Effect of physical habitat features at multiple scales in the occupation area of an endangered salamander: *Ambystoma ordinarium* (Caudata: Ambystomatidae)

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Introduction

Amphibians are the vertebrate group most threatened, more than a third of species[1]

64% species from Mexico[2]

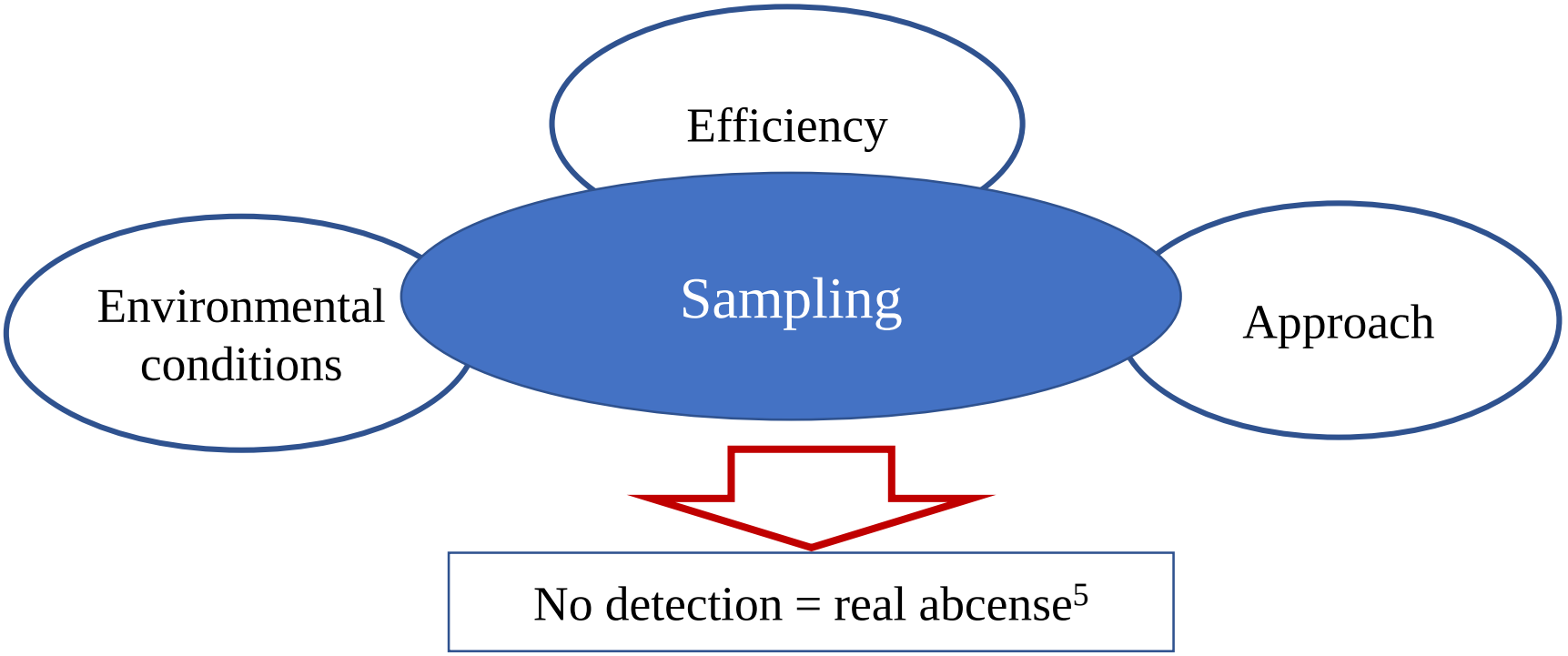
Low movility and permeable skin[3]

"habitat split"[4]

(1. IUCN 2018; 2. Frías-Alvarez et al. 2010; 3. Cushman 2006; 4. Becker et al. 2007)

Introduction

distribution and **abundance** estimations are vital for conservation



Bias estimations[6]

low abundance or low detectability

high abundance or high detectability

(5. Gu & Swihart 2004; 6. Royle & Dorazio 2008)

Introduction

In amphibians, long-term population monitoring commonly does not easy to achieve

Guimarães et al. (2014) 2006-2013, 95% doesn’t considering detection probabilities (p)

South American Journal of Herpetology

Journal of Herpetology

Introduction

Hierarchical models include **detection probabilities** (p) in same time that estimate **occupation probabilities** (ψ)[7], although these can be associated with explanatory variables

Amphibians population dynamic

11

9

8

12, 13

10

(7. MacKenzie et al. 2003; 8. Smith et al. 2006; 9. Zambrano et al. 2010; 10. Rubbo et al. 2006; 11. Jenkins et al. 2006; 12. Rothermel & Semlistch 2002 ;13. Trenham et al. 2001)

Objectives

General

Determine between seasons how affect the habitat features and in what scale the occupancy of *Ambystoma ordinarium* an endangered amphibian species

Particulars

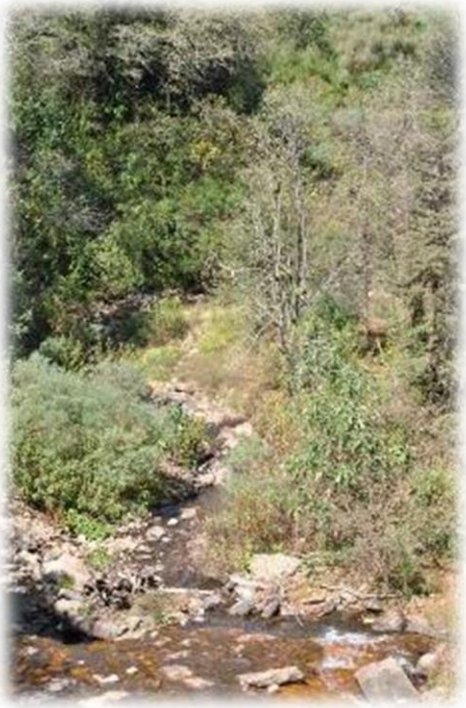
- Determine the habitat variables than affect the detectability and occupancy *A. ordinarium*, and
- Estimate the proportion of sites occupied by *A. ordinariun* inside a potential distribution area than unconsidered the species detectability.

Methods

Study species

Ambystoma ordinarium presents facultative pedomorphosis[14].

Protected by Mexican legislation and the IUCN (2018)

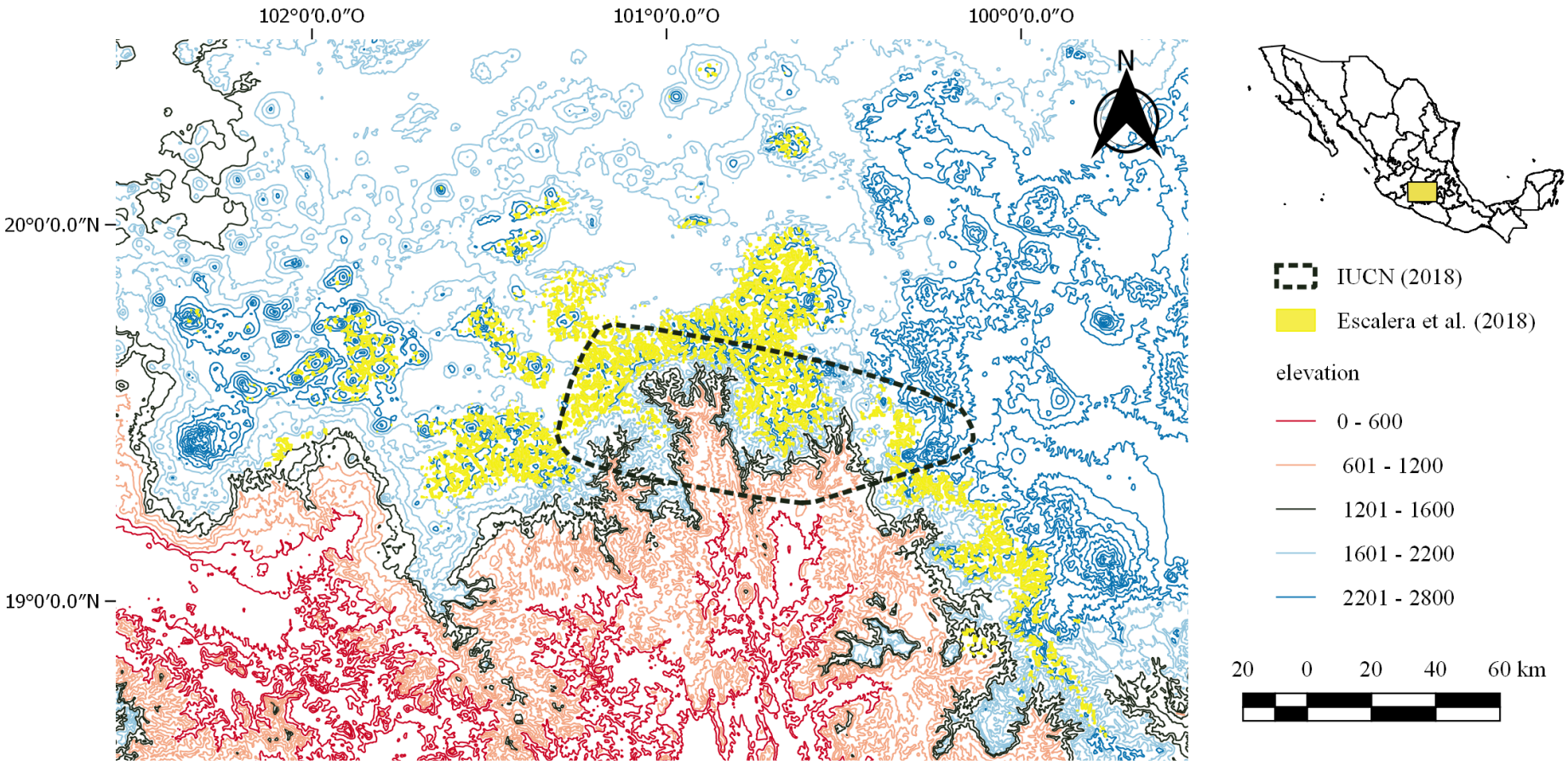


- Several habitat fragmentation,
- Quality decrease in the water bodies where it lives, and
- Occupies less than 500 km^2 of its total extension area estimates (≈5000 km^2)

(14. Duellman & Trueb 1994)

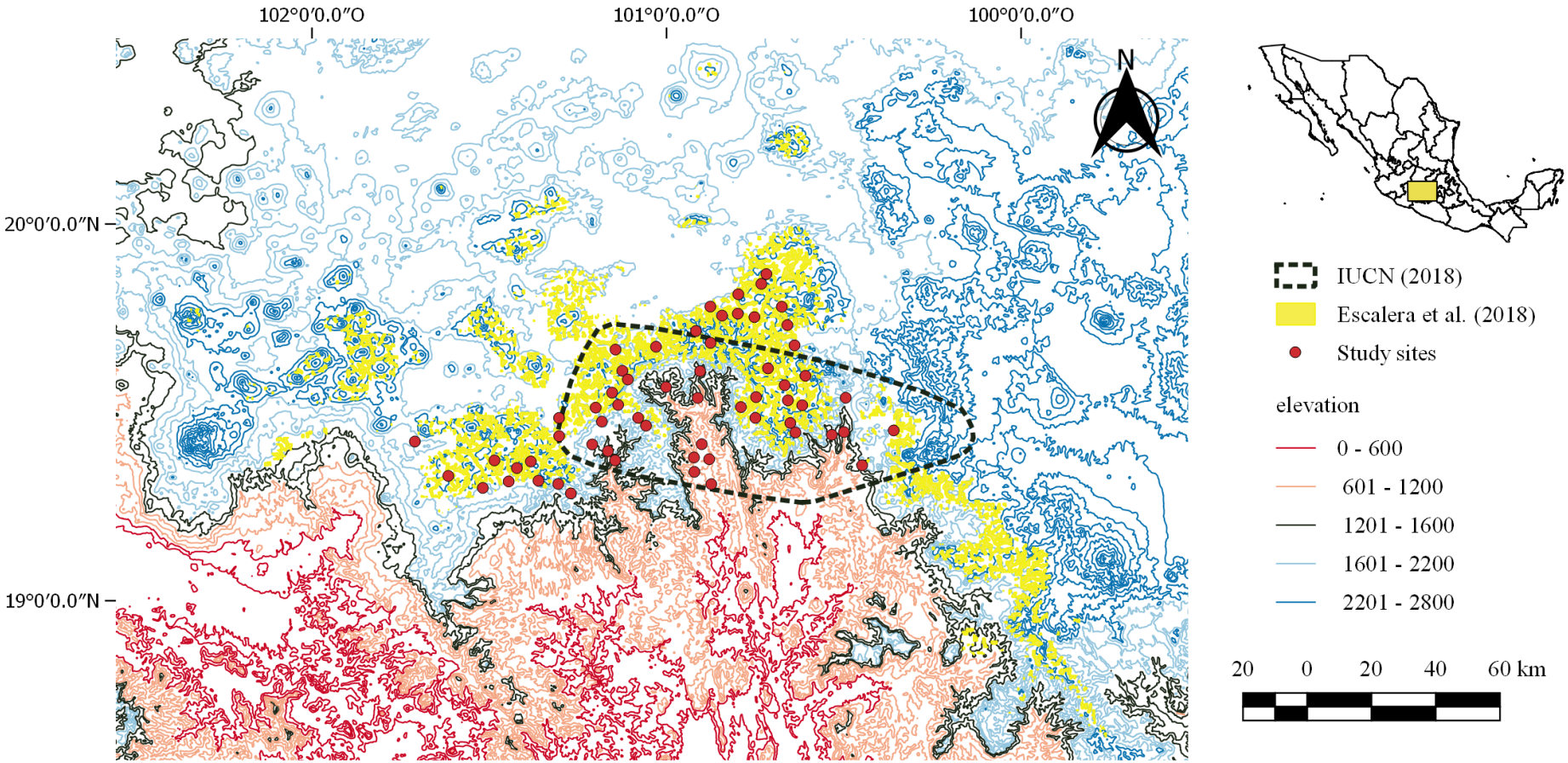
Methods

Study sites



Methods

Study sites



- Permanent streams
- 3km of distance[15]

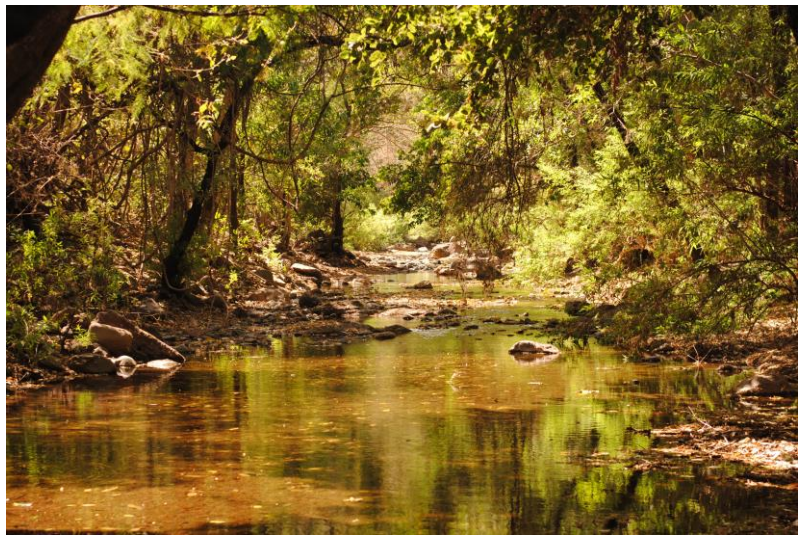
(15. Rittenhouse & Semlitsch 2007)

Methods

Sample design

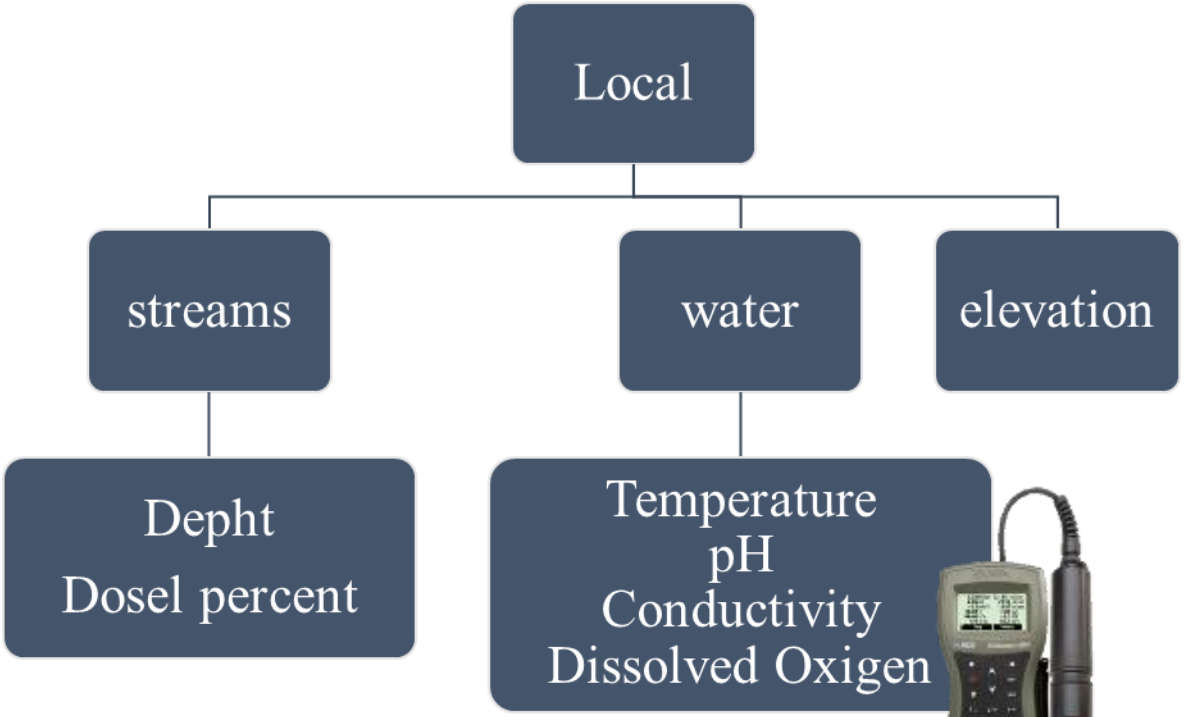
60 sites	transect (50m)	3 samples (15 days)	dry
			rain

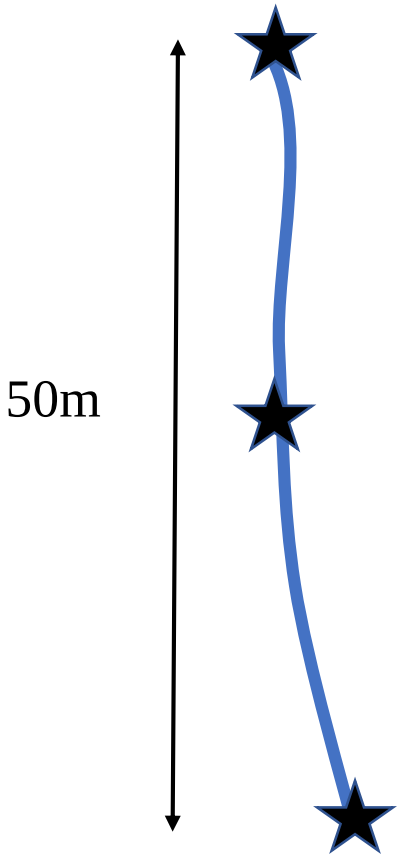
Search time from 10:00 to 18:00



Methods

Environmental conditions





ImageJ

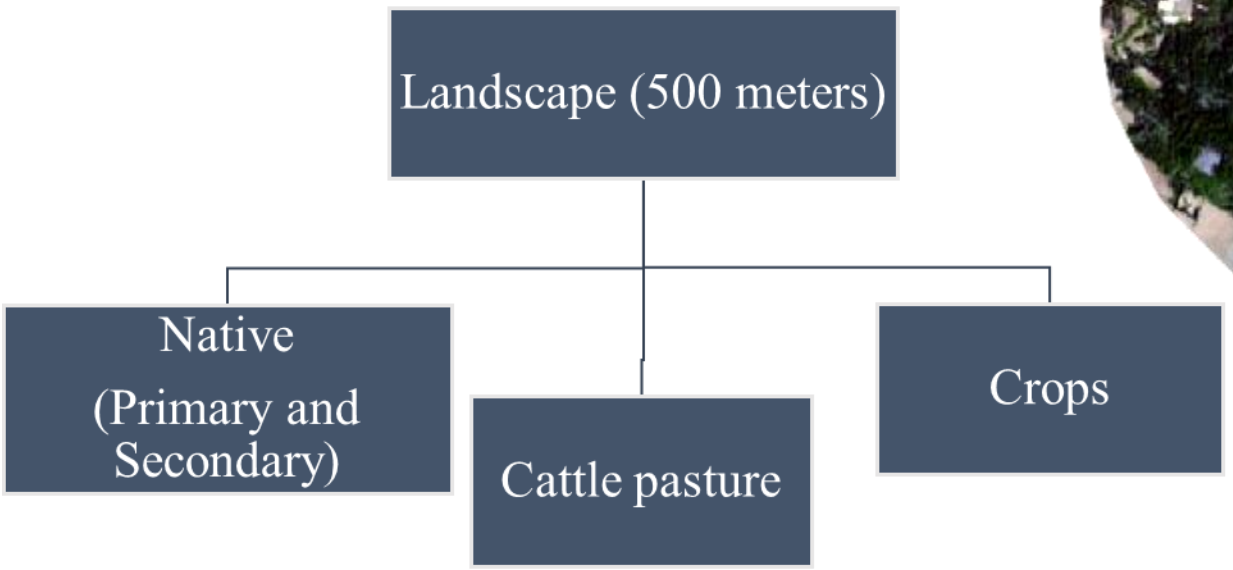
Image Processing & Analysis in Java

16

(16. Korhonen et al. 2006)

Methods

Environmental conditions



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Semi automatic classification plugin

(17. Quantum GIS Development Team 2012)

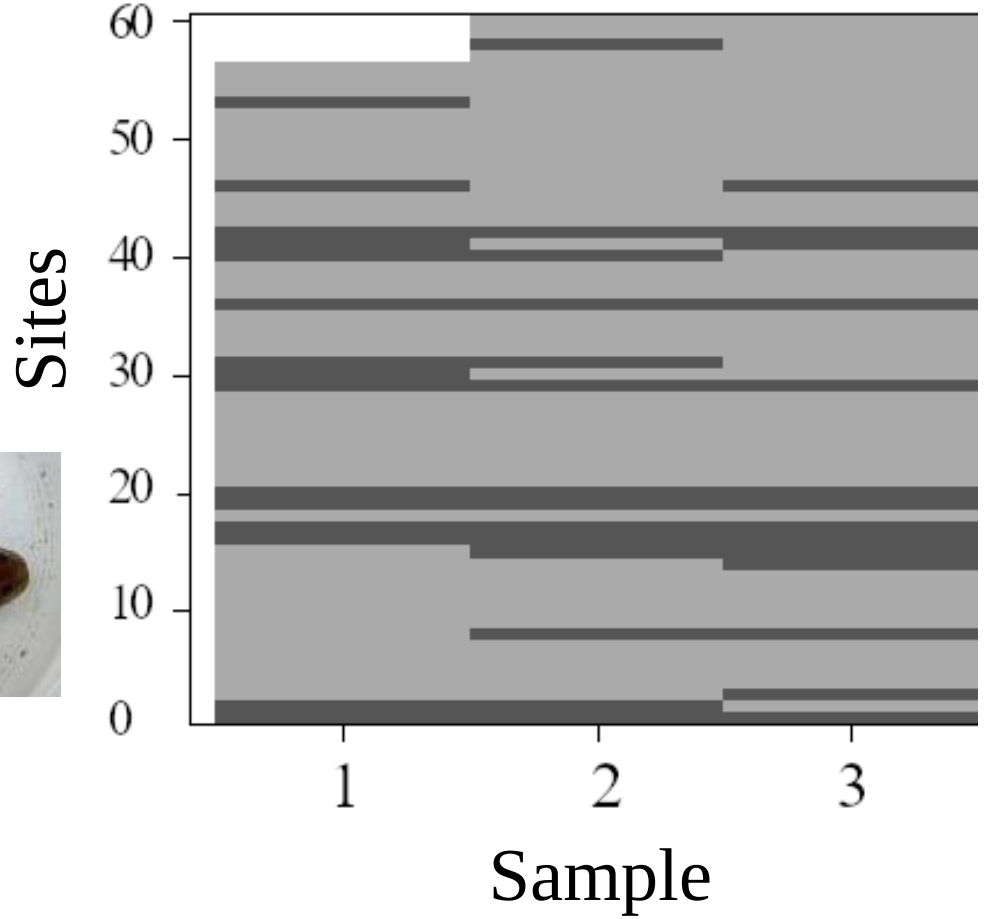
Methods

Data analysis

Occupancy models

Detection matrix:

0, 1, NA

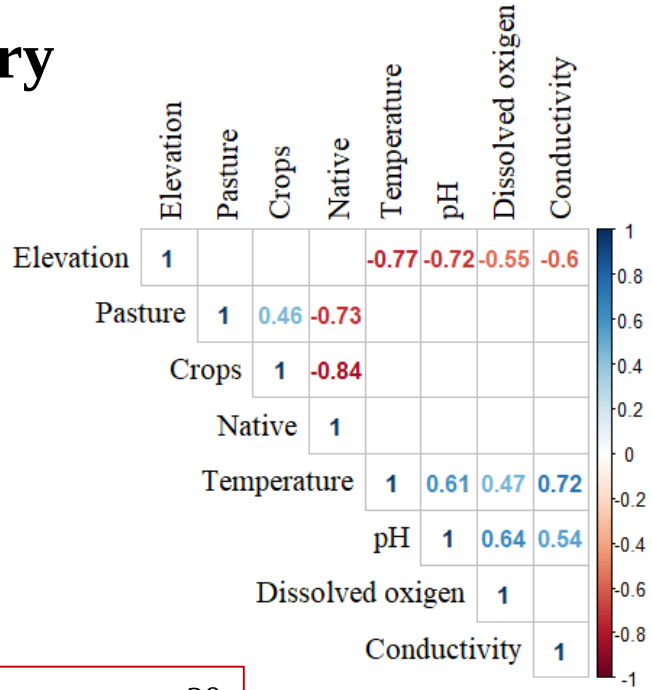


Methods

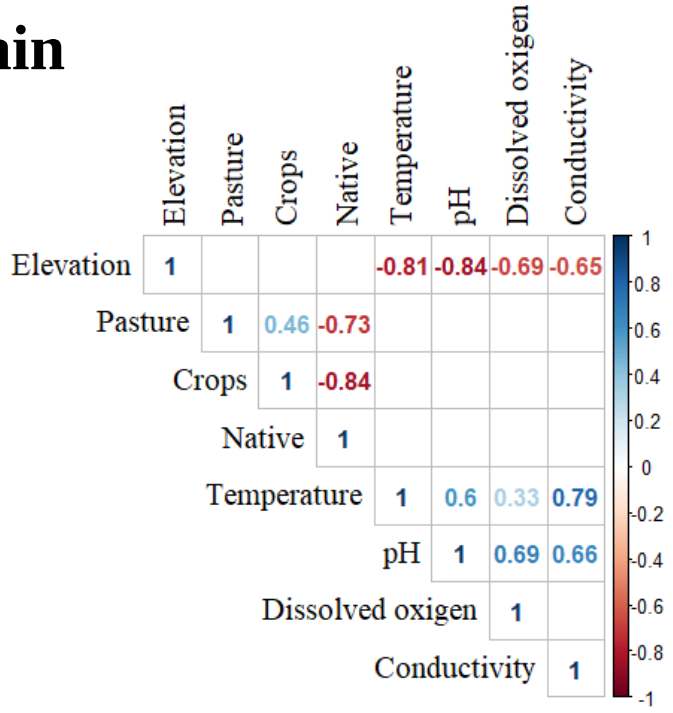
Data analysis

It was use single season occupancy models for each season[18], standardized variables[19]

dry



rain



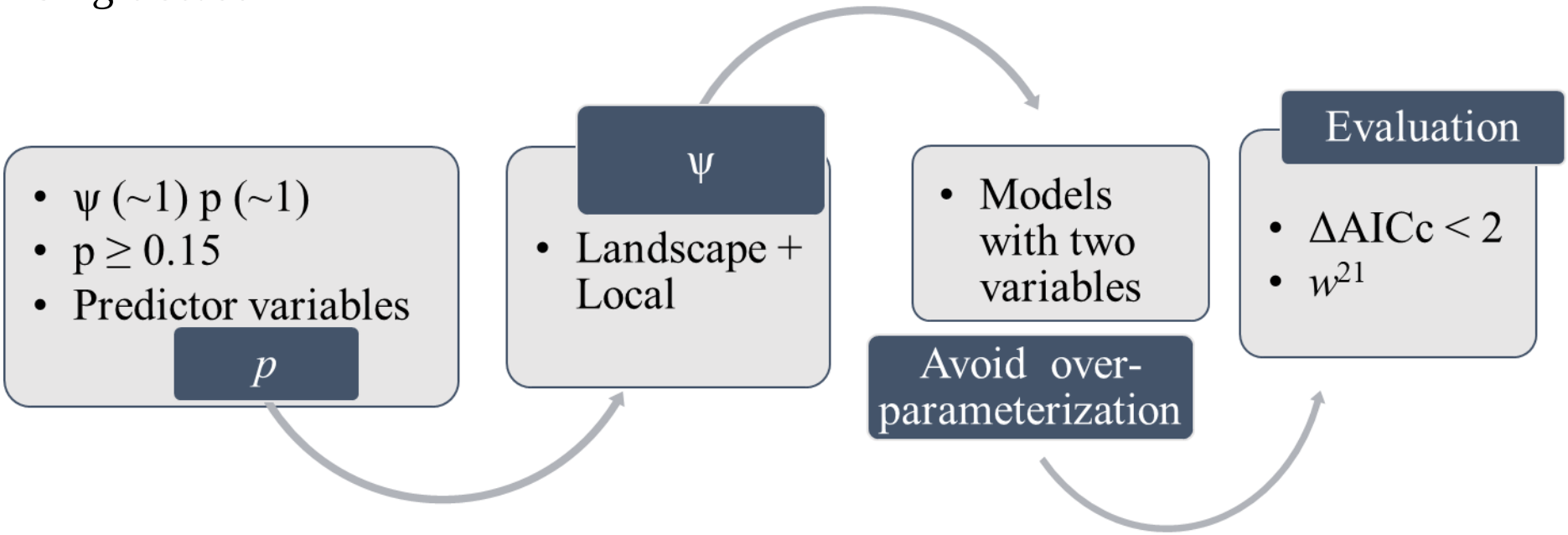
r = 0.7 o -0.7[20]

(18. MacKenzie et al. 2002; 19. Kéry & Royle 2015; 20. Dormann et al. 2012)

Methods

Data analysis

Single season

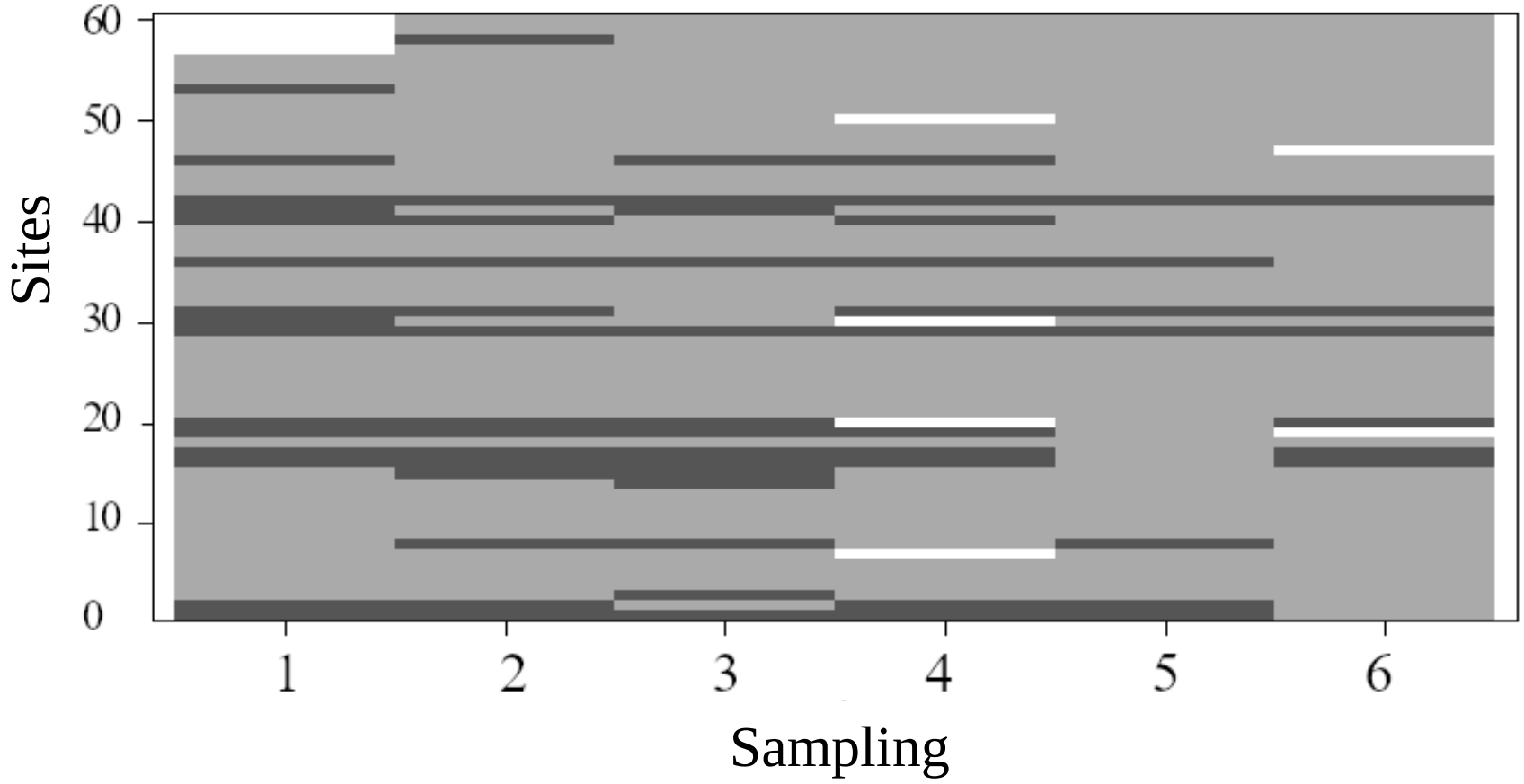


Proportion of sites occupied (PAO)[23]

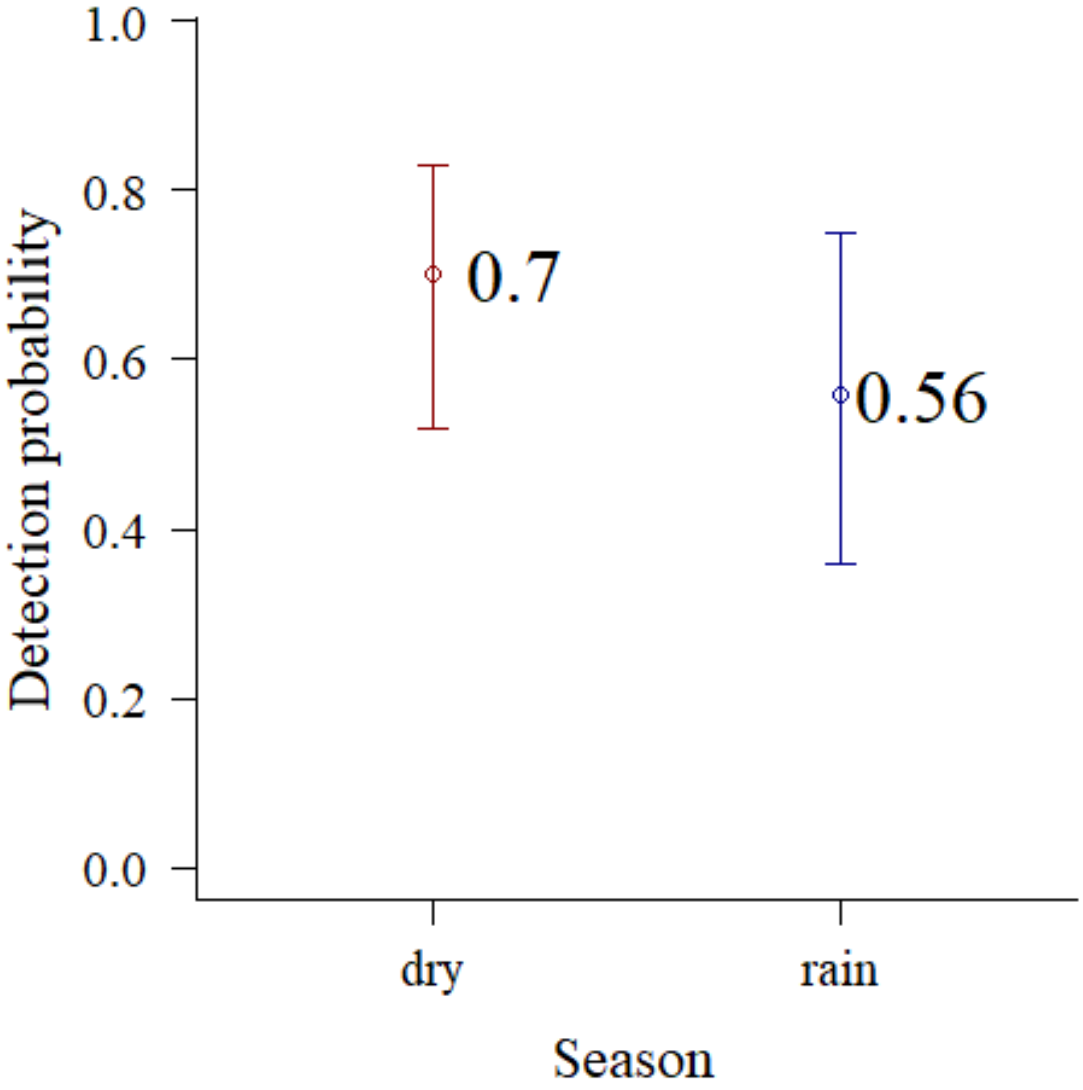
(21. Burnham et al. 2011; 22. Burnham & Anderson 2002; 23. Fiske & Chandler 2017)

Results

Ambystoma ordinarium was detected into 20 from 60 sites of study.



Results

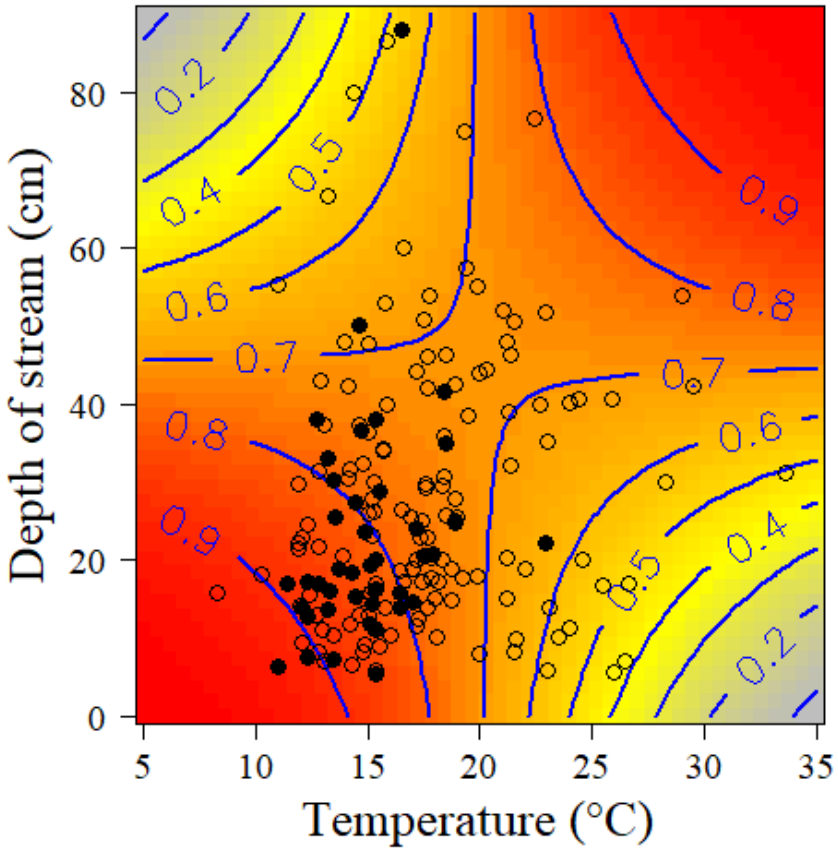

1.0
0.8
0.6
0.4
0.2
0.0
Detection probability
0.7
0.56
dry
rain
Season

Results

Occupancy dry season

Model	*w*	Parameter	Variable	Coeficient	Conf. Int.
ψ(crops) + (cond) p (temp:depth)	0.59	p	temp:depth	1.18	0.17—2.18
		ψ	crops	1.16	0.36—1.94
		ψ	cond	-1.56	-2.5— -0.54

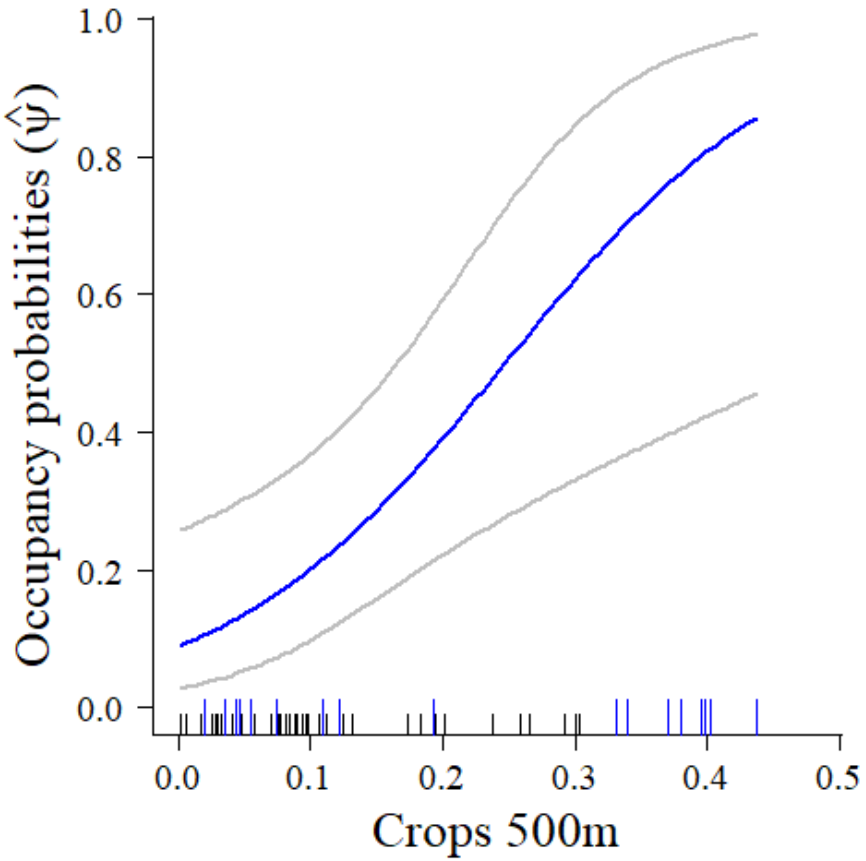
Results



Detectability in dry season can be result of tolerance and thermal preference[24,25]

(24. Thomson et al. 1980; 25. Soto-Rojas et al. 2017)

Results

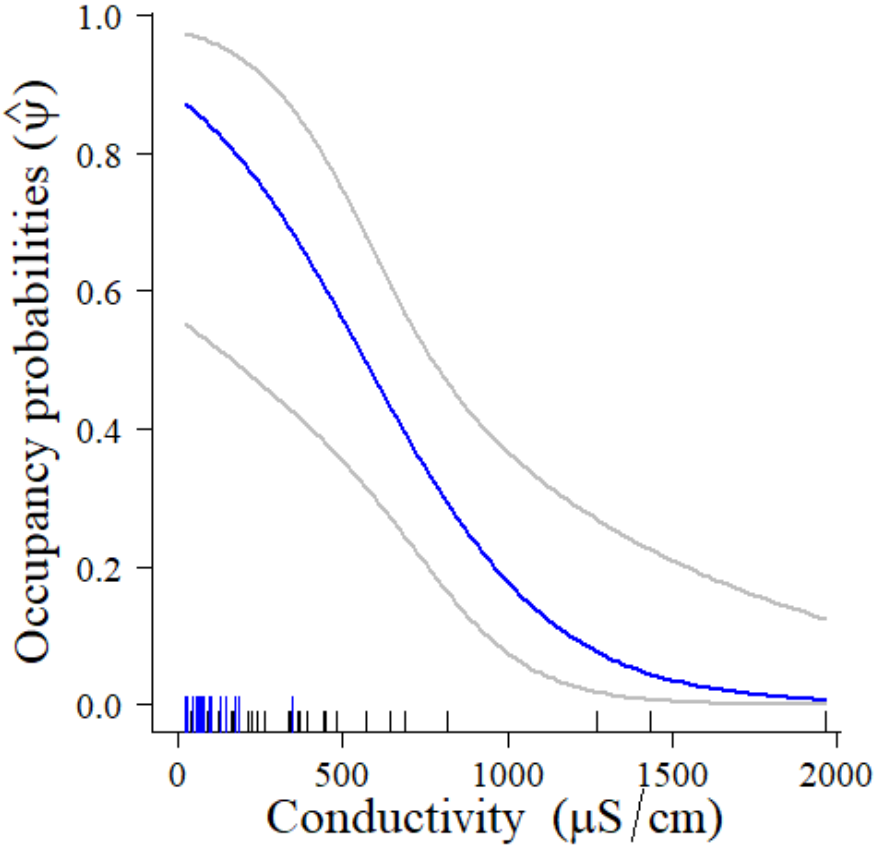


Land use change is the principal threat for amphibians

Pedomorphosis can be used like a strategy to face adverse environmental for surviving for *Ambystoma talpoidum*[26]

(26. Semlitsch et al. 1990)

Results



High conductivity

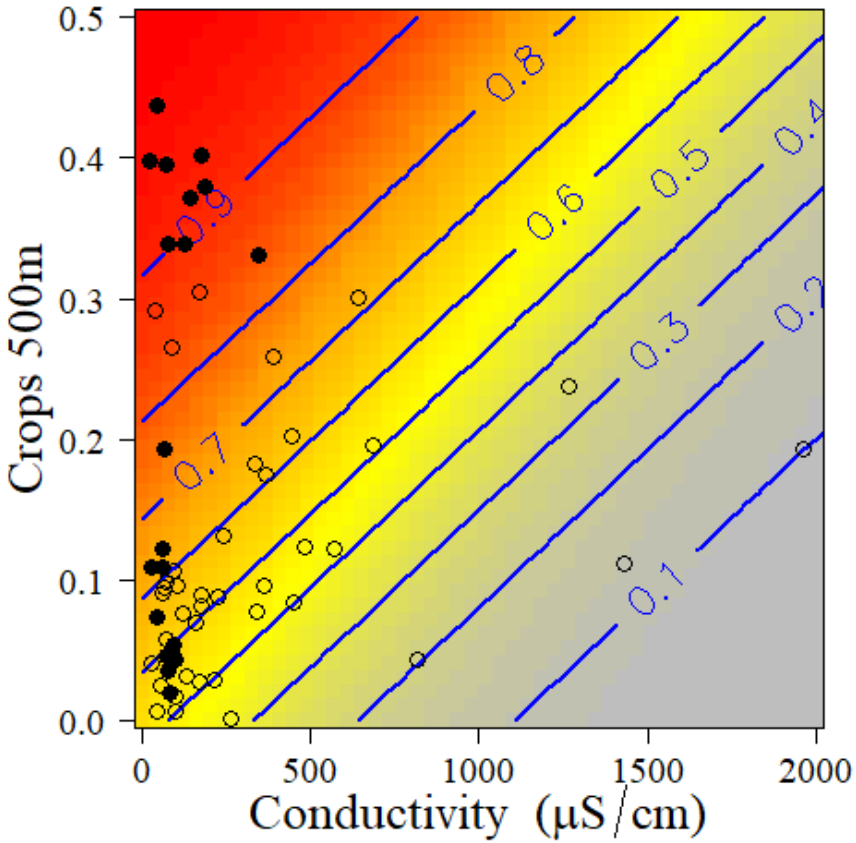
↓ survival of larvae and embryos in *A. maculatum*[27]

↓ abundance of *Eurycea cirrigera* larvae[28] and larvae density of *Desmognatus fuscus*[29]

Conductivity > 450 µS/cm can be producing local extinction events[25]

(25. Soto-Rojas et al. 2017; 27. Karraker et al. 2008; 28. Miller et al. 2007; 29. Schorr et al. 2013)

Results



Implementation of variables in multiple scales can be better to explain population dynamic[30]

(30. Mazerolle & Villard 1999)

Results

Occupancy rain

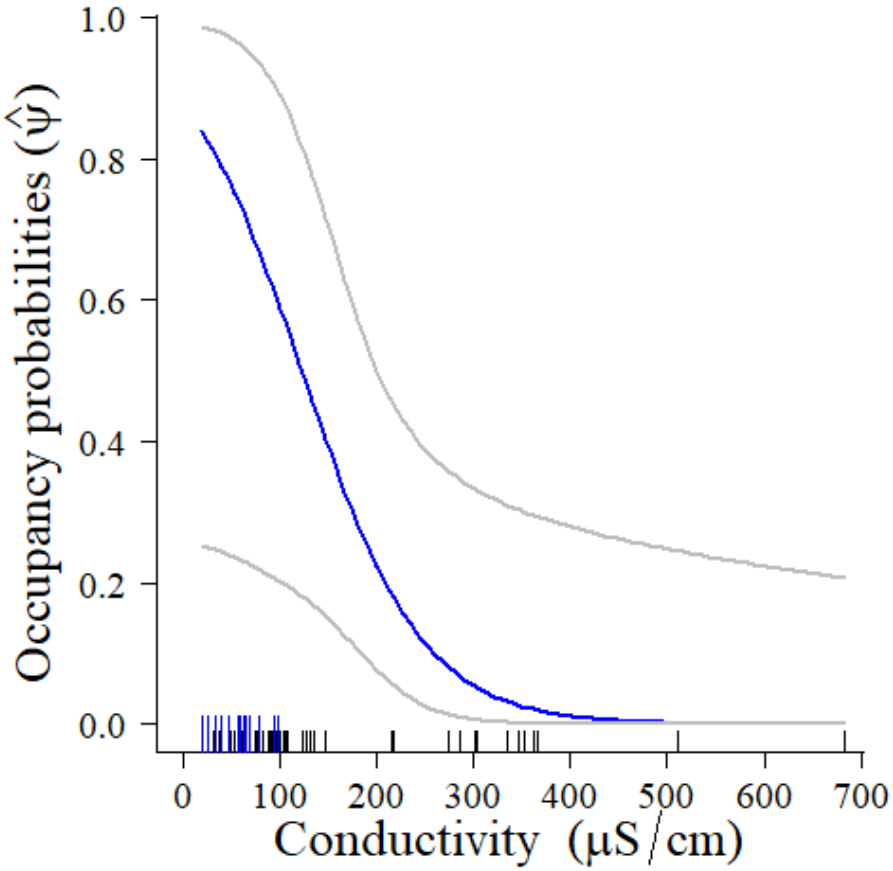
Model	*w*	Parameter	Variable	Coeficient	Conf. Int.
ψ(cond) + (DO) p (~1)	0.77	p	~1	0.56	0.36 — 0.75
		ψ	cond	-2.43	-4.72 — -0.15
		ψ	DO	-2.38	-4.75 — -0.02

Future work must include water turbidity

- Local condition must be considered[31], also
- environmental heterogeneity between seasons[32]

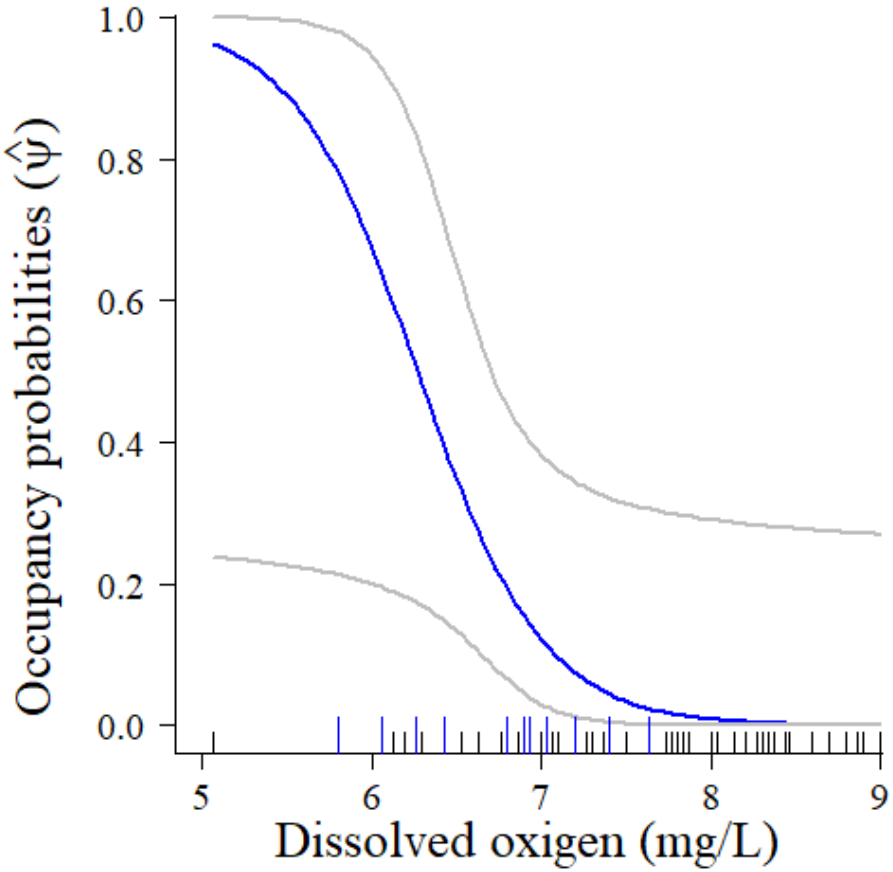
(31. Blanco-Torres et al. 2017; 32. Moreira et al. 2017)

Results



Same effect in dry season, between seasons this is an important variable

Results

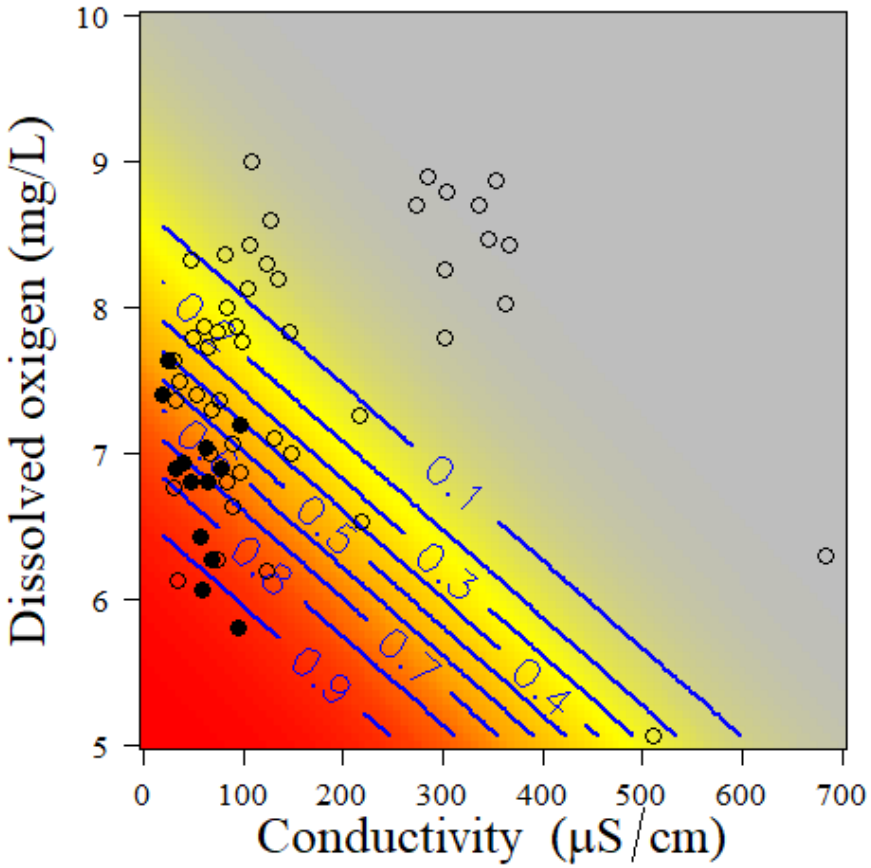


Ambystomatidae members has lung, gill and cutaneous breathing

High levels of dissolved oxygen can represent optimal conditions for predators or competitors like fishes[9,33]

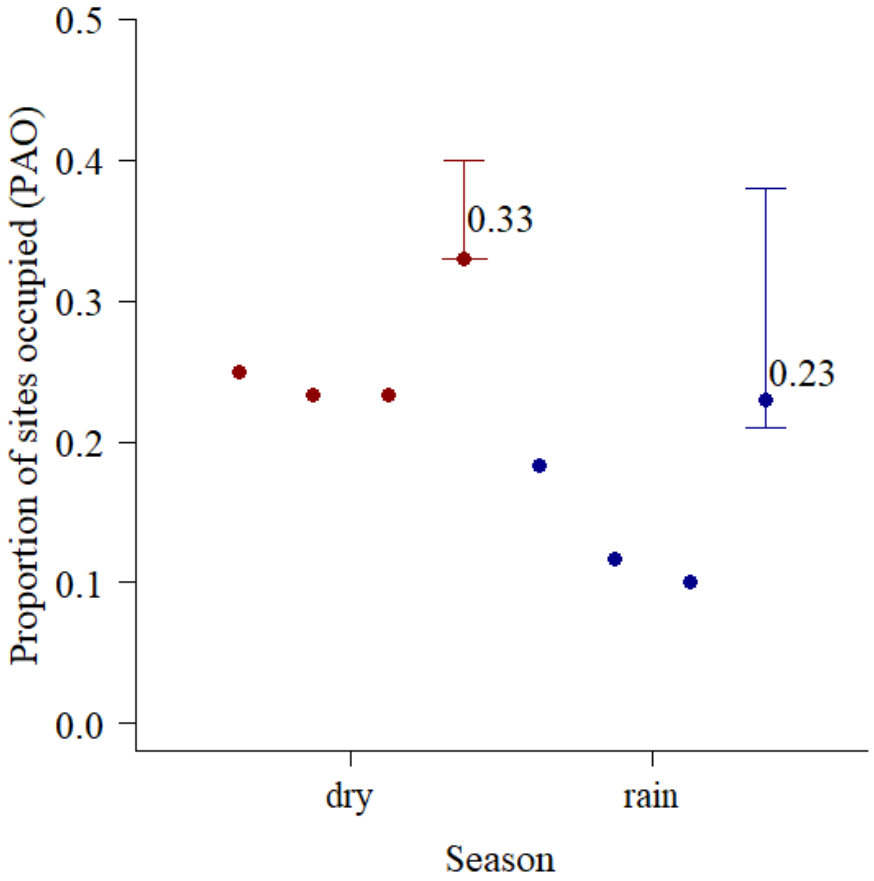
(33. Burggren & Pinder 1991; 9. Zambrano et al. 2010)

Results



The response to different variables in detection and occupancy probabilities of *Ambystoma ordinarium* was associate to the season

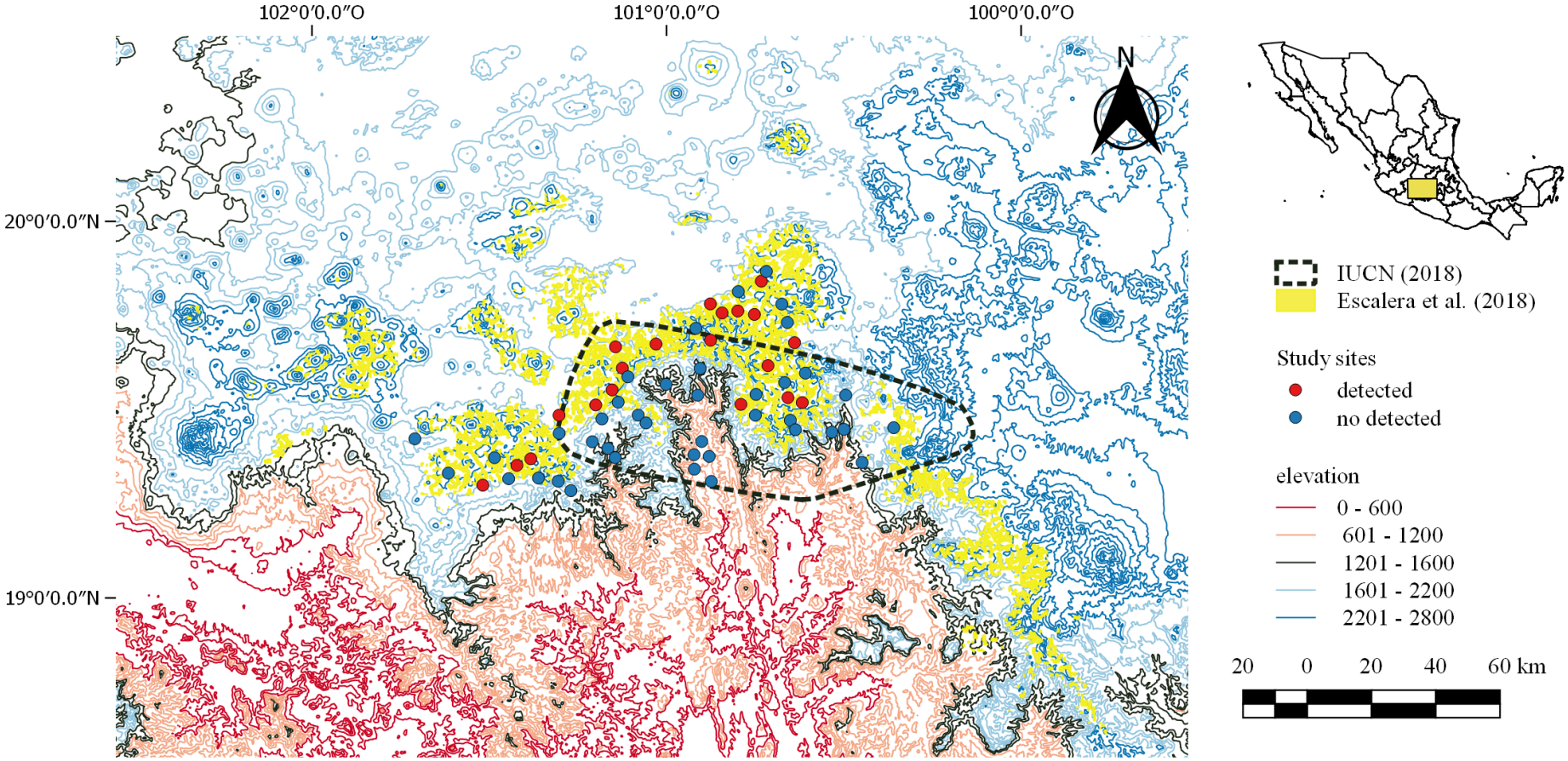
Results



The POA in the region reinforces the idea about the threat of extinction, due it have a spatial distribution reduced

Results

Proportion of sites occupied



A. ordinarium does not occupies 100% of the potential area (Escalera-Vázquez et al. 2018) or IUCN (2018)

Results

Amphibians have a limited dispersibility on landscapes dominated by agriculture[32,33,34]

Into this type of land use genetic flow has been reduced in *A. opacum*, *A. maculatum*[35] y *A. jeffersonianum*[36]

The presence of *A. ordinarium* on these landscapes can be categorized like “ecological tramp”[37]

(32. Moreira et al. 2016; 33. Boissinot et al. 2019; 34. Bodinof-Jachowski et al. 2016; 35. Greenwald et al. 2009; 36. Crawford et al. 2016; 37. Robertson & Hutto 2006)

Final Considerations

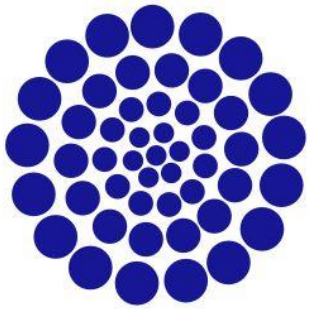
Ambystoma ordinarium can occupies **landscapes dominated by agriculture** when the levels of **dissolved oxygen** and **conductivity** are optimal

Define the response to variables on different scales can be difficult but represent an opportunity for construct more effective conservation strategies

For conservation plans is necessary

- Know how this land use affects process like the survival, reproduction, migration and dispersion, also
- Its necessary evaluated variables at multiple scales, and working with different development stage

Thank you!



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