FLOATING TREATMENT PODS FOR LAKE COMMUNITIES

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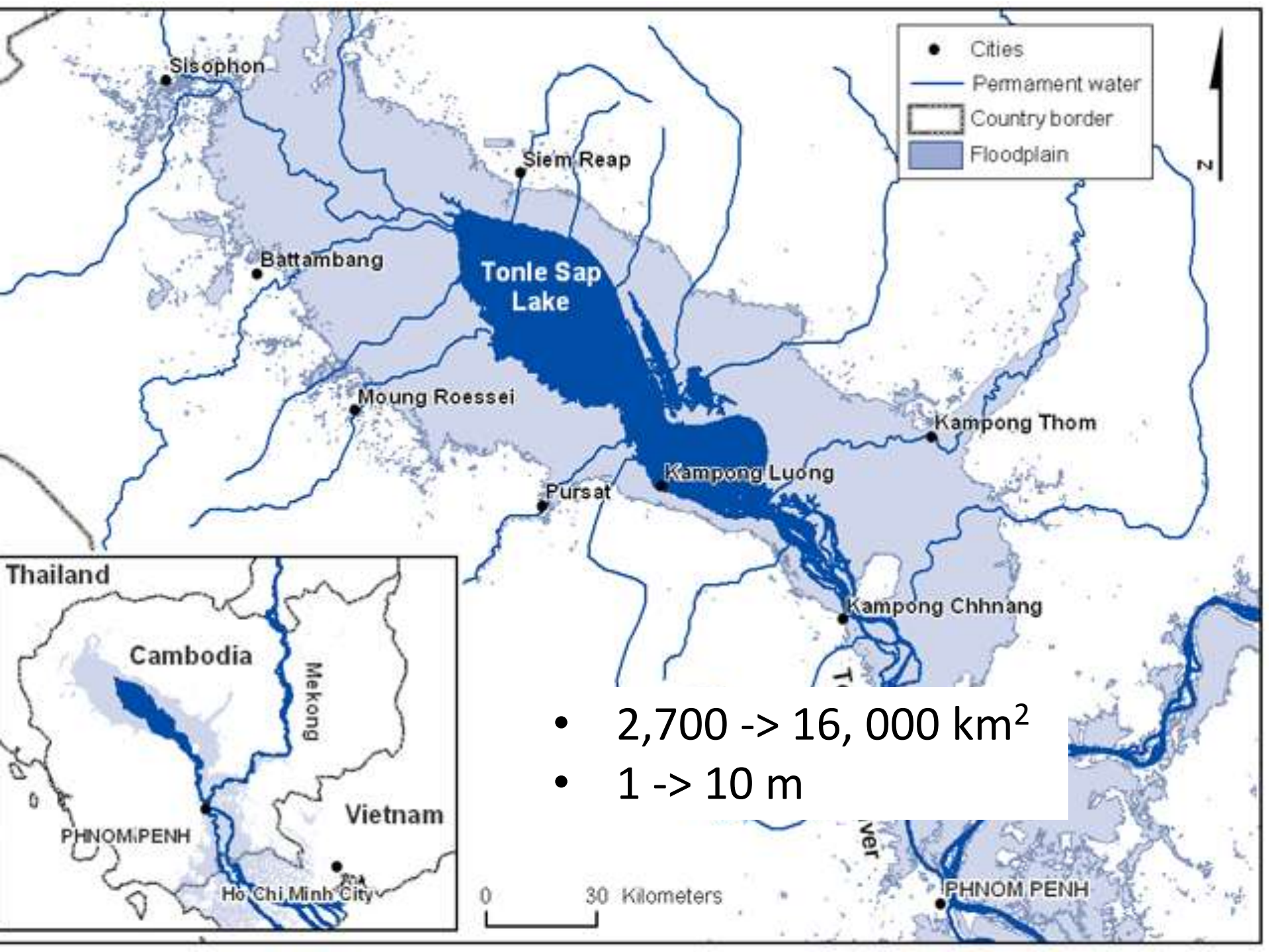
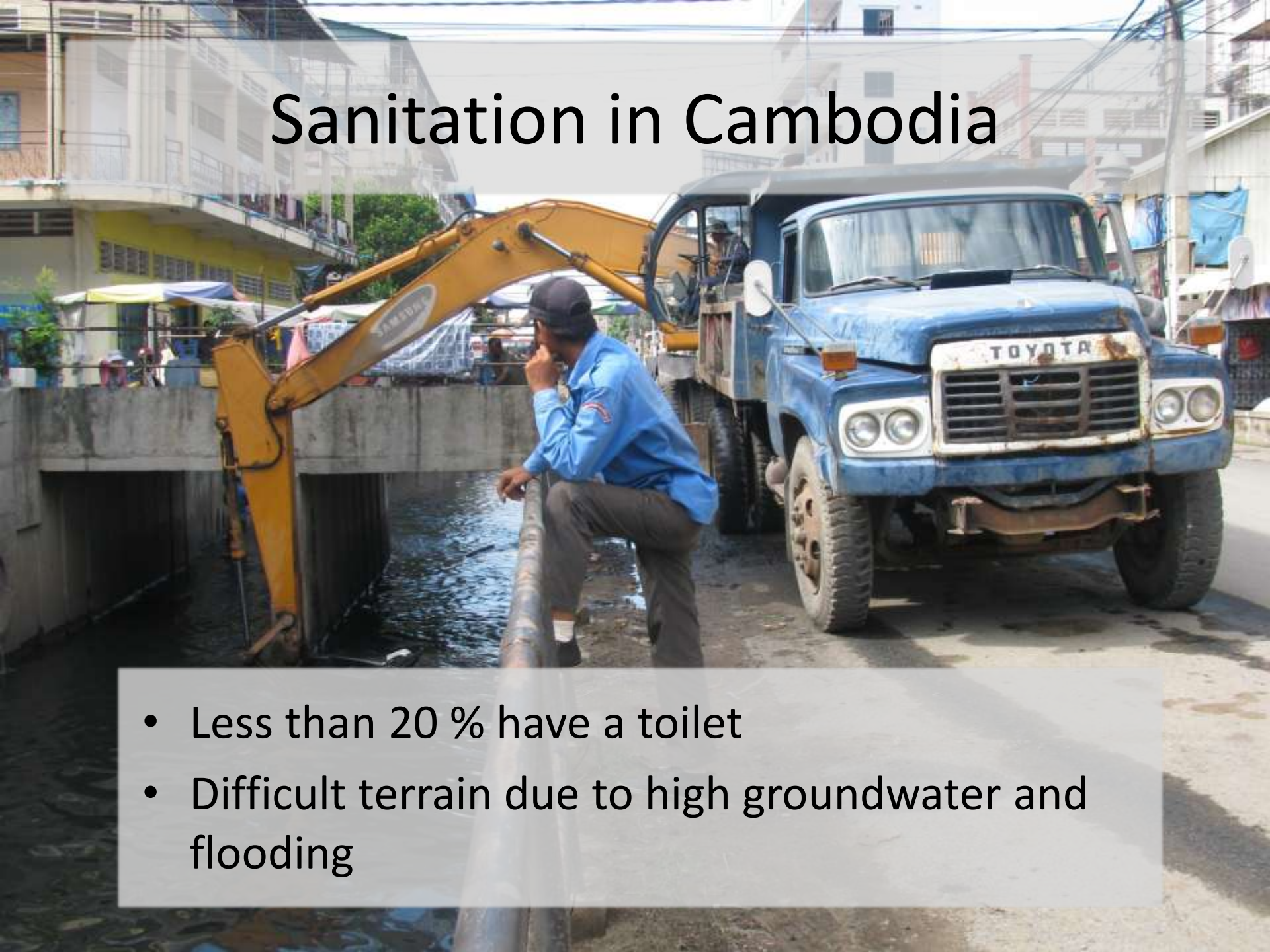
Wetlands Work! Ltd, Phnom Penh, Cambodia


Tonle Sap
Cambodia
Việt Nam
Moung Roessei
Pursat
Pouthisat
Krakor
Kampong Chhnang
Phnom Penh
Memot
Phước Long
Đồng Xoài
tx. Tây Ninh
Bảo Lộc
thành phố Hồ Chí Minh
Long Khánh
La Gi
Vũng Tàu
Mỹ Tho
Cao Lãnh
Long Xuyên
Châu Đốc
Hà Tiên
Kampot
Chhuk
Pleiku
Buôn Hồ
Buôn Ma Thuột
Vườn Quốc gia Chư Yang Sin
Phnum Prech Wildlife Sanctuary
Boeng Peae Wildlife Sanctuary
Kulen Prum Tep Wildlife Sanctuary
Roneam Daun Sam Wildlife Sanctuary
Aoral Wildlife Sanctuary
Phnum Bokor National Park
Virachey National Park
National Bio-Diversity Conservation Area
Conservation Area
อ.นางรอง
อ.ปราสาท
อ.ขุขันธ์
อ.กันทรลักษ์
อ.น้ำยืน
อ.บุณฑริก
อ.นาจะหลวย
จันทบุรี
ตราด



- 2,700 -> 16, 000 km^2
- 1 -> 10 m

Sanitation in Cambodia



- Less than 20 % have a toilet
- Difficult terrain due to high groundwater and flooding

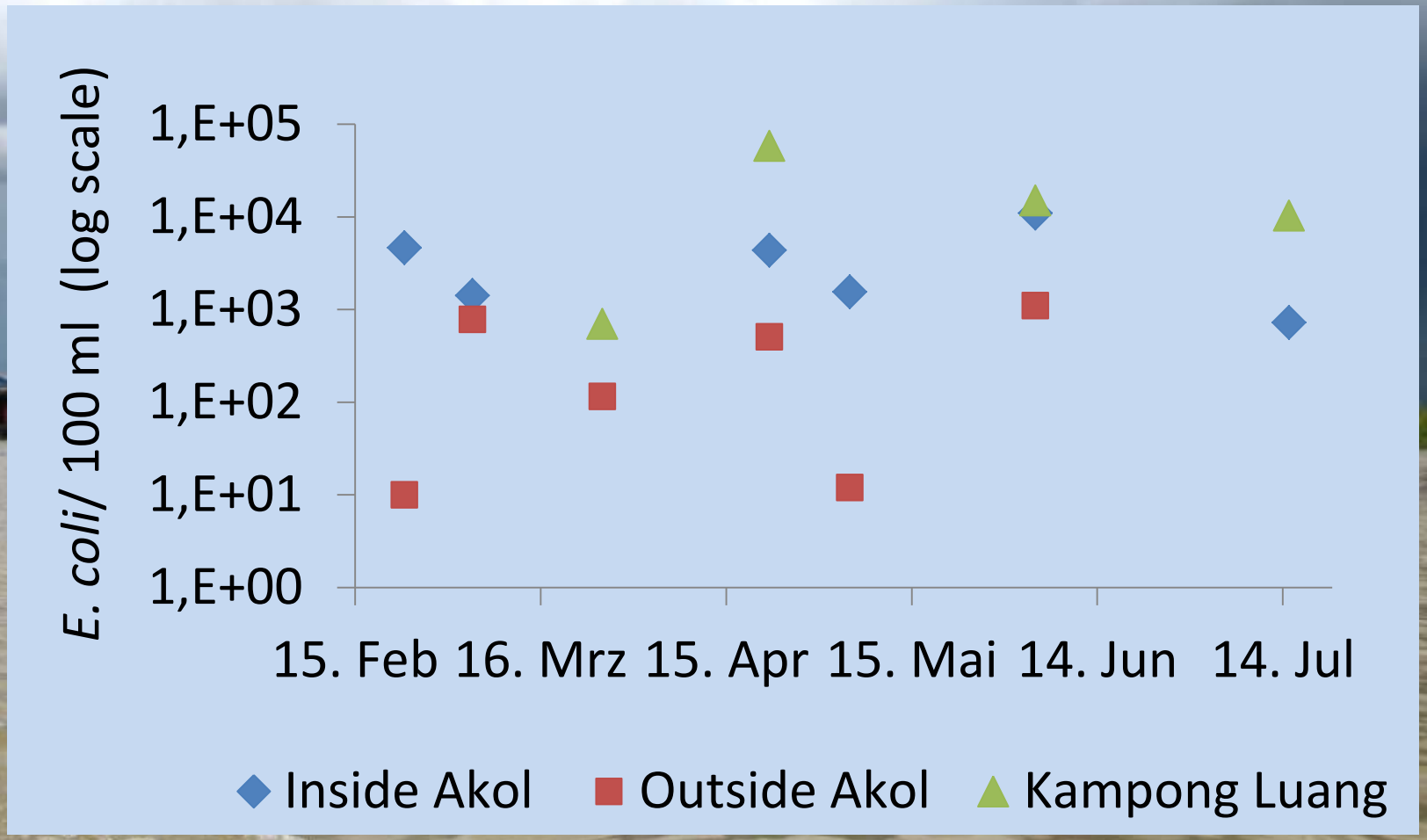
Floating villages

- >100,000 live in floating homes with no sanitation
- Villages move throughout the year
- Difficult to access

Water as playground

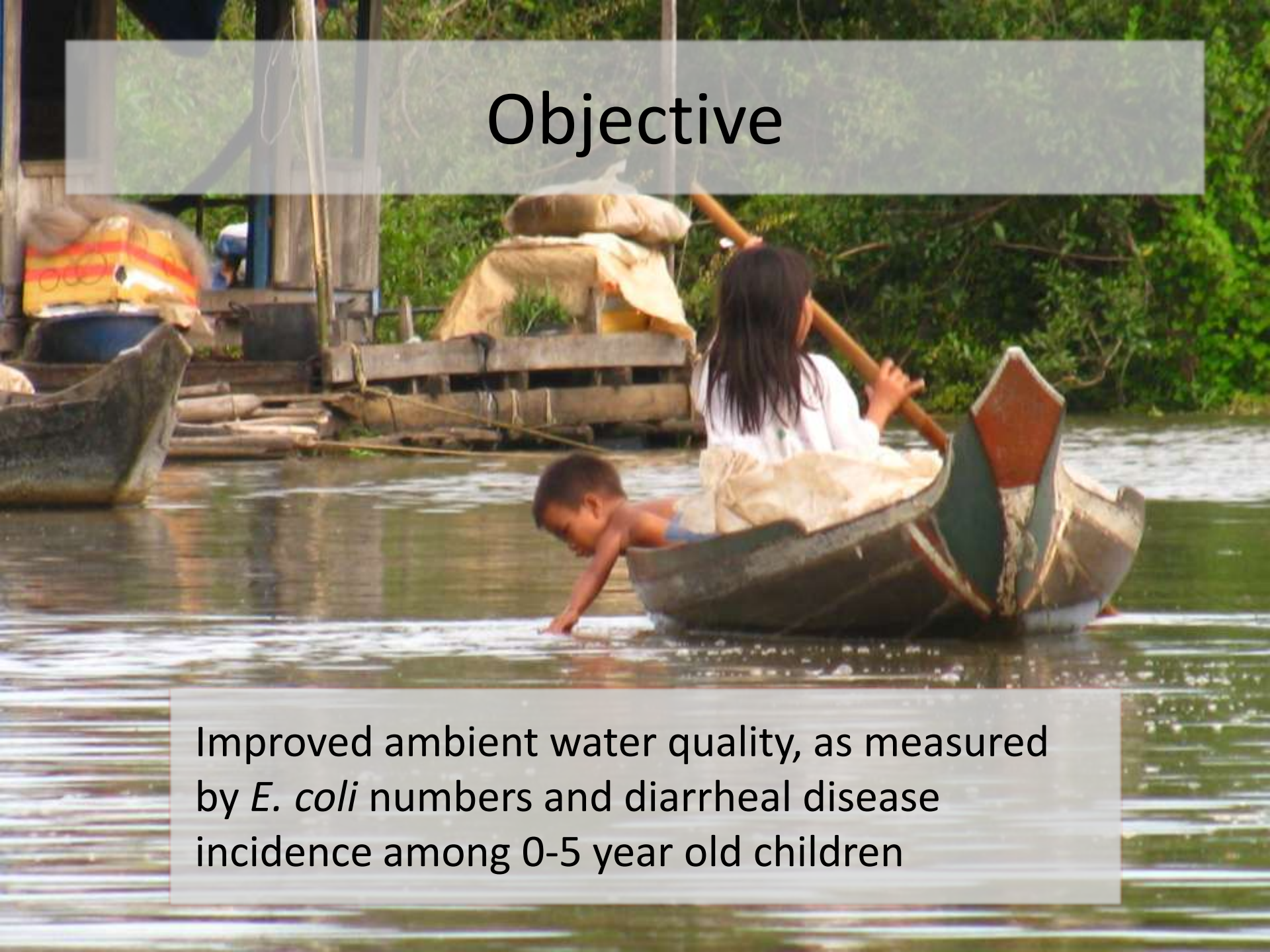
- Children spend hours each day in the water

Ambient water quality



Ambient water quality

REC -1 limit: 200 cfu / 100 ml
REC -2 limit: 2,000 cfu / 100 ml



Objective

Improved ambient water quality, as measured by *E. coli* numbers and diarrheal disease incidence among 0-5 year old children

The Basic Pod

- Widely used tarpauline
- Water bottles sewn into edge
- Volume of single pod: ~235 L
- ~1 x 1.5 x 0.4 m

The Pod

- Double pod (total vol: 470 L)
- Attached by ropes

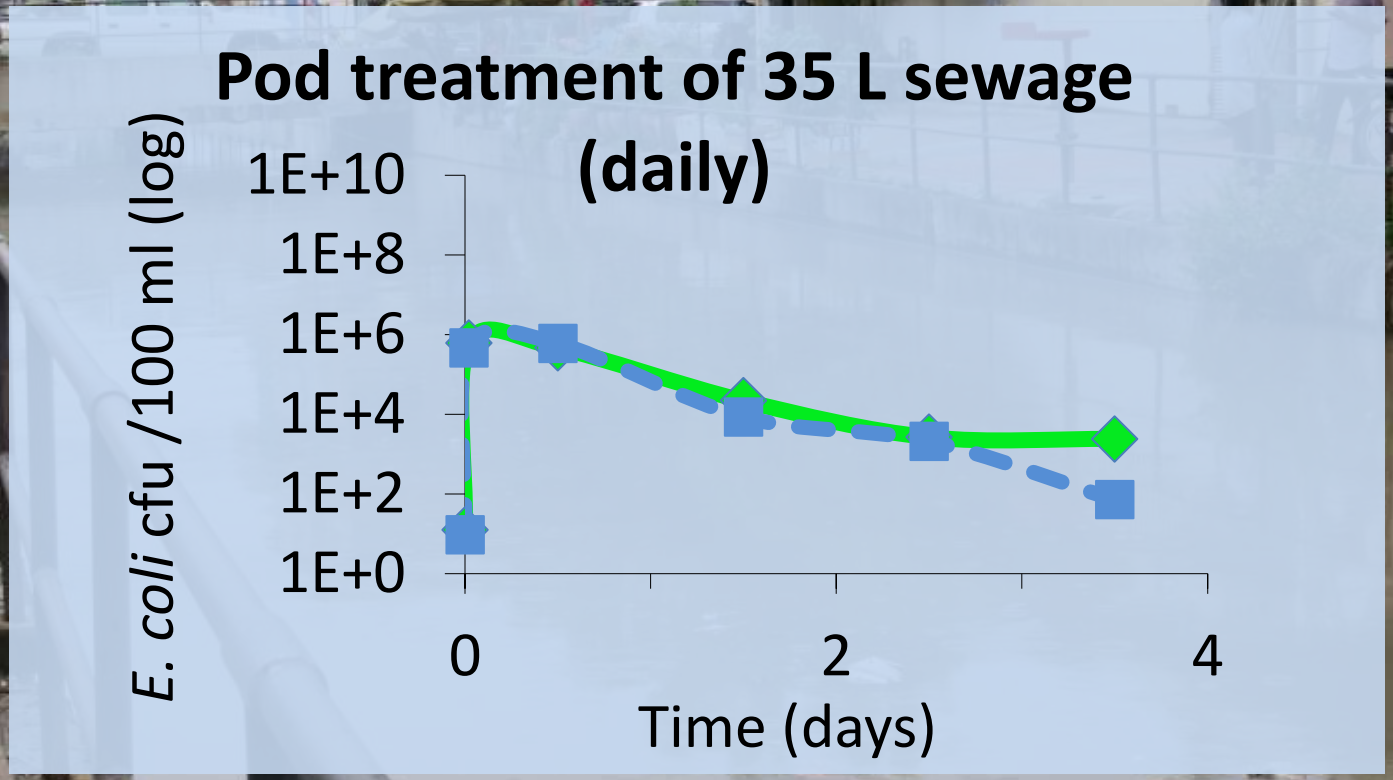
Water hyacinth (*Eichhornia crassipes)*

- Well-documented remediation abilities
- Originally from South America, now widespread in tropics
- Fast growing
  - In Pod: mass increased 5-fold over 3 weeks
- Resilient
- Large root surface area for microbiological activity

Pod tests: Method

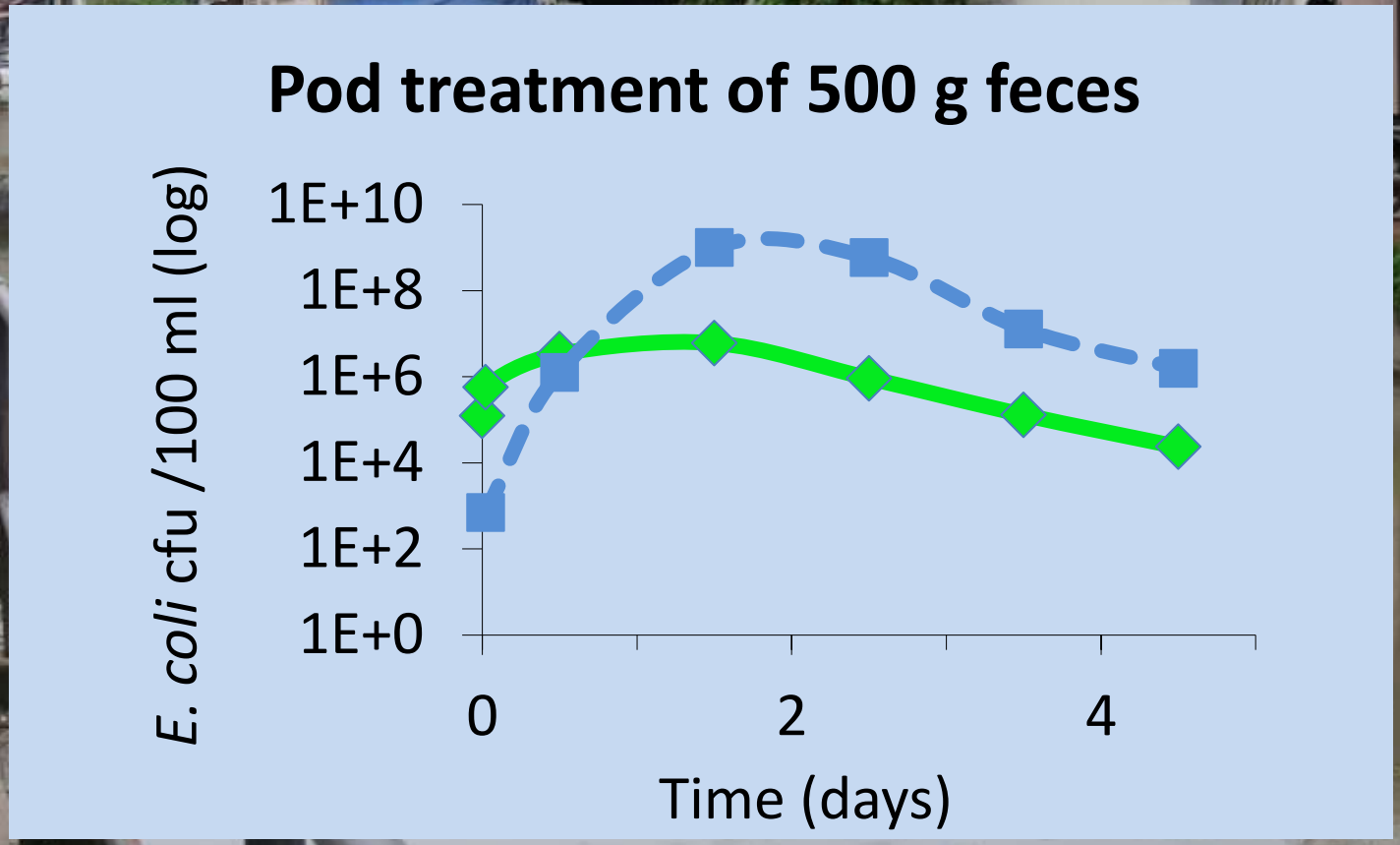
- Pods were filled with tap water and hyacinth (~3.5 kg)
  - No exchange
- Sewage or raw feces added
- *E. coli* measured in water samples

Pod test 1: Sewer water



Sewage: ~10-5 - 10^6

Pod test 2: Feces



Differences in smell and appearance of water

Pod tests on lake (Pod x2)

Input Pod: 65,000 cfu/ 100 ml (6.5 x 10 ^4)

Output Pod: 10,000 cfu/ 100 ml (10 ^4)

Total expected *E. coli* in Pods from four-person household: 10^8 cfu/ 100 ml

User experience

- Tested with a (floating) research station and a villager's house
- Challenges:
  - Accurate user feedback
  - Smell
  - Mice

Evolution of design

Key features of design:

- Affordable (current model: $20, including platform)
- Local materials, production
- Low-maintenance
- User-friendly

Evolution of design

- Bucket as a “toilet”
- First pod section covered to address smell
- Indoor or external installation option

Evolution of design

- Strategies to replace tarp
  - Bamboo Pod lined with a waterproof material
  - Stability issues; new proposed design connects section with innertube tires to allow flexibility
  - Biodegradable?
- Protect edges of tarp from light (e.g. paint)

Current work: Health impacts

- Adoption of Pods on the village scale
- Two villages: one with Pods, one as control
- Around forty households in one, fifty in the other; similar income levels
- Target: 0-5 year olds
- Simple questionnaire on gastrointestinal symptoms, contact with water

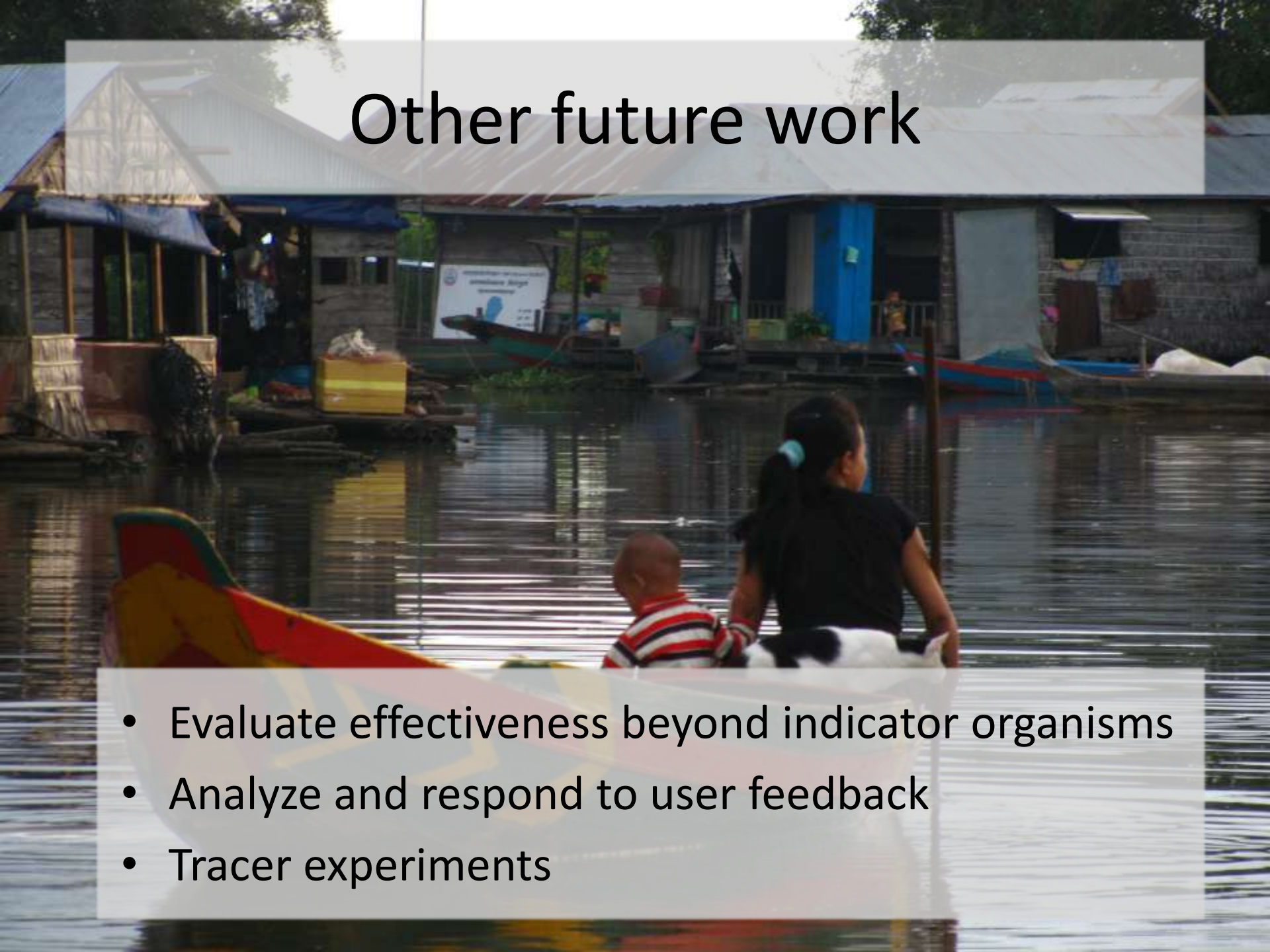
Lake Inle


Monywa
Mandalay
Pyin Oo Lwin
Yesagyo
Myingyan
Pakokku
Myanmar (Burma)
Meiktila
A
Mong Yang
Kunhing
Keng Tung
Tachileik
Chiang Khong
Mae Chan
Mae Ai
Chiang Rai
Fang
Thoeng
Phan
Chiang Kham
Phayao
Mae Taeng
Mae Rim
Chiang Mai
Saraphi
San Pa Tong
Lampang
Phrae
Nan
Chom Thong
Taungdwingyi
Pobba Thin
Naypyidaw
Pyinmana
Dekkhina Thin
Thayet
Pyay
Toungoo
Paungde
Phyu
Zigon
Kyangin
Bago Yoma Forest

Lake Inle

- March - May 2012
- Connected with Buddhist Youth for Inle Watershed
- Water level changes and household sewage untreated, similar to Cambodia
- Houses are stilted; 70,000 inhabitants
- Different attitude to sanitation

Other future work



- Evaluate effectiveness beyond indicator organisms
- Analyze and respond to user feedback
- Tracer experiments

Other future work

- Adapt Pods for pig waste

Acknowledgements

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