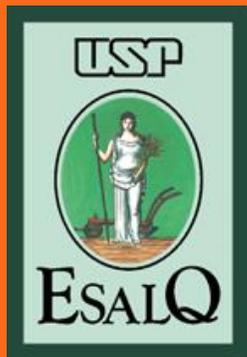


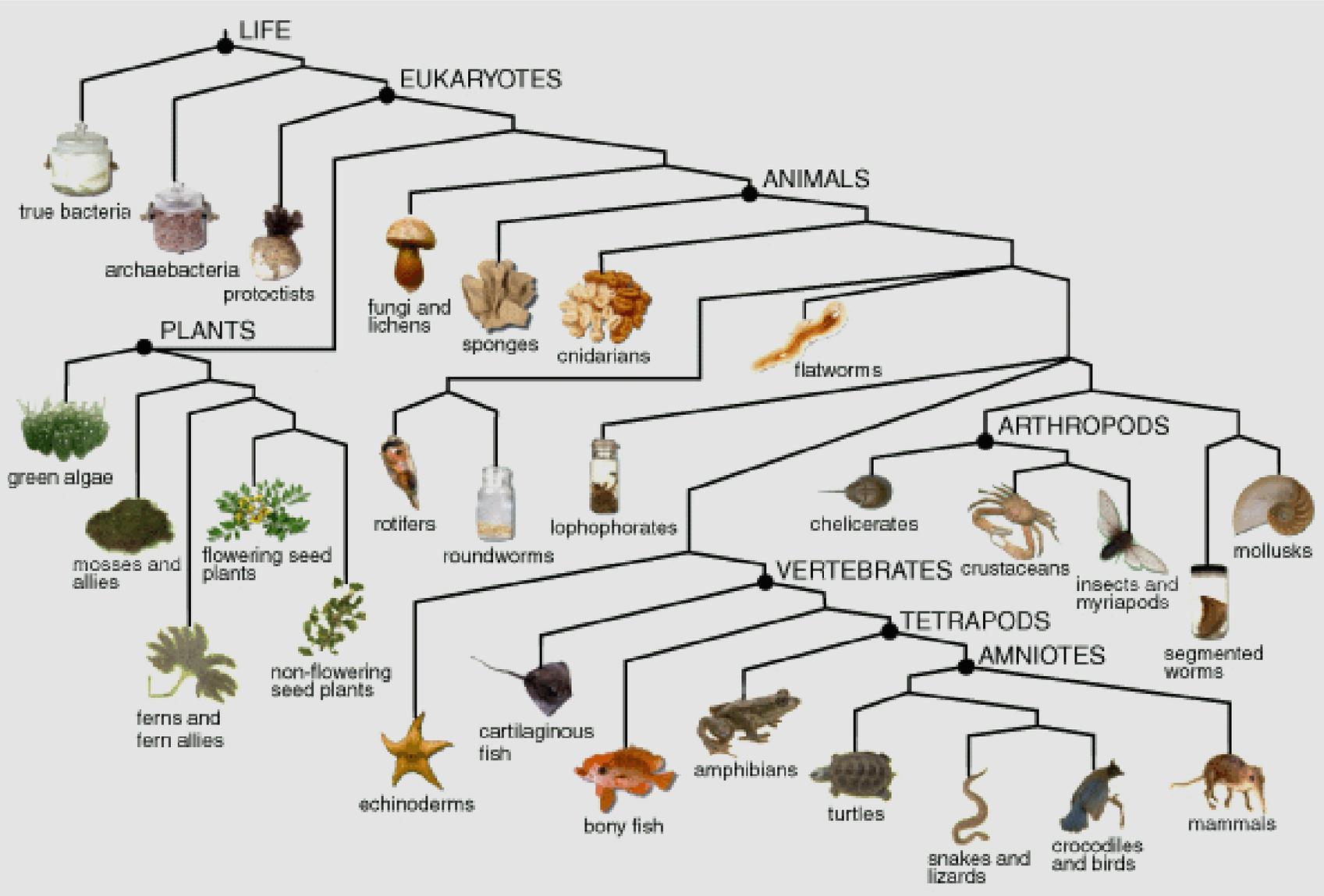
AULA 14
AMPHIBIA

Universidade de São Paulo
Escola Superior de Agricultura Luiz de Queiroz
Curso de Gestão Ambiental
LFN-0233 Zoologia e Ambiente
26 Novembro 2021



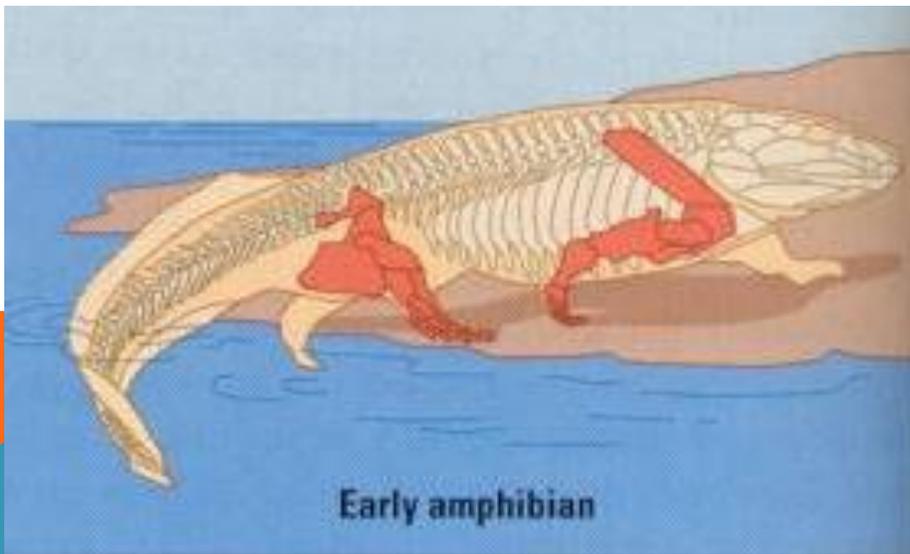
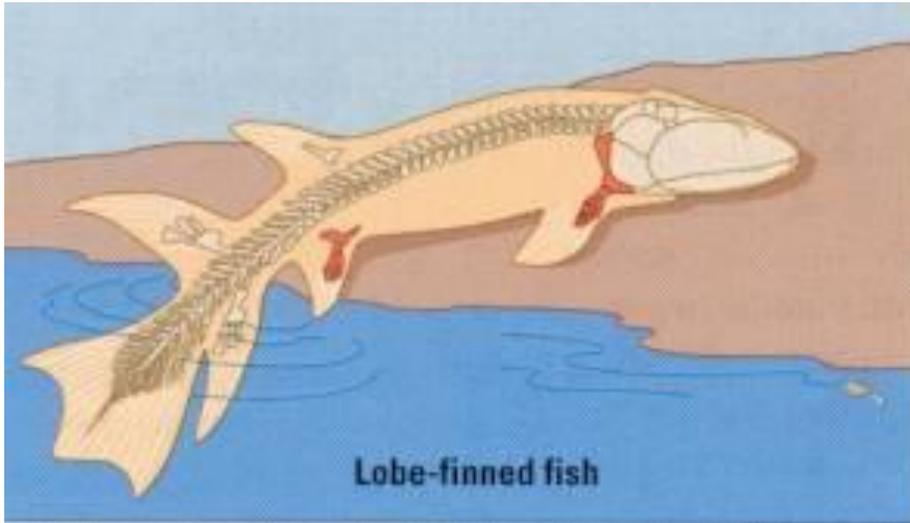
GENERALIDADES

Filogenia dos Chordata



PARTE 1
CARACTERIZAÇÃO

Origem e Diversidade dos Amphibia



http://lanbob.com/lanbob/H-Evolution/H-Evolution-007Animals_files/image094.jpg



Características dos Amphibia

Pele úmida e lisa.

Dois pares de pernas.

Esqueleto parcialmente ossificado.

Respiração pulmonar e cutânea (adultos);
branquial e cutânea (larvas).

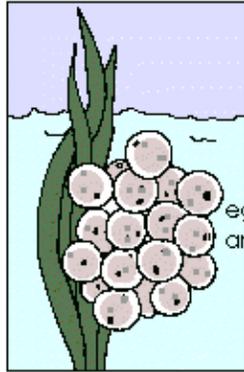
Ectotérmicos.

Fecundação externa.

Ovos com cápsula gelatinosa; com metamorfose.

Metamorphose

LIFE-CYCLE OF THE FROG



frog spawn
(frog eggs)

eggs are laid in the water
and are covered with jelly

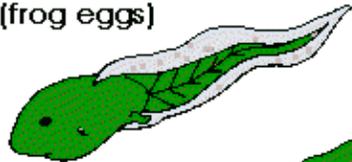
newly hatched
tadpoles



a week old
tadpole



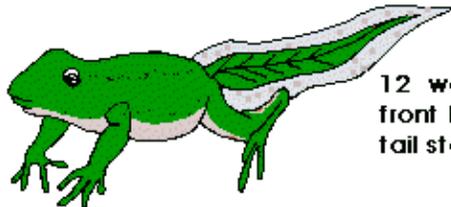
6 weeks old :
external gills
disappears



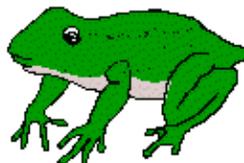
8 weeks old :
hind legs are
formed



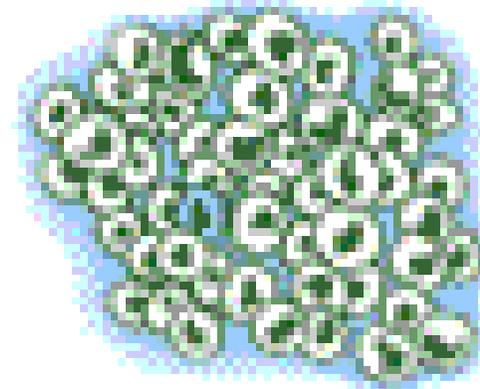
12 weeks old :
front legs are formed
tail start to shrink



the tail is almost gone



when the tails disappears, the frog
will then hop out of the water on to the land



Perguntas?

IMPORTÂNCIA

Alimentação



Rã-pimenta
Leptodactylus spp.



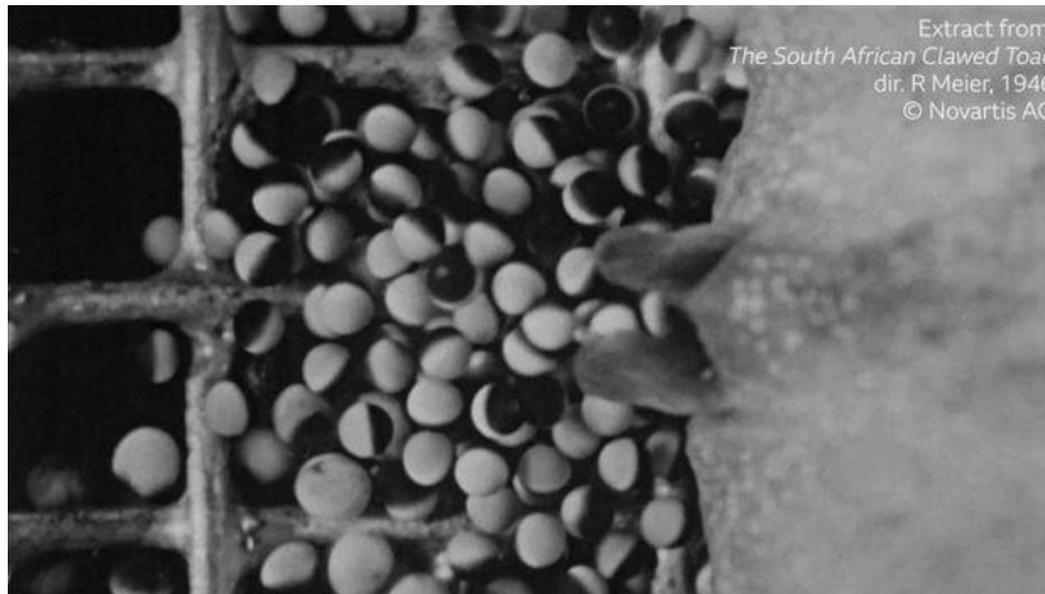
Rã-touro
Lithobates catesbeianus
Sin. *Rana catesbeiana*

<https://www.iucnredlist.org/species/58565/53969770>

Teste de Gravidez



<http://i1.wp.com/diariodebiologia.com/files/2010/07/frog.jpg?resize=600%2C655>



Extract from:
The South African Clawed Toad
dir. R Meier, 1946
© Novartis AG

<https://www.proambientecampinas.com.br/noticia/a-ra-que-pode-ser-usada-como-teste-de-gravidez/>

Teste de Gravidez *Xenopus laevis*

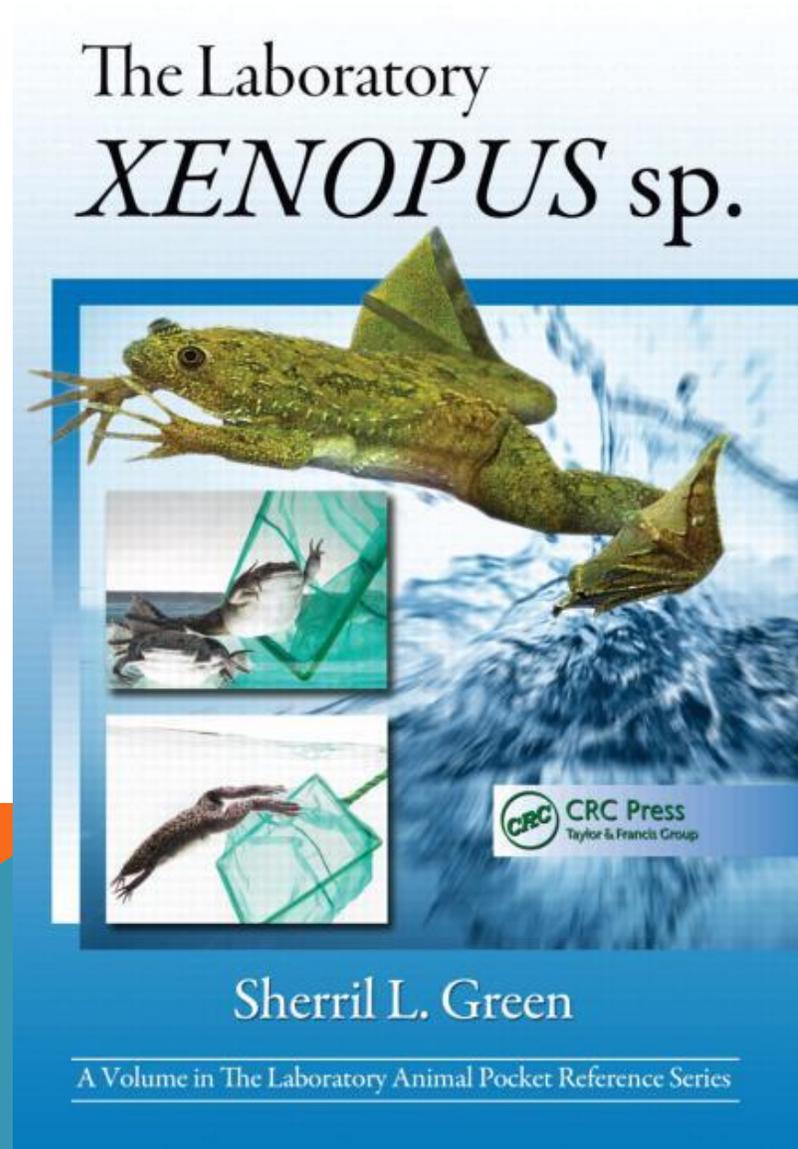


<https://wellcomehistory.files.wordpress.com/2013/02/audrey1.jpg>



https://upload.wikimedia.org/wikipedia/commons/5/5d/Gemeiner_Krallenfrosch_-_Xenopus_laevis_-_aus_Afrika.JPG

Outros Estudos *Xenopus laevis*



<https://images.tandf.co.uk/common/jackets/amazon/978142009/9781420091090.jpg>

Indústria Farmacêutica



Perereca-de-folhagem-com-perna-reticulada

Matas de galeria Brasil

Phyllomedusa ayeaye



“Gastric brooding frog”

Leste da Austrália

Rheobatrachus silus e *R. vitellinus*

Perguntas?

AÇÃO DO HOMEM

Introdução de espécies Sapo-cururu na Austrália, rã-touro e rã-de-unhas-africana

Alteração hábitat Aquecimento global (ação direta / indireta)

Poluição Fertilizantes nitrogenados e fosforados / poluição orgânica – esgoto doméstico (ação indireta)

Sapo-Cururu



<http://www.critterzone.com/animal-pictures-nature/stock-photos/may-beetle-Phyllophaga-species-sp-spp-AWIN073108-125.jpg>



<https://parkerbiolabs.files.wordpress.com/2015/05/grubs-in-soil.jpg>

Sapo-Cururu vs. *Dermolepida albohirtum*



<https://www.cirad.fr/en/our-research/research-results/2010/tracking-greyback-cane-beetle-flights-by-radiotelemetry>

D. albohirtum e *Lepidiota frenchi* são pragas da cana-de-açúcar na Austrália



<http://www.coleoptera-forum.nl/viewtopic.php?t=255>



<https://sugarresearch.com.au/wp-content/uploads/2017/02/Greyback-canegrub-B14017.pdf>

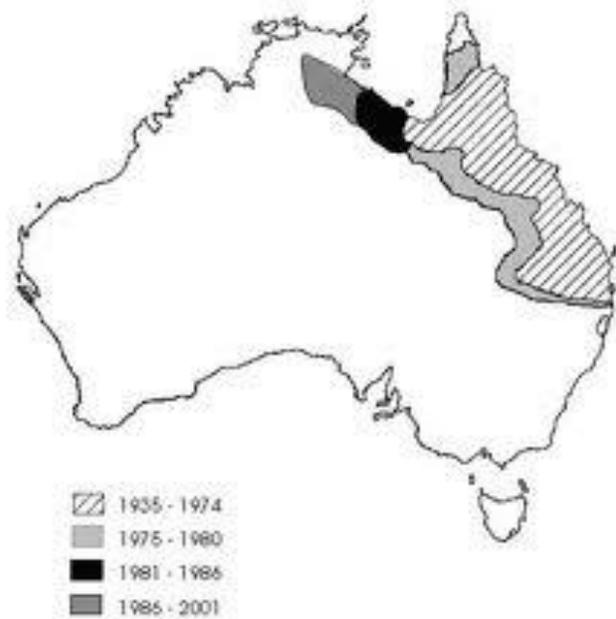
Em 1932, congresso sobre tecnologia canavieira em Porto Rico: relato sobre o uso do sapo no controle de pragas da cana em Porto Rico, Jamaica e Barbados



2 cm

<https://www.invasive.org/browse/subthubmb.cfm?sub=63161&Fam=443&aut=35841&view=3>

Sapo-Cururu Austrália



Dasyurus hallucatus

<http://3.bp.blogspot.com/-Eh4MznsKaUQ/TsRy3VC3F3I/AAAAAAAAAU/J-8RcLv9Ps8/s320/N+quoll+and+Cane+Toad.jpg>

Sapo-Cururu Distribuição



https://upload.wikimedia.org/wikipedia/commons/0/0d/Bufo_marinus_distribution.png

Biological control of the cane toad in Australia: a review

T. Shanmuganathan¹, J. Pallister², S. Doody³, H. McCallum⁴, T. Robinson¹, A. Sheppard¹, C. Hardy¹, D. Halliday¹, D. Venables¹, R. Voysey², T. Strive¹, L. Hinds¹ & A. Hyatt²

¹ CSIRO Entomology, Black Mountain Laboratories, Acton, ACT, WA, Australia

² CSIRO, Australian Animal Health Laboratory, Geelong, Vic., Australia

³ Department of Botany and Zoology, Australian National University, Canberra, ACT, WA, Australia

⁴ School of Zoology, University of Tasmania, Hobart, Tas., Australia

Keywords

genetically modified organisms; BIV; *Bufo marinus*; immune response; species specificity.

Correspondence

Alex Hyatt, CSIRO, Australian Animal Health Laboratory, Private bag 24, Geelong, 3220 Vic., Australia.
Email: alex.hyatt@csiro.au

Received 9 January 2009; accepted 23 September 2009

doi:10.1111/j.1469-1795.2009.00319.x

Abstract

The marine toad *Bufo marinus* is native to northern South America, parts of Central America and Southern Texas. It was deliberately introduced into Australia's tropical north-east in 1935 in an unsuccessful attempt to control the cane beetle, a damaging insect pest of sugarcane crops. The toads quickly established in the new environment and began to spread. Today, they inhabit most of the Australian tropics and sub-tropics and have reached Western Australia. Models predict that global warming will enable the toads to extend their range further south. They cause severe environmental impacts, as all life stages of *B. marinus* contain bufadienolides, alkaloid substances toxic to vertebrates, resulting in death of the predators ingesting it. The continental scale of this biological invasion in combination with the remoteness of the areas affected, poses a specific set of challenges to potential control approaches for cane toads. This review covers different biocontrol strategies pursued over the past 8 years, with particular focus on an immunological approach aiming at the disruption of toad metamorphosis. So far, research efforts have failed to produce a tool for large-scale reduction of toad populations. Considerations of future research priorities and efforts are also discussed.

Rã-Touro, Rã-de-Unhas-Africana



<https://www.iucnredlist.org/species/58565/53969770>

Competição com espécies locais

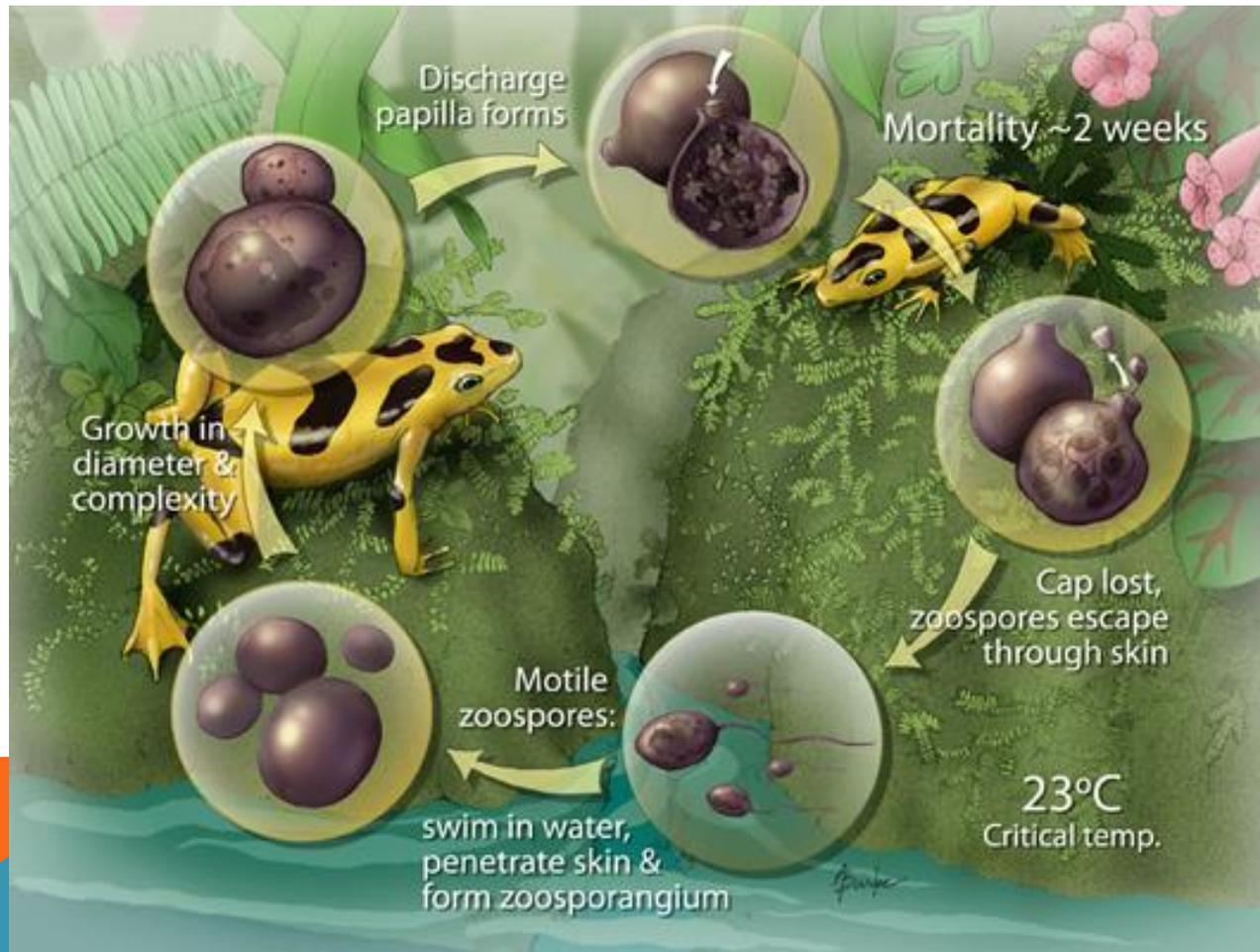
Introdução de doenças
(*Batrachytrium dendrobatidis*)



Xenopus laevis

Batrachochytrium dendrobatidis

Quitridio



Causa doença na pele. Originário do sul da África e dispersão com *Xenopus laevis* e outros anfíbios

X. laevis é tolerante à doença, mas vários outros anfíbios são muito sensíveis

Alterações climáticas aparentemente exacerbam o problema

Efeito de *Batrachochytrium dendrobatidis*



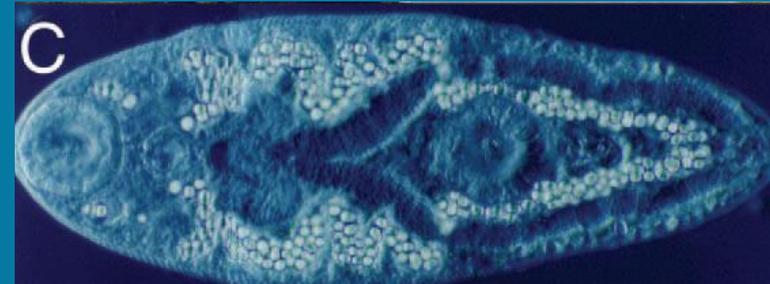
Perereca morta na
Nova Zelândia



Ação do quitrídio em uma perereca no Brasil.

Johnson PT *et al.* (2008) Aquatic eutrophication promotes pathogenic infection in amphibians. Proc. Nat. Acad. Sc. USA 104 (40): 15781-15786.

↑P (adubos fosfatados / detergentes) ↑N (adubos nitrogenados / matéria orgânica solo / dejetos domésticos) → ↑ algas perifíticas → ↑ caramujos → ↑ trematódeo *Ribeiroia ondatrae* → deformidades em rãs



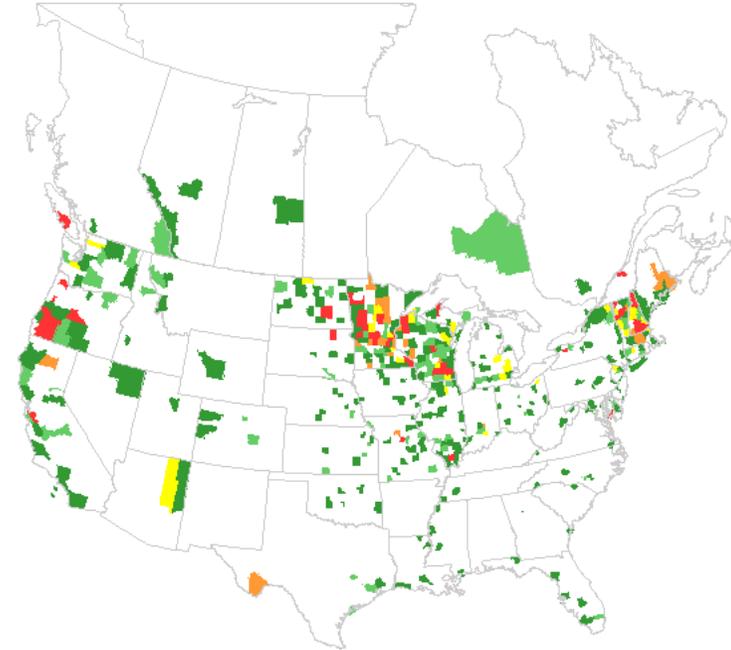
Biomphalaria / esquistossomose?

↑P (adubos fosfatados / detergentes) ↑N (adubos nitrogenados / matéria orgânica solo / dejetos domésticos) → ↑ algas e plantas aquáticas → ↑ caramujos → ↑ trematódeo *Schistosoma mansoni* → incidência de esquistossomose ??? (hipótese de Johnson *et al.*, 2008)



Santana do Mundaú (AL) Novembro de 2009

Declínio dos Anfíbios



Países mais ameaçados Haiti, República Dominicana, Cuba, Jamaica e Porto Rico (72 a 92% das spp.)

Arca dos Anfíbios



Coleta de espécime no Panamá 35 spp. em El Valle enviados para os EUA (projeto Zoo Atlanta) e 60 spp. mantidas no Panamá (projeto Houston Zoo)

Marris, 2008. Bagged and Boxed: It's a Frog Life. *Nature* 452: 394-395. 6.000 spp. de anfíbios; 1.896 spp. ameaçados de extinção; 100 spp. extintas desde 1980

Amphibian Ark Proteção de 500 spp.



Perereca dourada do Panamá
(*Atelopus zeteki*)

The Vanishing Frog (2009) Jeff Corwin

Perguntas?

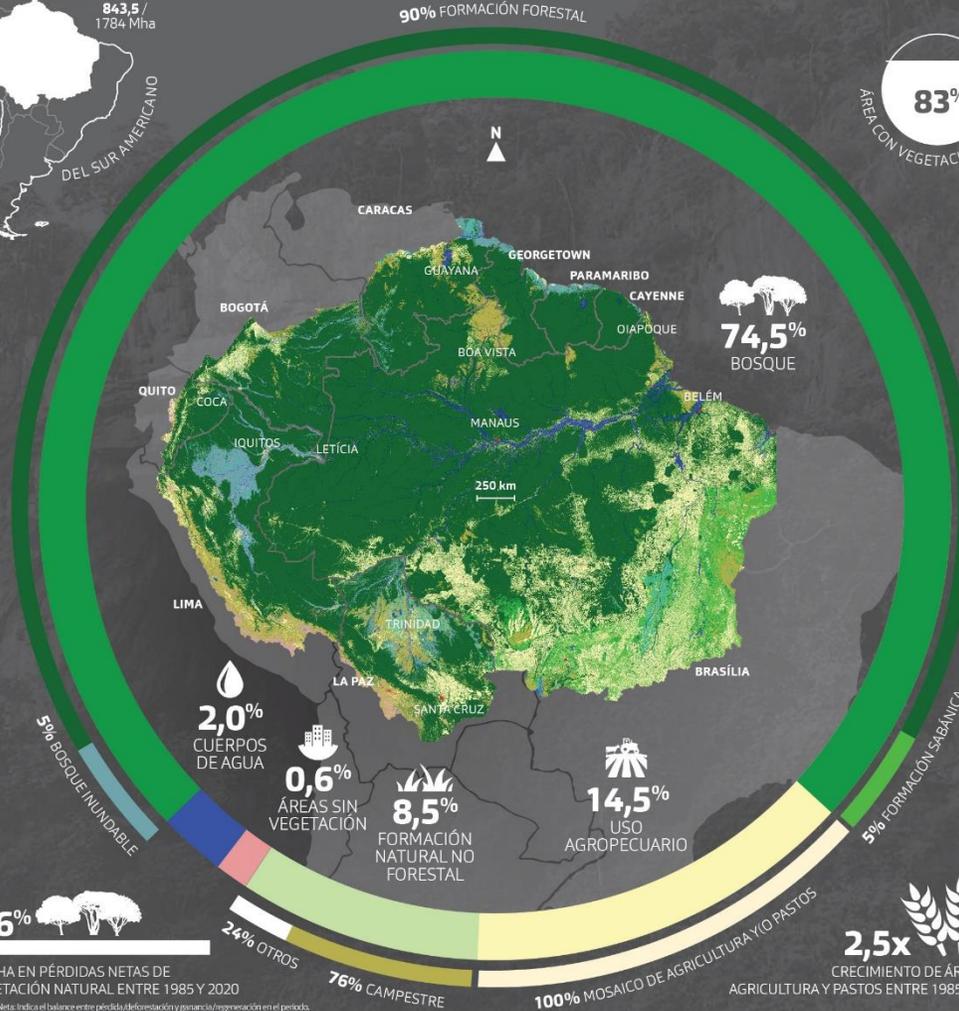
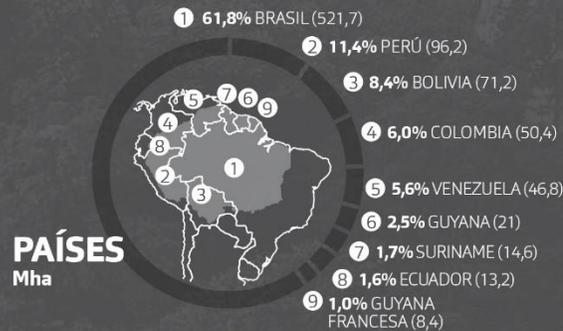
FLORESTA AMAZÔNICA

Perguntas?

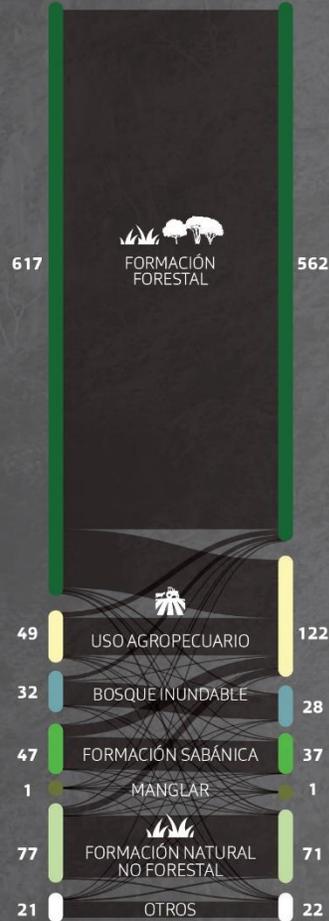
AMAZONÍA 1985-2020

Evolución anual de la cobertura y uso de la tierra

Para más información acceder a: amazonia.mapbiomas.org MAPBIOMAS AMAZONIA 1985



1985 — Unidades en Mha —> 2020



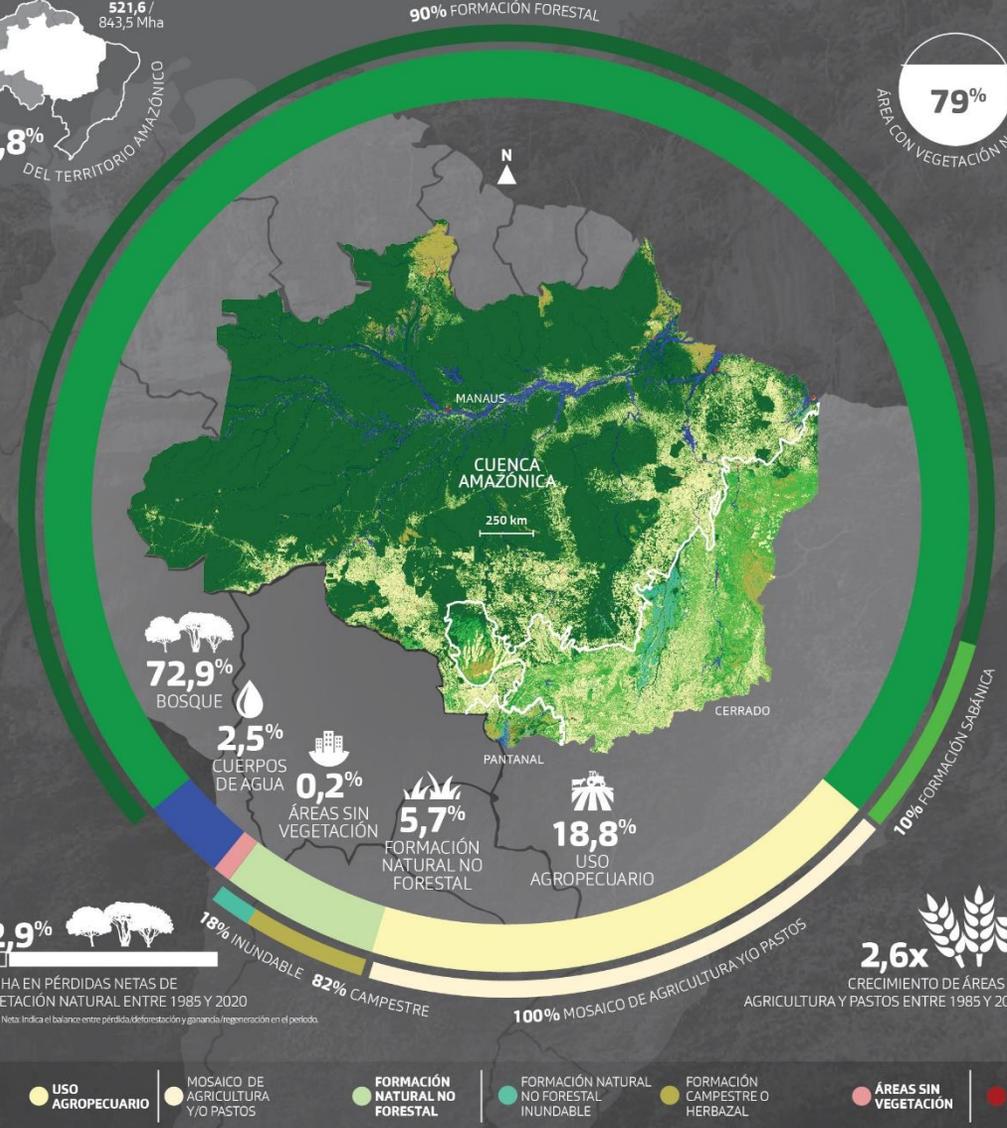
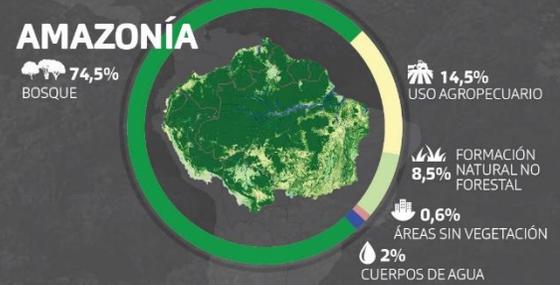
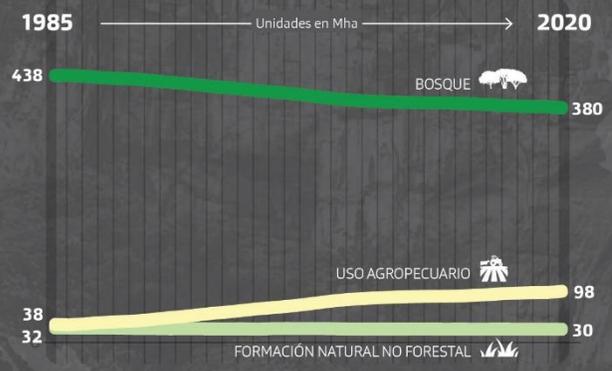
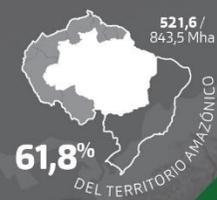
FUENTE: MapBiomas Amazonia, Colección de U.S. La Red de Mapeo de Biomas Amazonia, es un producto de BMFC, es el mayor proveedor de datos de uso de la tierra del mundo, mapbiomas.org los cambios ocurridos en el período 1985 a 2020. Datos por región, datos y metodología pueden ser descargados en el sitio de la red de biomas: www.amazonia.mapbiomas.org

- BOSQUE
- FORMACIÓN FORESTAL
- FORMACIÓN SABÁNICA
- MANGLAR
- BOSQUE INUNDABLE
- USO AGROPECUARIO
- MOSAICO DE AGRICULTURA Y/O PASTOS
- FORMACIÓN NATURAL NO FORESTAL
- FORMACIÓN NATURAL NO FORESTAL INUNDABLE
- FORMACIÓN CAMPESTRE O HERBAZAL
- ÁREAS SIN VEGETACIÓN
- INFRAESTRUCTURA URBANA
- MINERÍA
- CUERPOS DE AGUA

<https://amazonia.mapbiomas.org/infografias>

BRASIL 1985-2020

Evolución anual de la cobertura y uso de la tierra en la **Amazonía legal** y **Cuenca amazónica**



1985 — Unidades en Mha → 2020



12,9%  **61MHA EN PÉRDIDAS NETAS DE VEGETACIÓN NATURAL ENTRE 1985 Y 2020**
Pérdida Neta: Indica el balance entre pérdidas (deforestación) y ganancias (regeneración) en el periodo.

- BOSQUE
- FORMACIÓN FORESTAL
- FORMACIÓN SABÁNICA
- MANGLAR
- BOSQUE INUNDABLE
- USO AGROPECUARIO
- MOSAICO DE AGRICULTURA Y/O PASTOS
- FORMACIÓN NATURAL NO FORESTAL
- FORMACIÓN NATURAL NO FORESTAL INUNDABLE
- FORMACIÓN CAMPESTRE O HERBAZAL
- ÁREAS SIN VEGETACIÓN
- INFRAESTRUCTURA URBANA
- MINERÍA
- CUERPOS DE AGUA

<https://amazonia.mapbiomas.org/infografias>

FUENTE: Mapbiomas Amazônia Colección 3.0 - La Iniciativa Mapbiomas Amazônia es una iniciativa de IANIGLA que ofrece mapas anuales de cobertura y uso de la tierra. Para más información, consulte el sitio web de la iniciativa: www.amazonia.mapbiomas.org

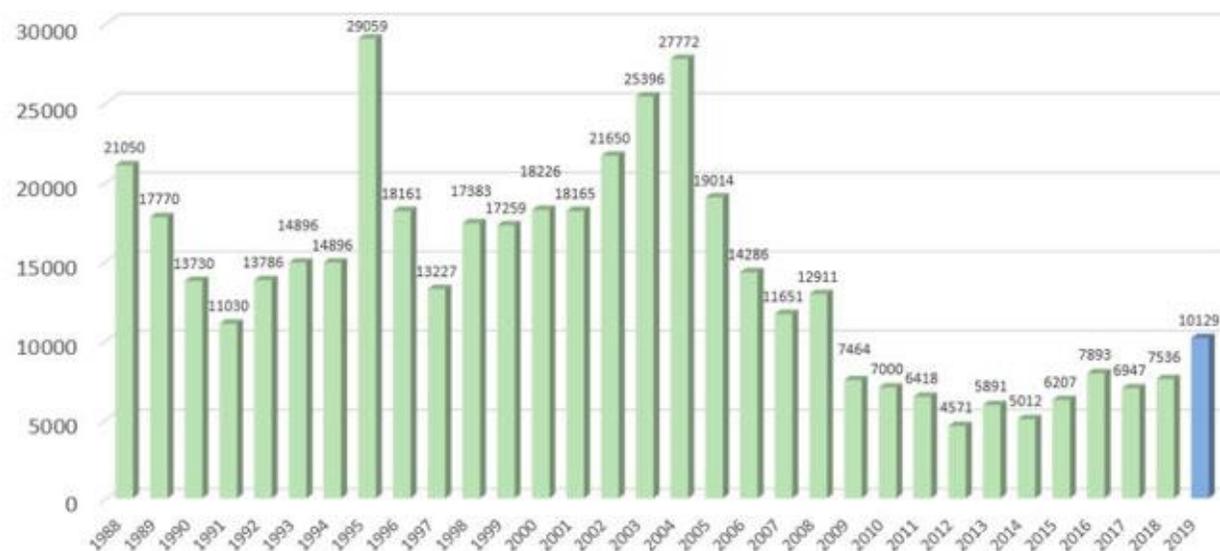


Tabela 2 – Valores absolutos e variação percentual para cada estado.

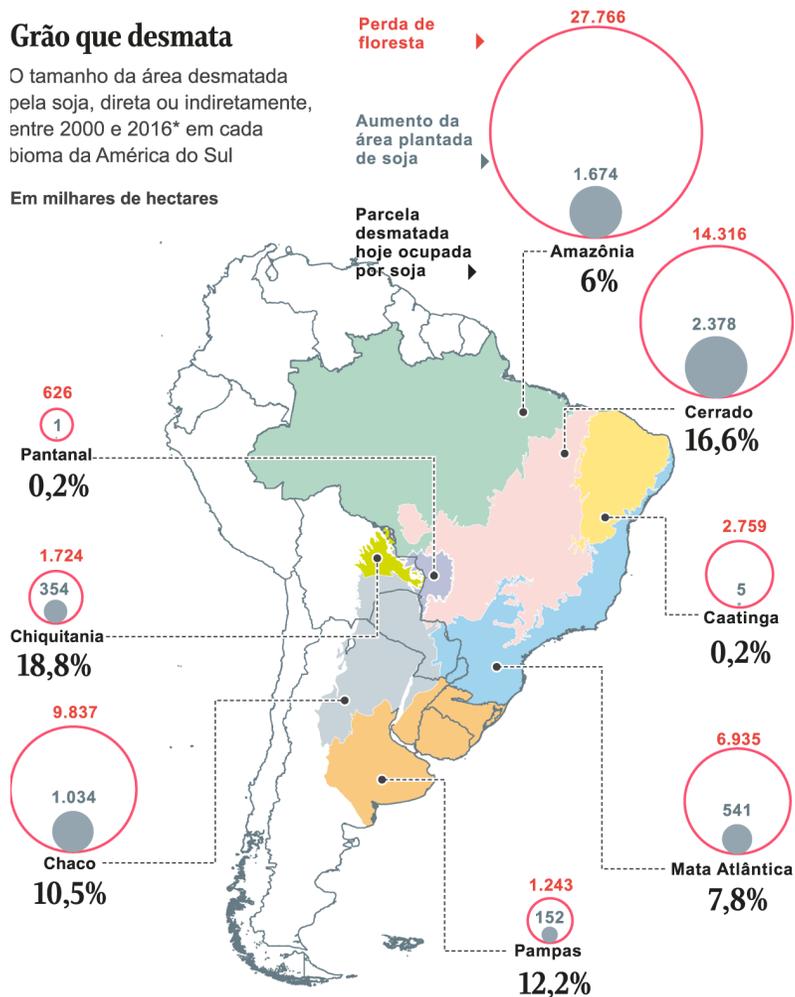
Estado	PRODES 2018 (km²)	PRODES 2019 (km²)	Variação (%)
Acre	444	682	53,60%
Amazonas	1.045	1.434	37,22%
Amapá	24	32	33,33%
Maranhão	253	237	-6,32%
Mato Grosso	1.490	1.702	14,23%
Pará	2.744	4.172	52,04%
Rondônia	1.316	1.257	-4,48%
Roraima	195	590	202,56%
Tocantins	25	23	-8,00%
AMZ. Legal	7.536	10.129	34,41%

http://www.inpe.br/noticias/noticia.php?Cod_Noticia=5465

Grão que desmata

O tamanho da área desmatada pela soja, direta ou indiretamente, entre 2000 e 2016* em cada bioma da América do Sul

Em milhares de hectares



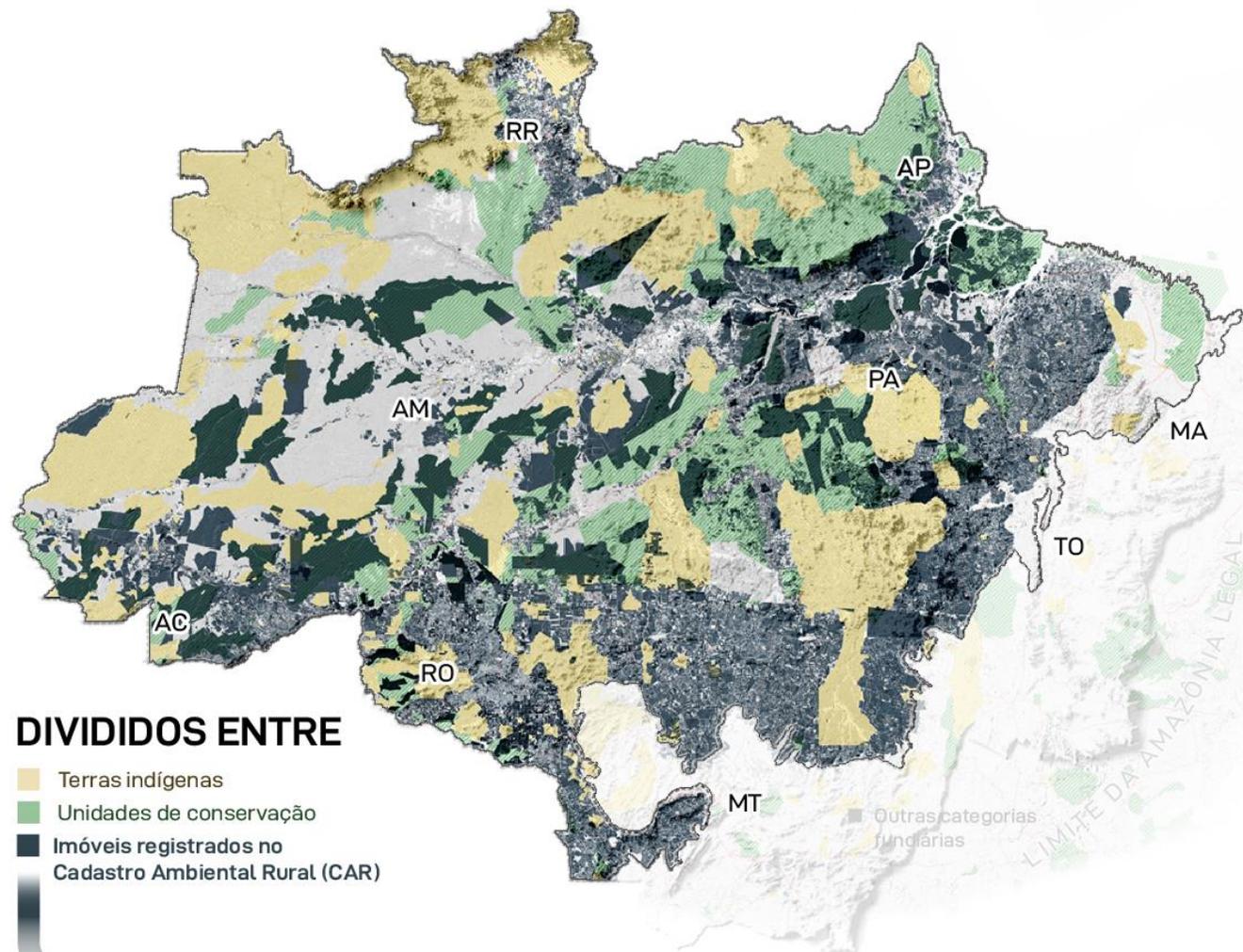
* Estudo incluiu desmatamento ocorrido até 2019, mas como terras desmatadas há menos de 3 anos ainda podem vir a ser ocupadas por influência direta da soja, cientistas consideram números até 2016

Fonte: Nature Sustainability

GLOBO

O BIOMA AMAZÔNIA

tem 5,5 milhões de km²



<https://oglobo.globo.com/um-so-planeta/soja-contribuiu-para-10-do-desmatamento-na-america-do-sul-em-20-anos-mostra-estudo-25054890>

<https://piaui.folha.uol.com.br/reserva-legal-uma-ilusao-amazonica/>

Hemiphractus johnsoni ("Johnson's Horned Frog")



<https://www.gettyimages.ae/detail/photo/hemiphractus-johnsoni-royalty-free-image/1141873475>



https://calphotos.berkeley.edu/cgi/img_query?enlarge=0000+0000+1209+2218

Boa Noite!