

Conservation of the Suweon Treefrog on the Korean Peninsula and the importance of agricultural wetlands



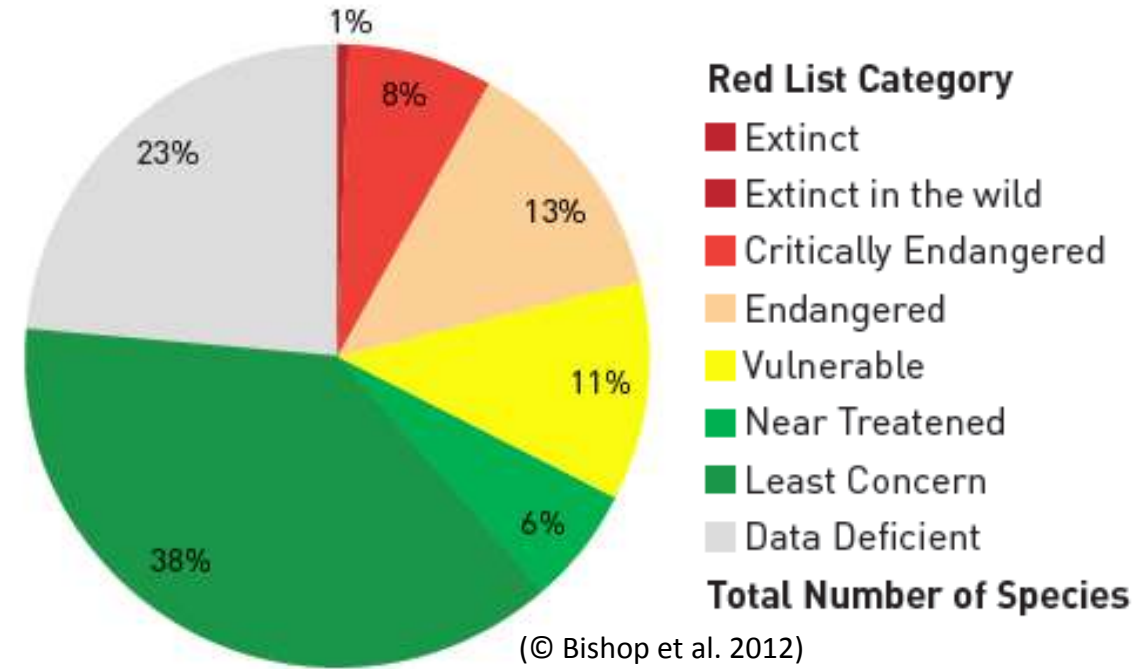
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World amphibian crisis

- 6th mass extinction
- Amphibians more endangered than any other group of species
- Non-charismatic, little studied group



% of amphibian species by threat category

Multiple threats

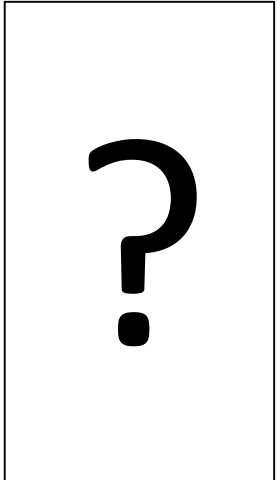
- (1) habitat destruction
- (2) (agro)chemical pollution
- (3) UV-B radiation
- (4) diseases
- (5) introduced species
- (6) over-exploitation
- (7) climate change
- (8) complex causes - combined effects of factors above



Examples of threats to amphibians

(Rabb 1999; Semlitsch & Semlitsch 2003; Beebee & Griffiths 2005; Cushman 2006; Bishop et al. 2012)

Threatened species in Korea?



Threatened amphibian species from the Republic of Korea

Status of *Dryophytes suweonensis*






The IUCN Red List of Threatened Species™
2017-2
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VIEW MAP



TAKE ACTION NOW

| | | | | | | |
|---------------|----------------|---------------|-----------------|------------|---------------------------|-----------------------|
| NOT EVALUATED | DATA DEFICIENT | LEAST CONCERN | NEAR THREATENED | VULNERABLE | <ENDANGERED> | CRITICALLY ENDANGERED |
| NE | DD | LC | NT | VU | EN | CR |

Summary

Classification Schemes

Images & External Links

Bibliography

Full Account

| | |
|-------------------------------|---|
| Red List Category & Criteria: | Endangered A2ace+4ace; B1ab(i,ii,iii,v); C1 ver 3.1 |
| Year Published: | 2017 |
| Date Assessed: | 2014-03-03 |
| Assessor(s): | IUCN SSC Amphibian Specialist Group |
| Reviewer(s): | Hilton-Taylor, C. |
| Contributor(s): | Borzee, A. & Matsui, M. |

Government Publications Registration Number : 11-1480592-000718-01

**Korean Red List
of Threatened Species**
Second Edition



EN

Hyla suweonensis Kuramoto, 1980
Anura: Hylidae

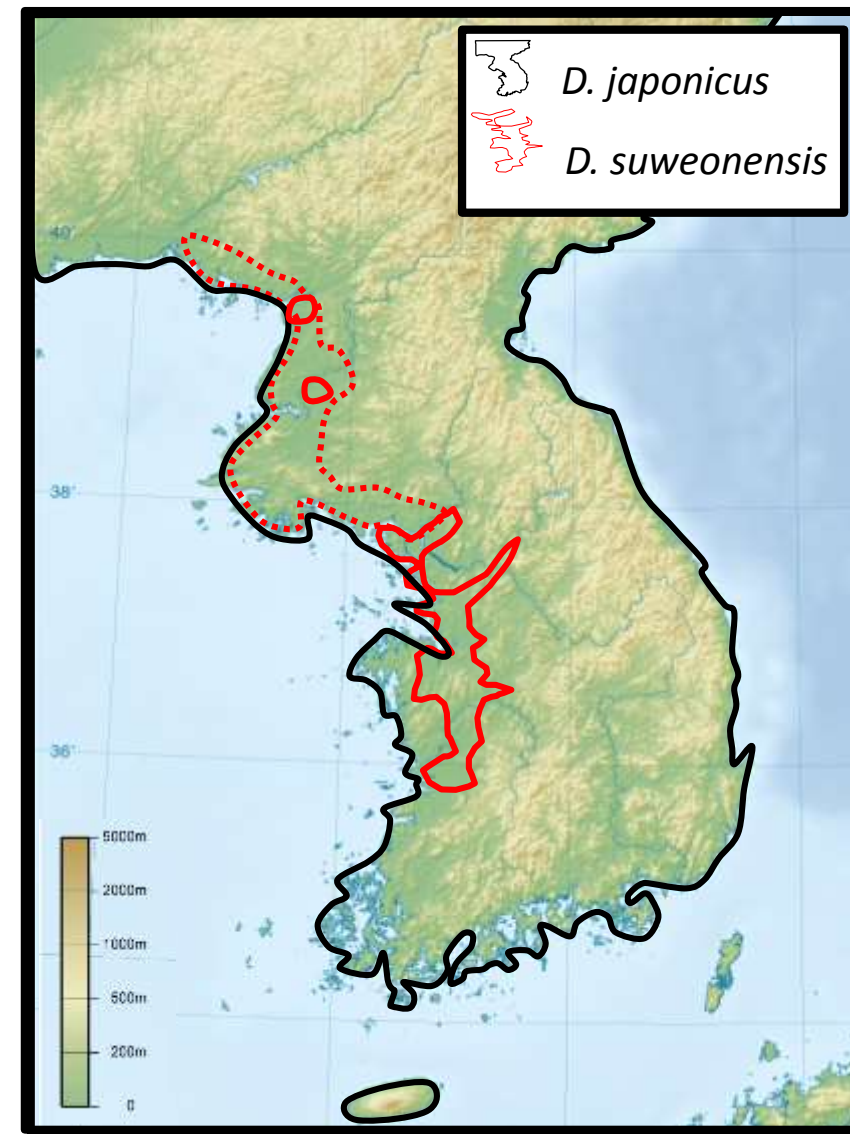
Hyla suweonensis is a frog endemic to Korea that was previously known from the Suwon area in Gyeonggi-do and Incheon. However, in recent years this species has been observed at the Pyeongtaek area in Gyeonggi-do, the Cheonan area in Chungcheongnam-do, and the Gangwha area in Incheon. Natural habitats and oviposition habitats are rapidly declining. This species is found in low elevation wetlands, especially, in rice fields. The species is assessed as EN B2ab(iv). Lowland development and use of pesticides may be threatening this species. There are currently no regional conservation measures.

A multiple species' question



Dryophytes suweonensis:

- Breeding in rice paddies
- only in sympatry with *D. japonicus*
- Advertising calls highly distinctive and identifiable



Range description for all Asian
Dryophytes species

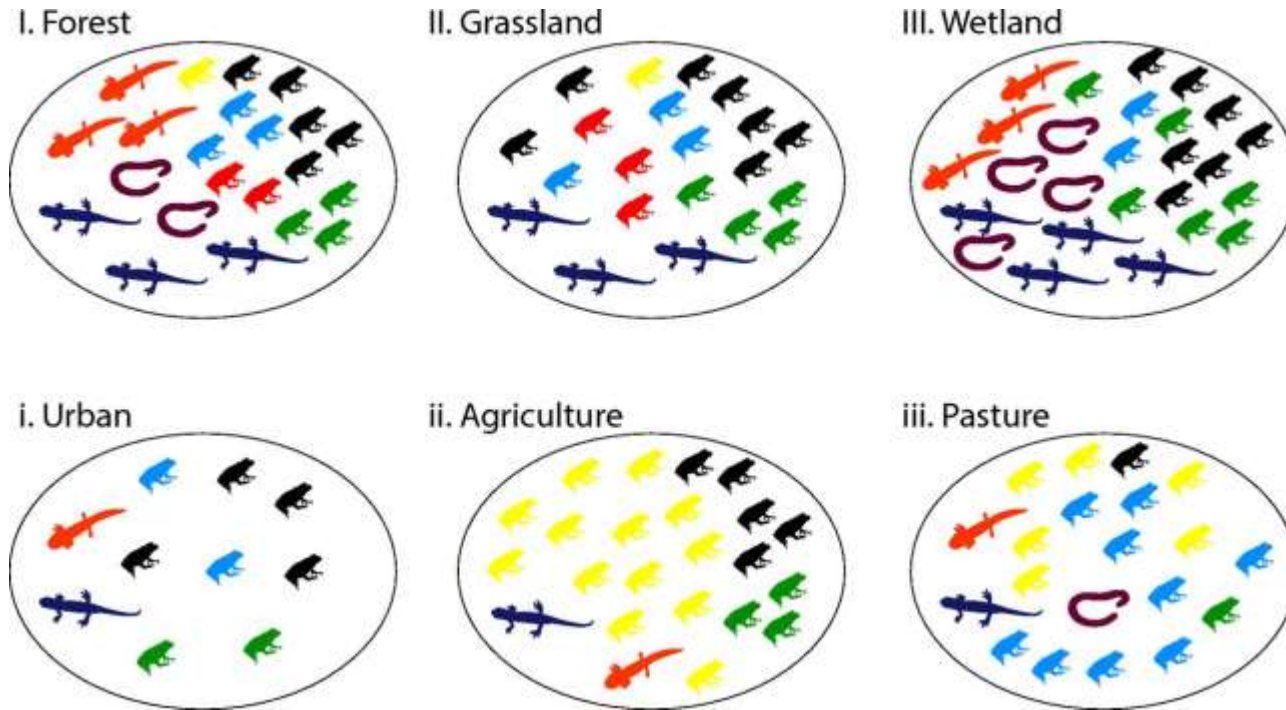
Is rice agriculture important in Korea?

- Rice cultivation started ~ 5,000 year ago
- Rice fields cover 22 % of the peninsula (2015)



1955 © Jonathan Gazeley

Amphibians and modified landscapes?



Species diversity and abundance changes in modified landscapes

Winners and losers. Pyron (2018). PNAS. 115 (15) 3739-3741

Current agriculture does not help!

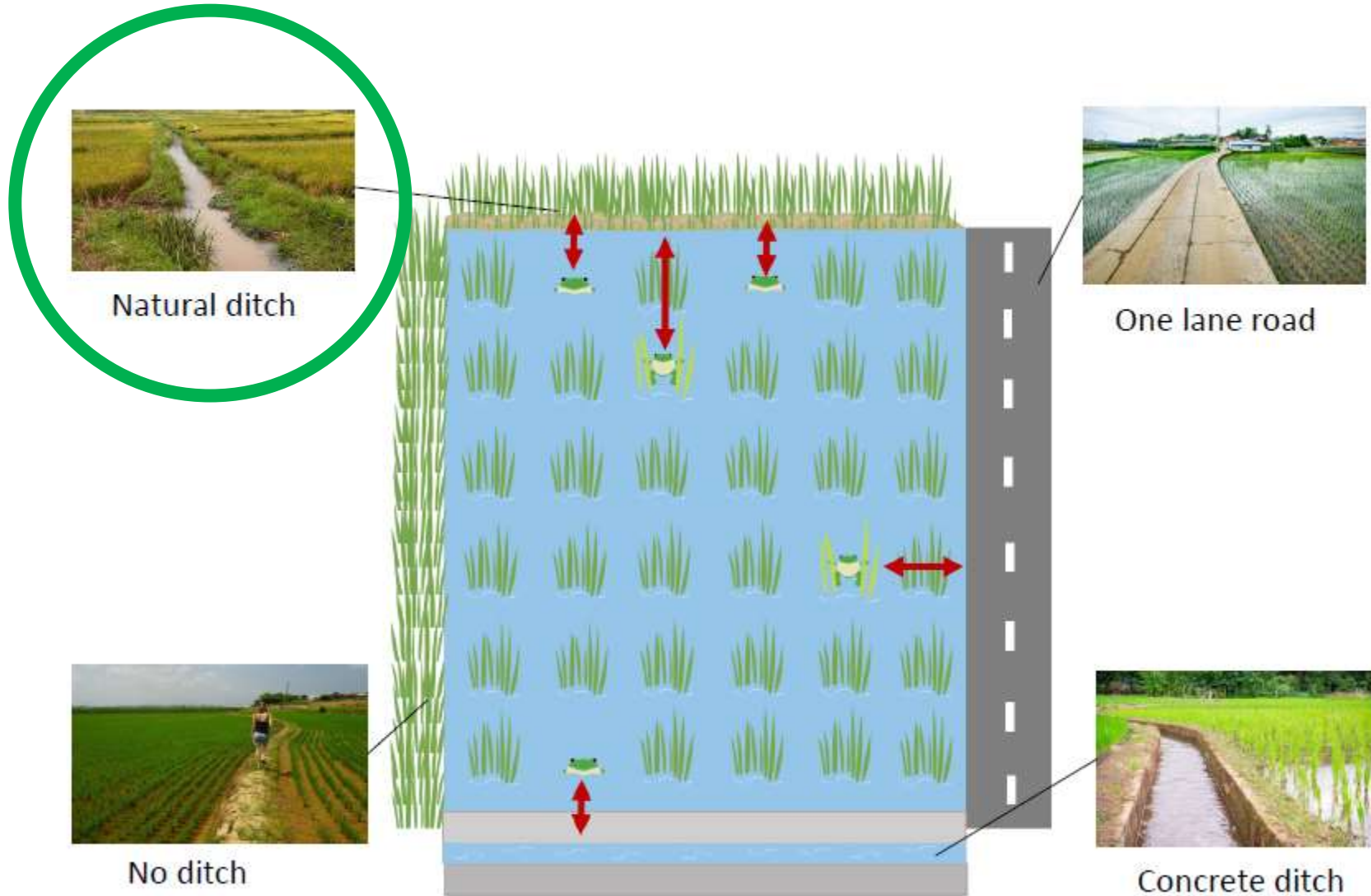


Suweon treefrog (*Dryophytes suweonensis*)



Gold spotted frog (*Pelophylax chosonicus*)

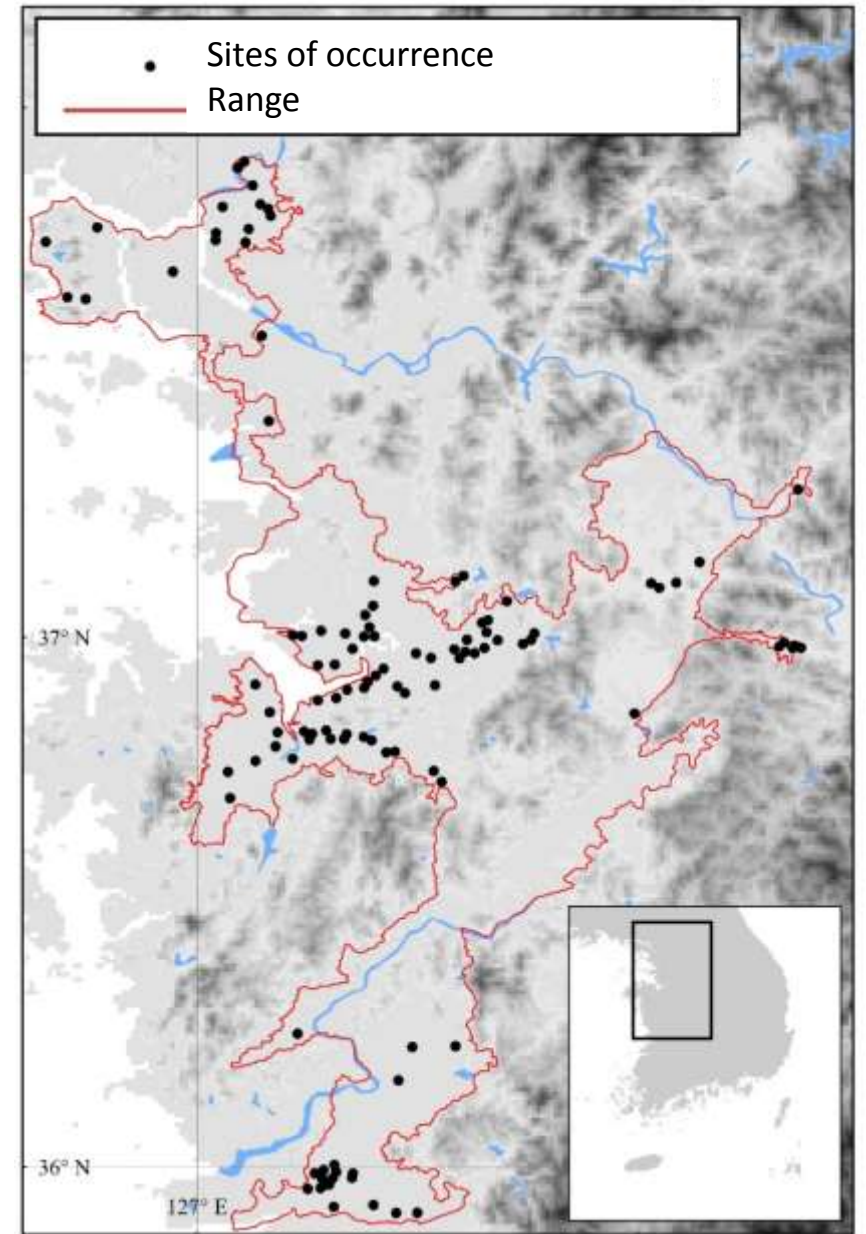
Ditch type affects species presence



Range description

> 1000 sites surveyed

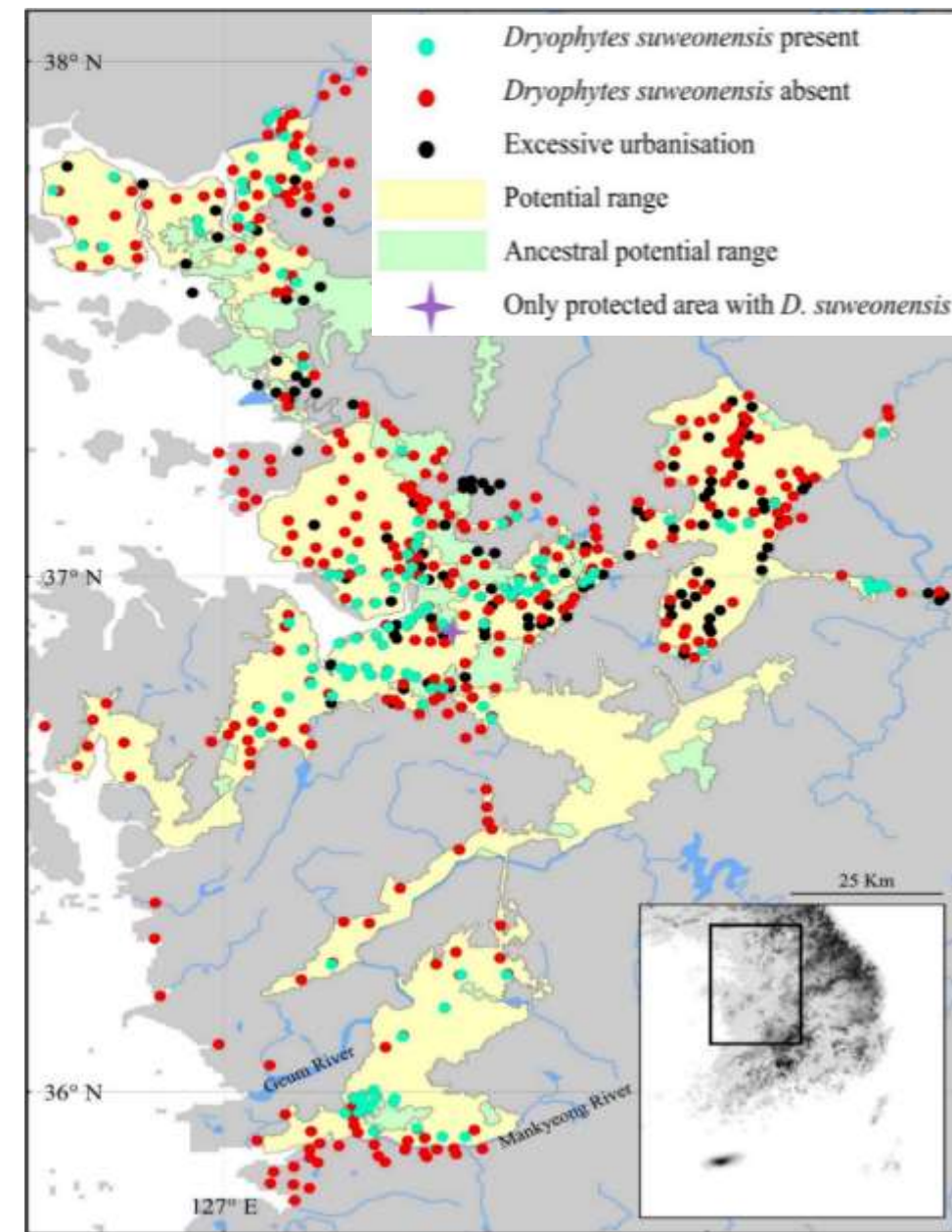
D. suweonensis found at 123 sites



Known sites for *D. suweonensis*

Range and dynamics

- Loss of site due to urbanisation
- No overlap with protected area, only with an edge
- 39.47% of the sites created or enlarged by tidal flat reclamation



Occurrence and potential range

(Borzée et al. 2018)

A last natural site

A single semi-natural site – representative of ecological requirements?

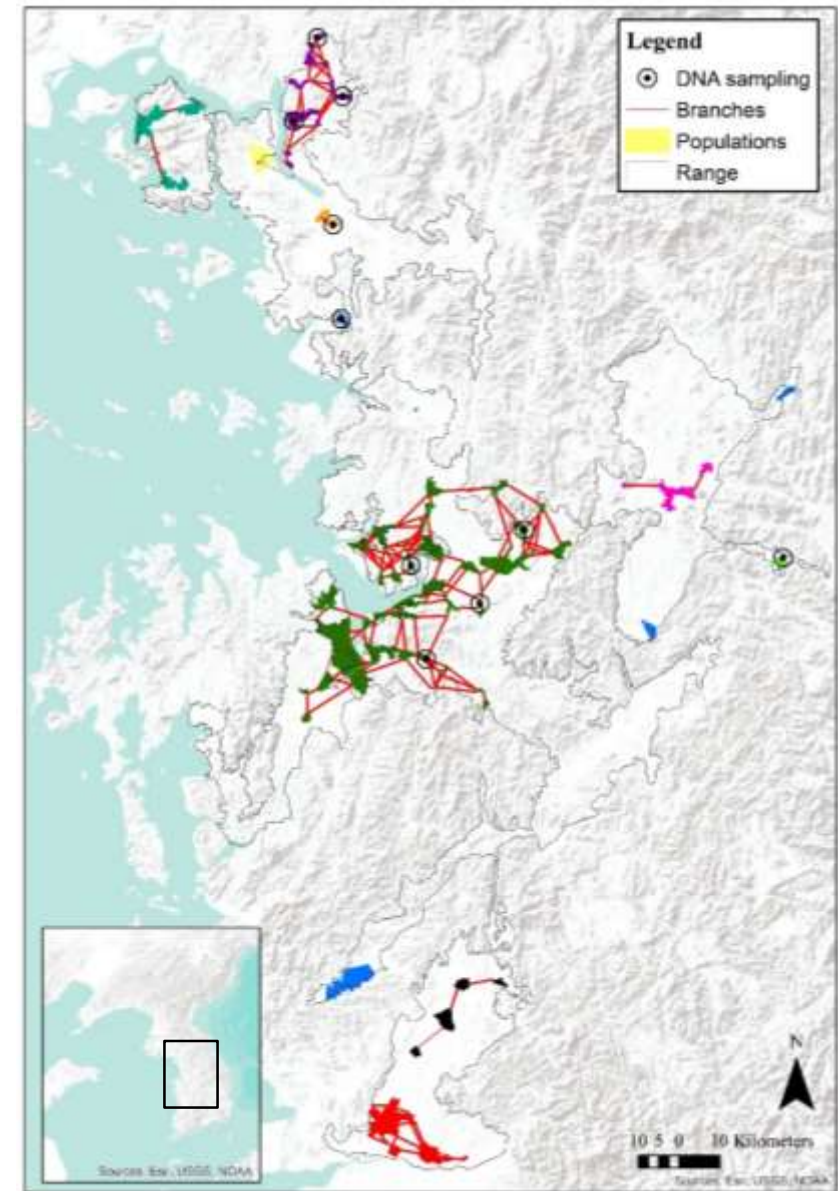
i.e. not a rice paddy: swamps bordered by Korean willow trees



Last semi-natural site where *D. suweonensis* was recorded to occur

Impact of landscape barriers

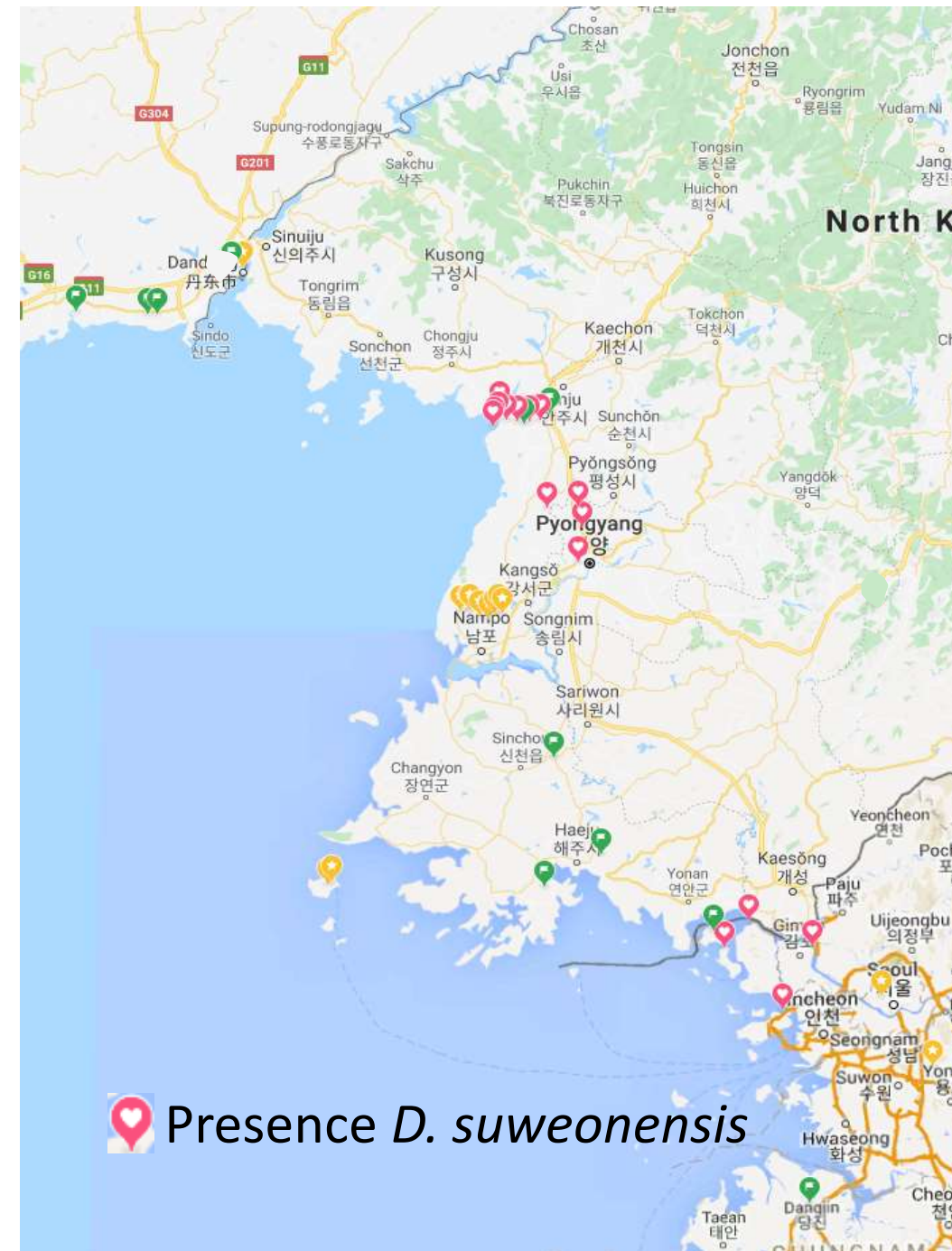
- Aural surveys repeated in 2015, 2016 & 2017
- 95 clusters, isolated by 10 km max
(*i.e.* branches)
- 14 isolated populations, denoted by colours
- Genetic sampling at 10 sites in 2015
(COI sequencing; $6 < n < 10$)



D. suweonensis populations

Field surveys in DPRK

- *Dryophytes suweonensis* in Mundeok
- *Dryophytes suweonensis* not present in Dandong area in China
- Where is the northern edge of the range?

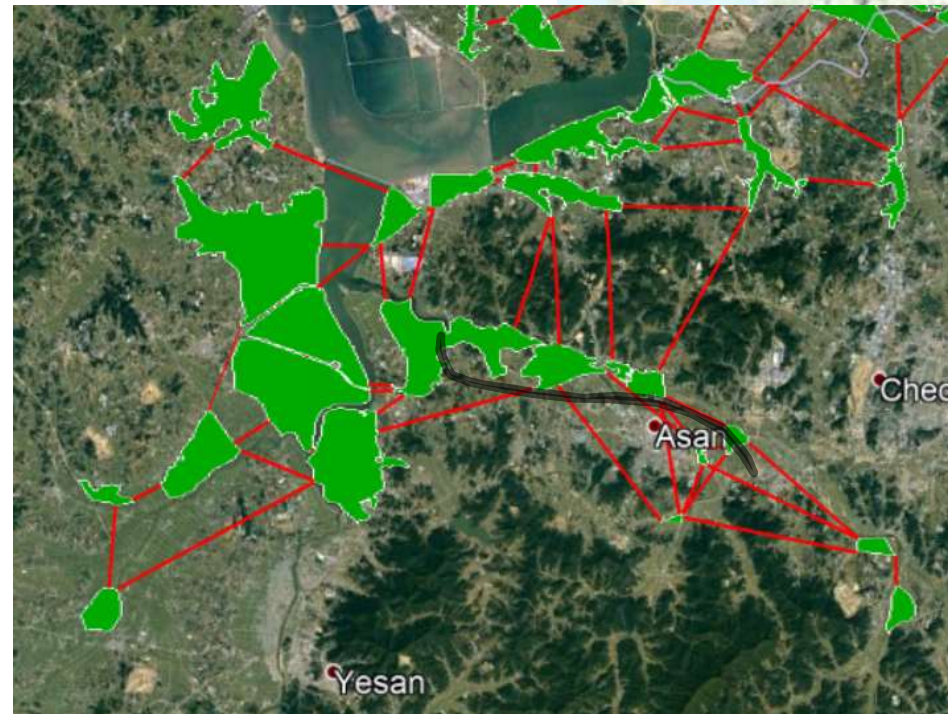
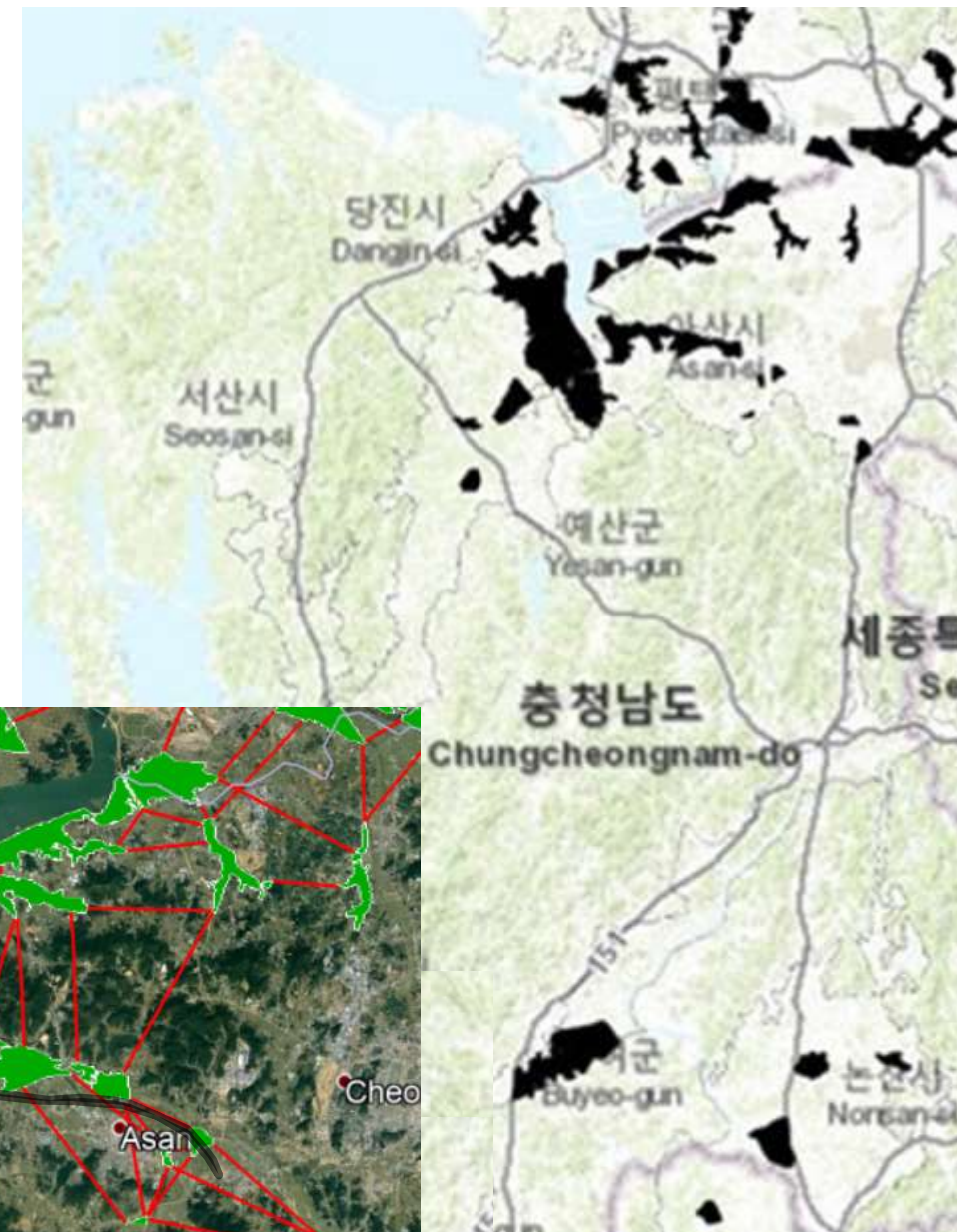


South Chungcheon Province

Three independent populations:

- Asan, Yesan, Dangjin
- Buyeo
- Nonsan

Northern population in decline
(new highway)



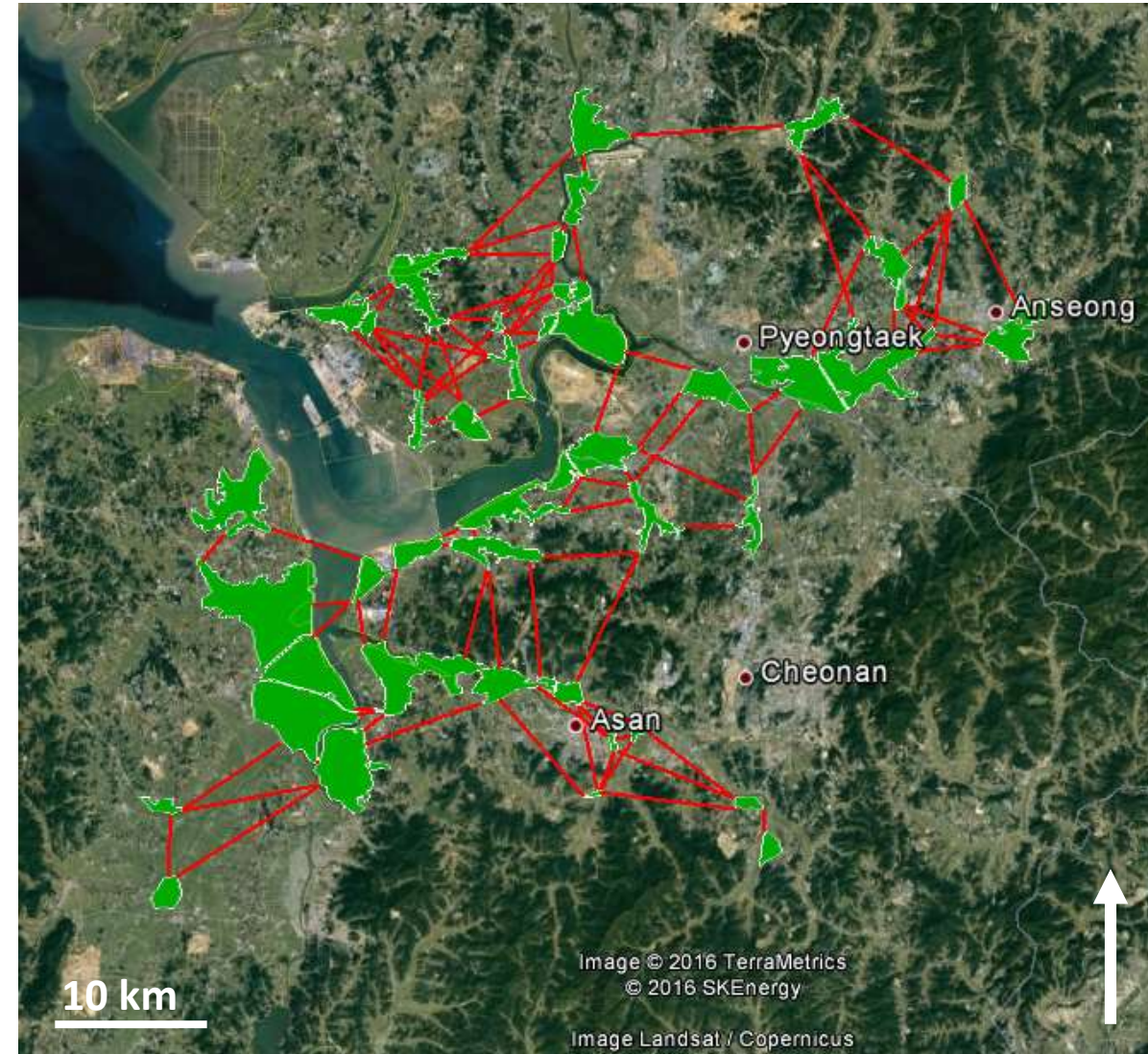
Advantages and disadvantages of rice paddies



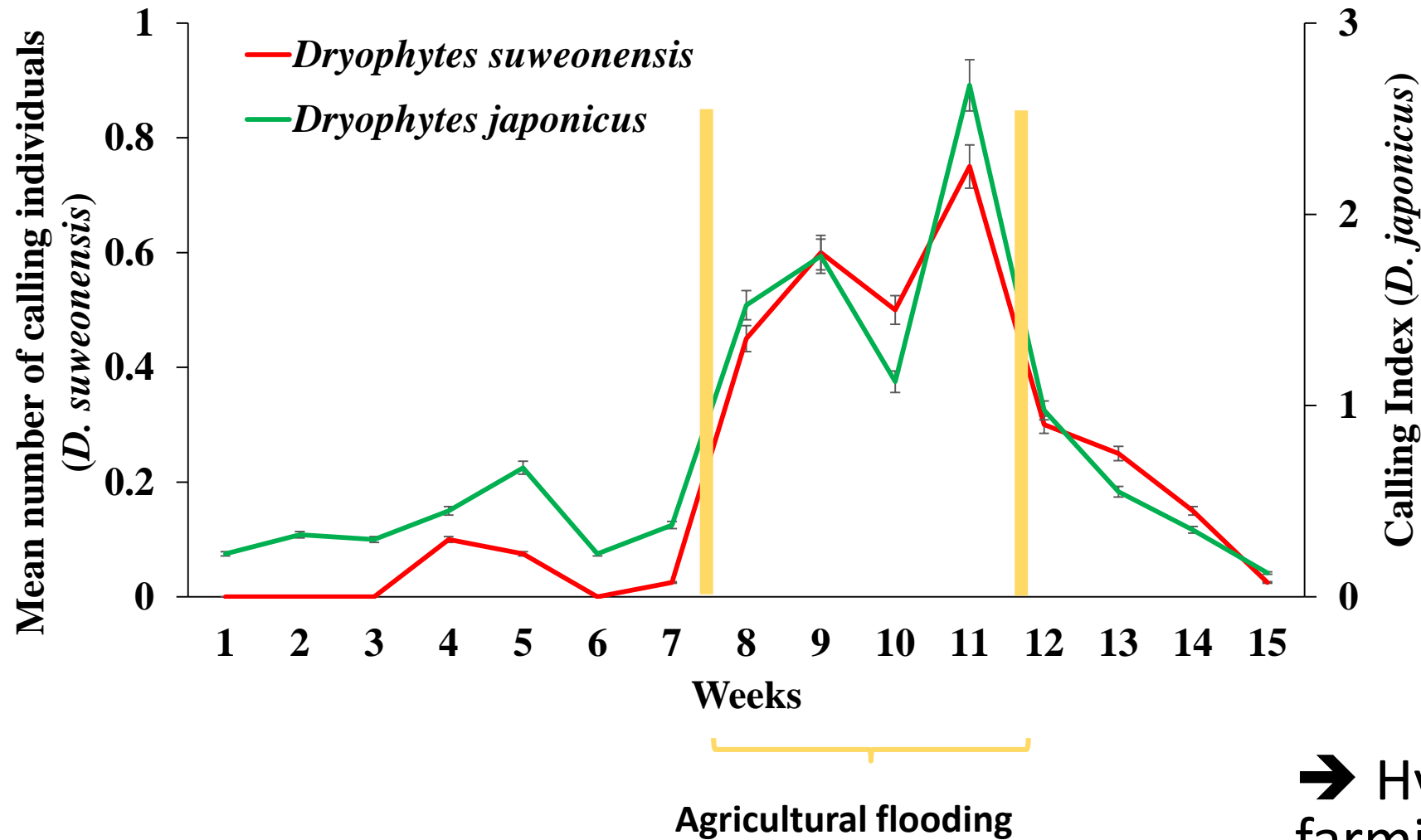
Paddies: increased connectivity



- Anthropogenic modification of landscapes to increase rice production
- Linkage of valleys by rice paddies
- Increased connectivity in *D. suweonensis* populations



Synchrony between flooding and breeding



➔ Hylids take advantage of farming practices

Paddies: advantageous for breeding

Elongated hydroperiod:

Elongated hydroperiod
for pest control



Potential for second egg
mass deposition



Typical agricultural
breeding habitat

Decreased larval competition:

Synchronised breeding
for both *Dryophytes*



No early start and
competitive advantage
for any of the two

Paddies: calling props

- *Dryophytes suweonensis* needs calling perches to breed
 - ➔ Paddies are adequate substitute breeding environment



Impossible hibernation in paddies

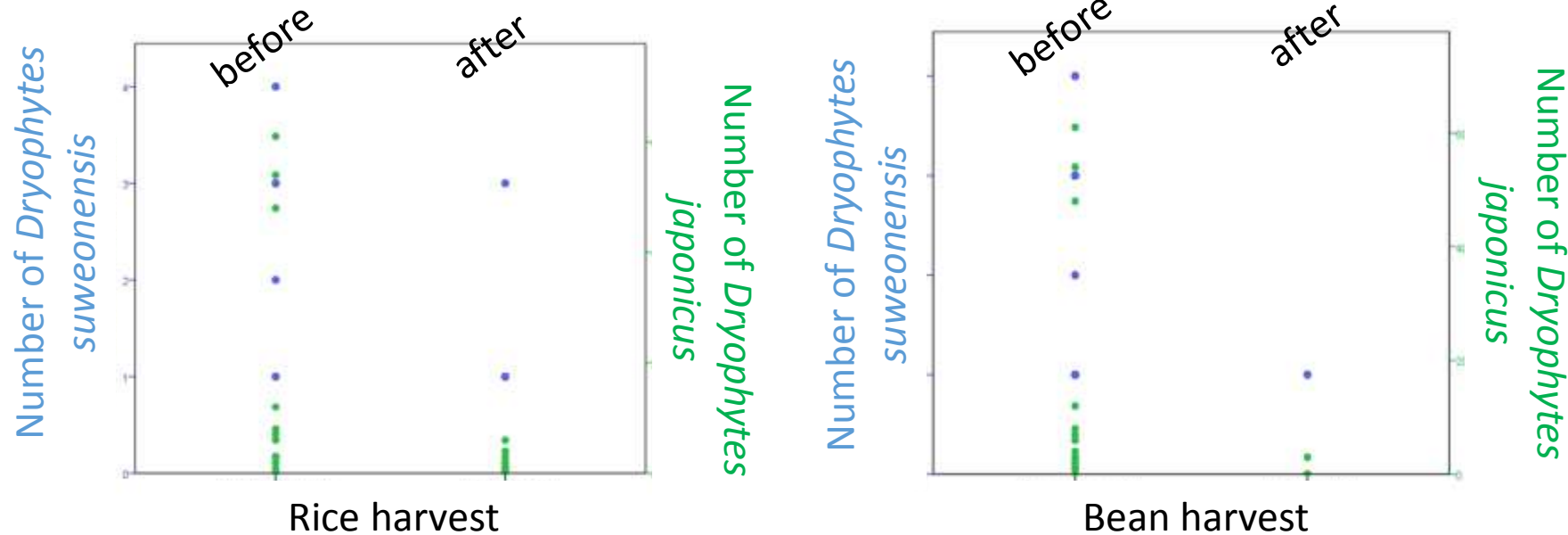


- Rice paddies are unnaturally drained in winter and cannot be used for hibernation by *D. suweonensis* and *P. chosenicus*



Impact of farming practices

- Some *D. japonicus* breed before agricultural flooding
- Tadpoles and egg masses crushed in their majority during tilling and planting



Irrigation ditches



- Ditches are regularly replaced, from natural to cemented

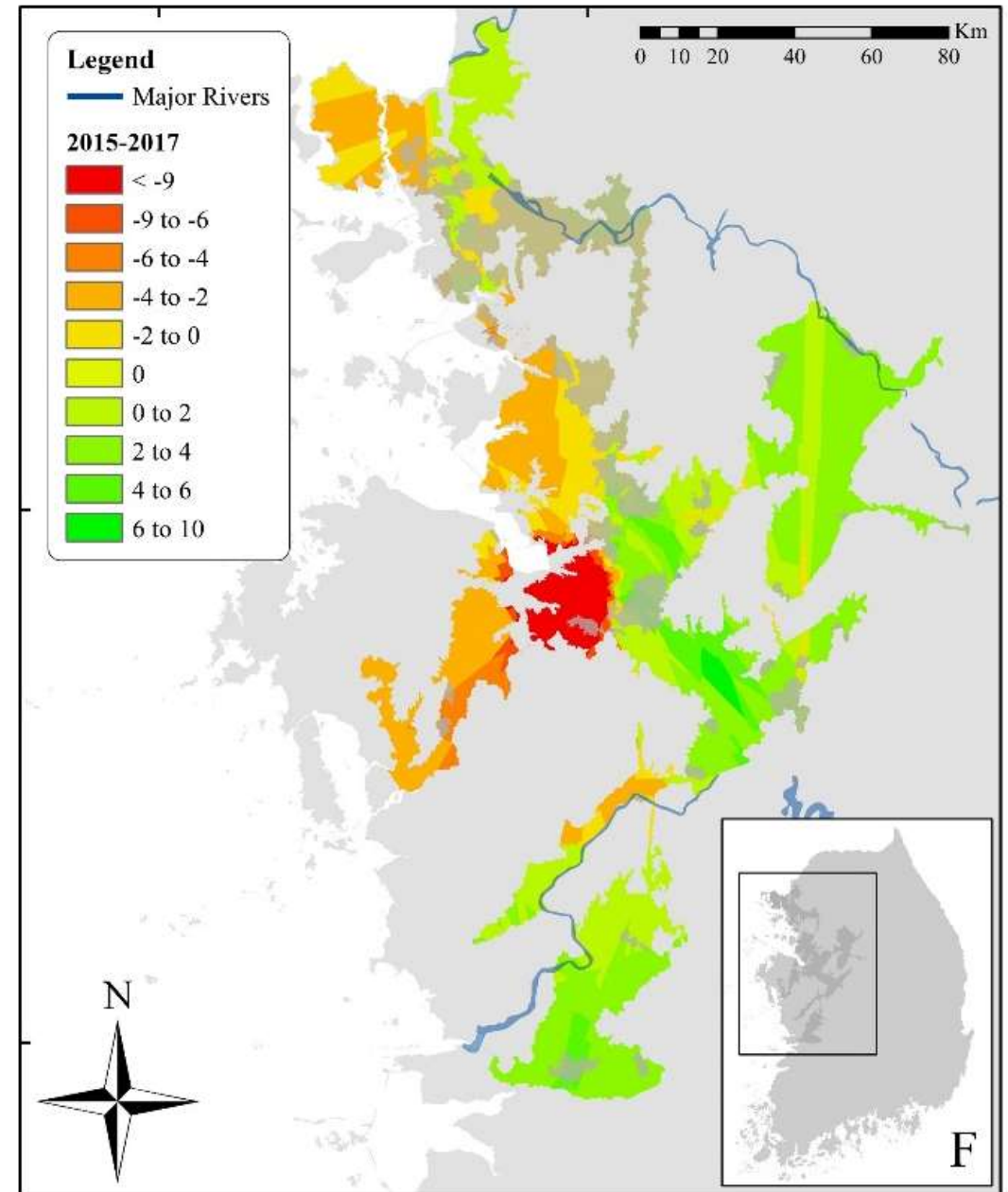


Dryophytes spp. avoid concrete ditches

➔ Vegetation needed
for day time sheltering

Population dynamics

Significant negative change in the number of calling *D. suweonensis* when adjusted for population size fluctuations



Population change between 2015 and 2017

(Borzée et al. 2017)



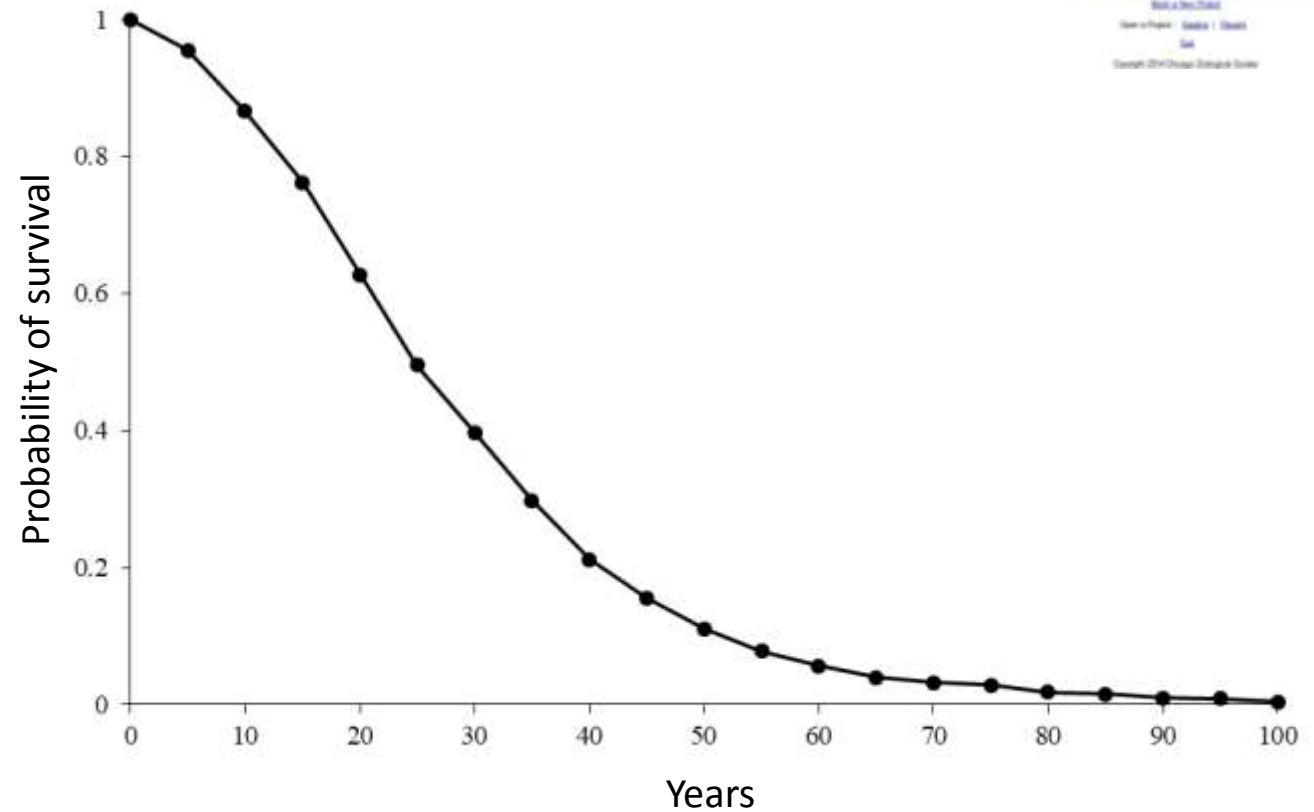
Run a Vortex
New or Project: Species 1: Species
Set
Download (2019-01-01) (2019-01-01)

What will happen next?

Population viability analysis for *Dryophytes suweonensis*?

PVA for 1000 iterations over
100 years for *D. suweonensis*

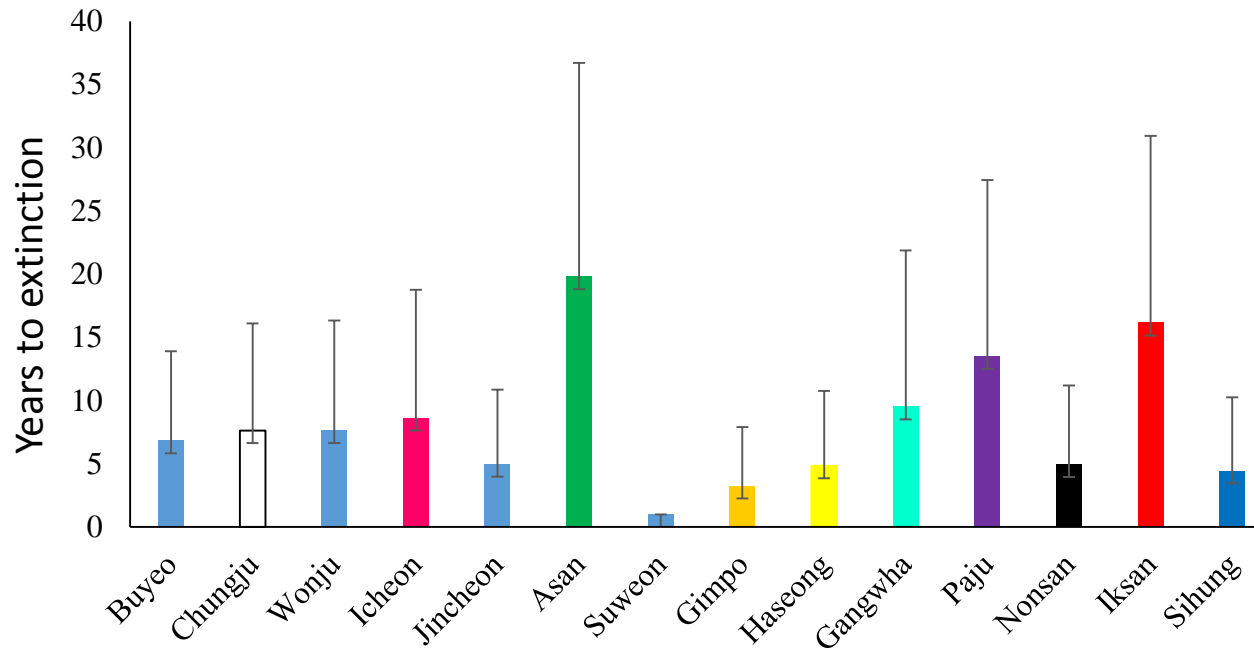
Probability of extinction >
0.99 within 100 years



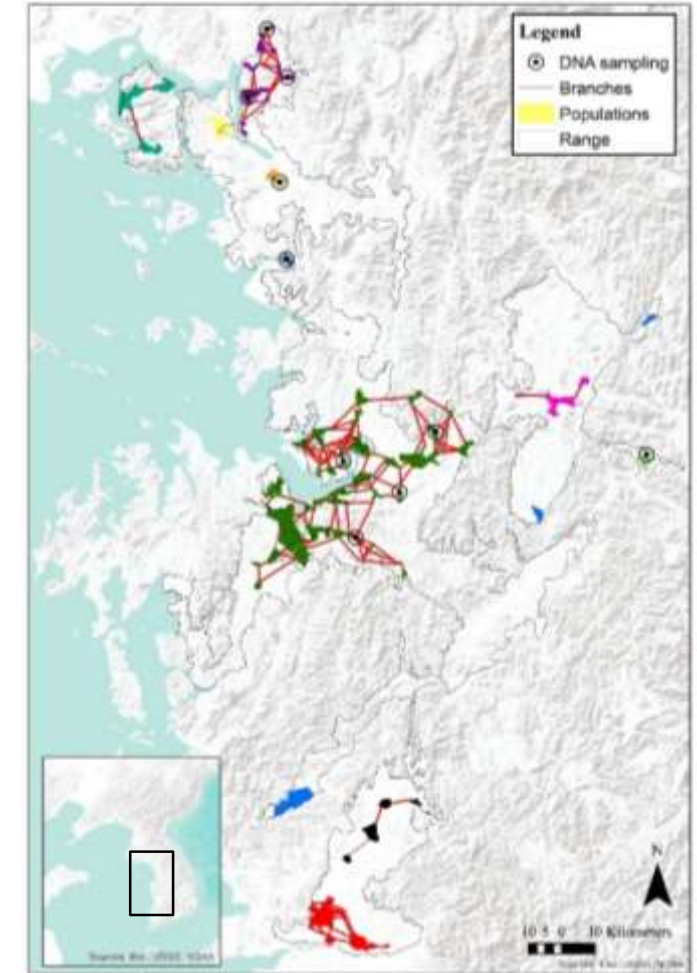
Probability of survival over time for *D. suweonensis*

Local extirpation

Extracted results of the PVA for 1000 iterations over 100 years for *Dryophytes suweonensis*



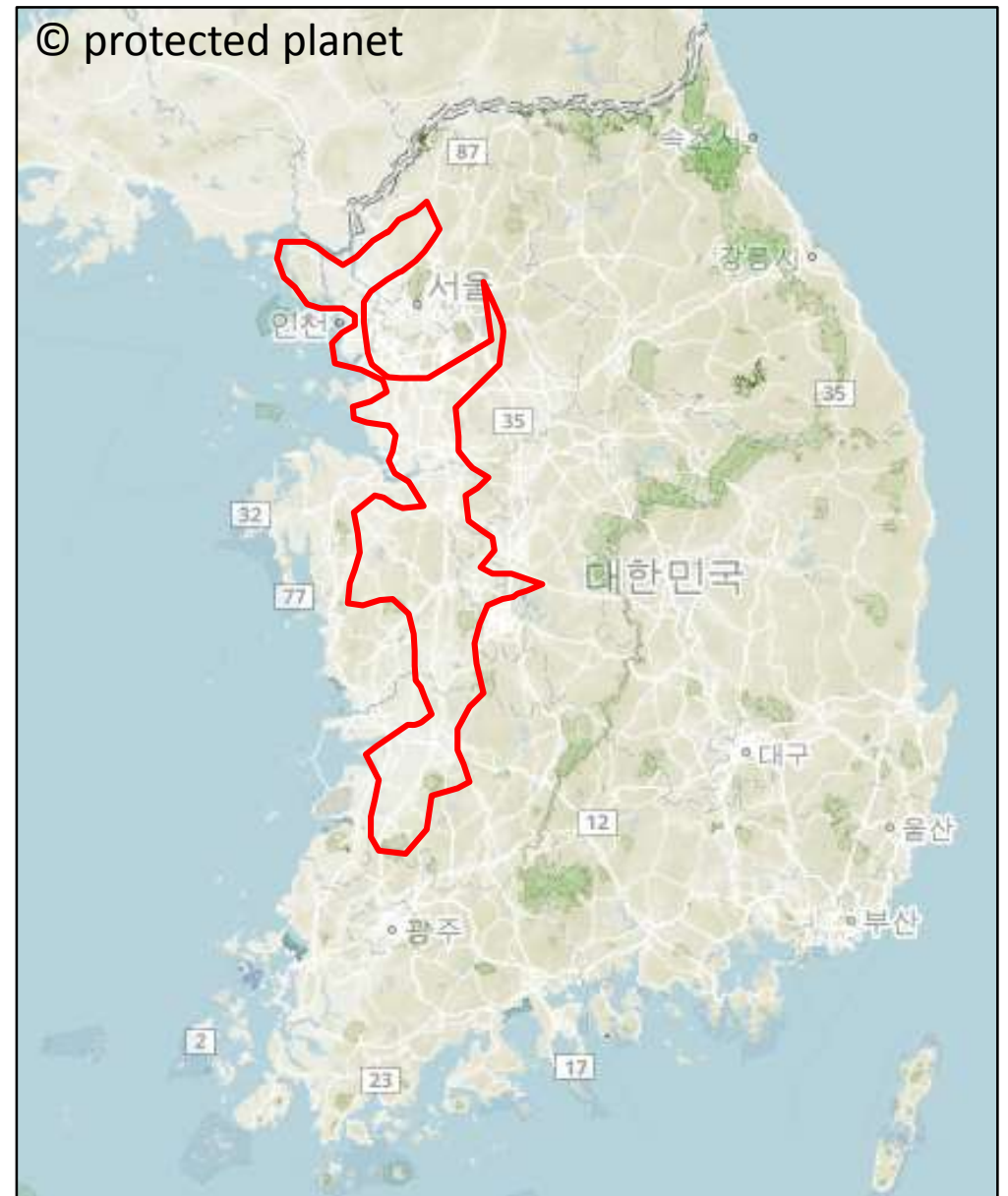
Average time to extinction per population



Populations of *D. suweonensis*

A need for protected areas

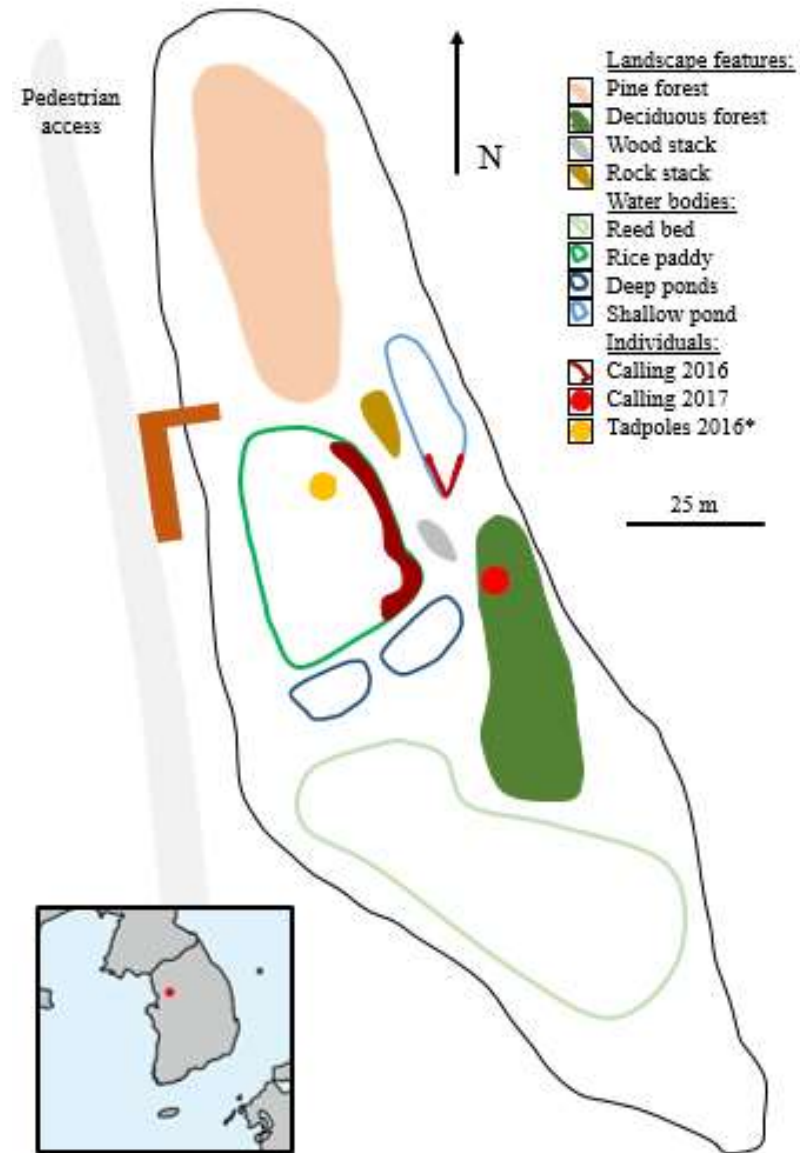
Dryophytes suweonensis is not within
a single protected area



Location of protected areas and range
of *D. suweonensis*

Reintroduction is possible!

- Rice paddy
- Shallow pond
- Deep ponds
- Deciduous forest
- Pine forest
- Hibernation habitat
- Calling & breeding in 2016
- Calling in 2017



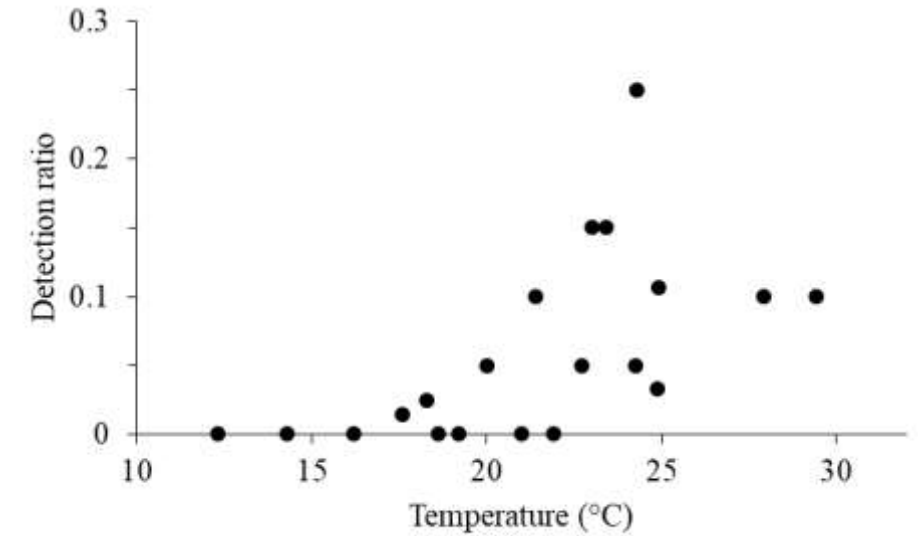
Bird's-eye view of Ilwol
restoration site

Frogs breeding in the second year

Breeding success in 2016



Ilwol restoration site during breeding season 2016



Observation of locally-born
froglets in 2016

➔ Project failure due to
human activities ←

Policy recommendations



- Designation of protected areas within the range of the species
 - preservation of rice paddies
 - continued agricultural practices by farmers
 - under the guidelines stipulated in the RAMSAR convention
- Habitat protection
 - ban of pesticides and herbicides (where *D. suweonensis* is present)
 - “Suweon Treefrog friendly” label
- Microhabitat Management
 - limit in the cutting of grass surrounding rice paddies (where *D. suweonensis* is present)
 - vegetation presence (Korean willows, high grasses) maintained close to rice paddies



Thank you



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POLICY RECOMMENDATION →

