread of wildlife diseases?
- Importance of biodiversity?

Research: What's needed?

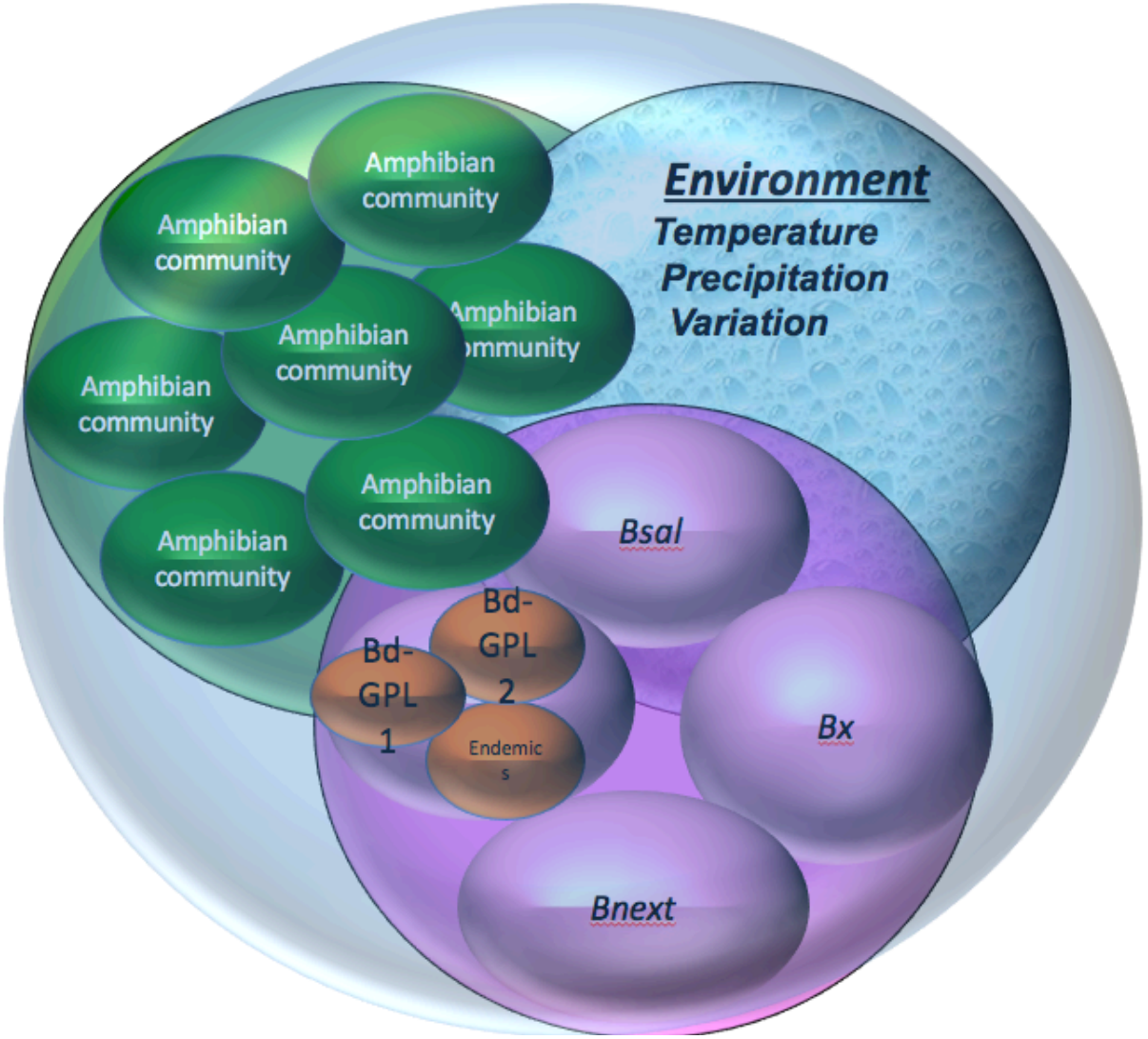


Lab

- Discovery of new chytrid strains
- Adaptation of species and populations
- Immunogenetic mechanisms
- Experimental manipulation:



Reality: Multi-host, Multi-pathogen systems



Field Research

- Surveys: Changes in Species richness & abundance
- Museum collections: Specimens & tissues for detecting changes in populations
- Population Monitoring: Mark-Recapture, Occupancy & Detection
- Disease surveillance: seasonal changes
- Ecosystem Ecology: Impacts of declines on ecosystems & on human health

Big Data & Analyses

- Forecasting future outbreaks – Machine Learning & Artificial Intelligence
- Identifying species & areas of new disease emergence
- Global Synthesis – identifying patterns, sharing data and techniques

Conservation: What's next?

- Fight the Fungus: vaccines? CRISPR?
- Assisted Evolution: Selecting for resistance (Corroboree frog, AUS)
- Accepting new reality: Fewer species, lower density

Building global capacity

- Research techniques
- Multidisciplinary collaborations
- Training programs: Lab, Field, Computational
- Communication & Public engagement

Public engagement: why science matters

- Importance of biodiversity
- Ecosystem Goods & Services
- One Health

Disease Ecology: Past and Present for a Better Future

XI Latin American Congress of Herpetology, Quito, Ecuador, July 24–28 2017

Jenny Urbina[1], Sandra P. Galeano[2,3], Leonardo D. Bacigalupe[4], and Sandra V. Flechas[2]

Latin Americans have been leaders on amphibian decline research

Taking it to the next level will require:

- **Multidisciplinary** research collaborations
- **Scholarly Communication**: training & dissemination with public groups
- **Public Engagement**: training and engagement on policy issues with governments

Copeia. 2019.

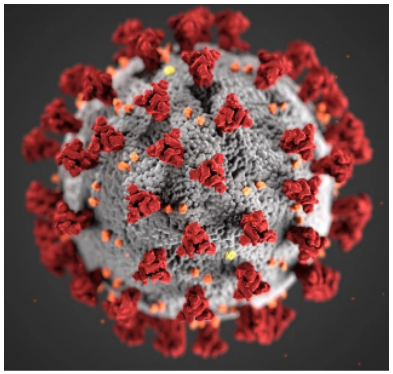
CIENCIA CAFÉ
Pa' Sumercé!

Carlos Guarnizo
Vicky Flechas
Sandra Galeano
Nicolas Urbino
Andrew Crawford
Valentina Munoz
Santiago Herrera
Caitlin May
Carolina Guarnizo

Citizen Science Programs

iNaturalist

Policy: can we use Coronavirus to further conservation?



- Lessons learned: COVID19 is evidence of the importance of wildlife disease to human health & the global economy
  - It has impacted every aspect of our lives, in every corner of the world
- Pass laws to prevent imports of infected animals (laws); World Organization for Animal Health (OIE)

ORGANISATION MONDIALE DE LA SANTÉ ANIMALE
Protéger les animaux, préserver notre avenir

Amphibian disease as a case study

- We need better legislation to detect & regulate pathogens and parasites in wildlife imports
- Better coordination among agencies that regulate wildlife, trade & disease
- Increased science-policy dialogue



Thankyou

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