



# Urban and periurban agriculture and flood

Some imputs from a northern and southern experience

INRAE
la science pour la vie, l'humain, la terre

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CAFRUA Research project, G-Eau Montpellier 16-17th of May, 2024

# 1. May Intra urban agriculture play a role in containing flood ?

New York City

Brooklyn Grange

*In Cohen N, 2014. UA as Green Infrastructure : the case of NYC. In RUAF magazine, mars2014*

A MF Business Model!

Box scheme selling

Visits events

+

Paiement for an « ES » of rain captation

0.6 millions $ for the « rain captation service » of NYC Urban Farms (open air) 4000 $m^2$ ≈ 4 millions In 2012 l

*« it allows not to change the size of pipes » (NYC Department of City Planning) : a tool to manage storm water ?*

BUT

Intensive crop production needs irrigation
(around 36t/year on 1,3 ha at total )

"We found **cumulative discharge exceeded precipitation by 11 % hence the farm was a net source of water** during the entire study period, in the urban hydrologic cycle"

*Harada, Y., Whitlow, T. H., Todd Walter, M., Bassuk, N. L., Russell-Anelli, J. et Schindelbeck, R. R. (2018). Hydrology of the Brooklyn Grange, an Urban Rooftop Farm. Urban Ecosystems, 21(4), 673-689. doi: 10.1007/s11252-018-0749-7*

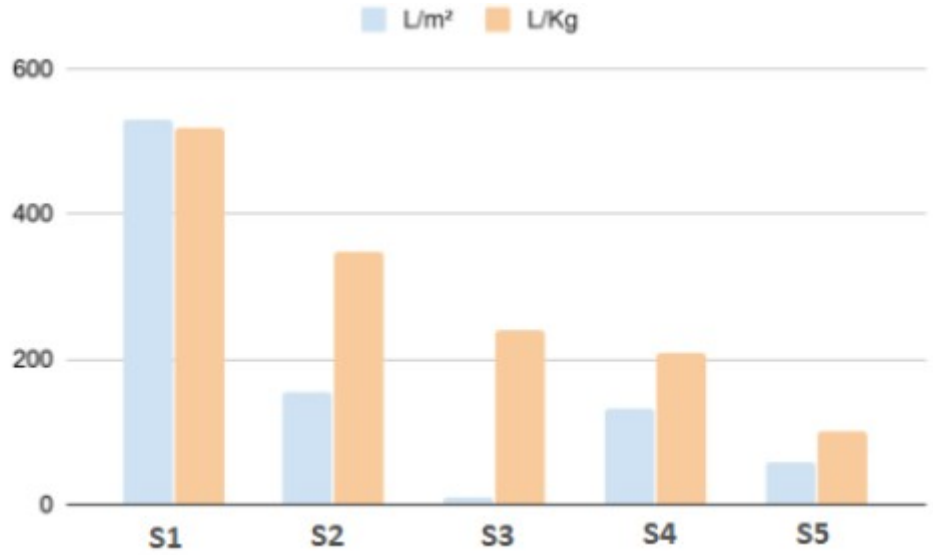
**Experimental Rooftop on AgroParisTech Paris 2012-2022**

Grard BJ-P, Chenu C, Manoucherhi N, Frascaria N ,Aubry C, 2018. Rooftop farming on urban waste provides many ecosystem services . Agronomy for Sust.Dev., 38-2

Retention rates from **74 to 90%** of rainfall and irrigation water

BUT *High losses of Nitrogen and Carbon in drainage water*

SEMOIRS Research program (2018-2020)




*In Chtioui, 2020*

FEW Meter Research program (2019-2022) Caputo et al, 2022

Figure 2a

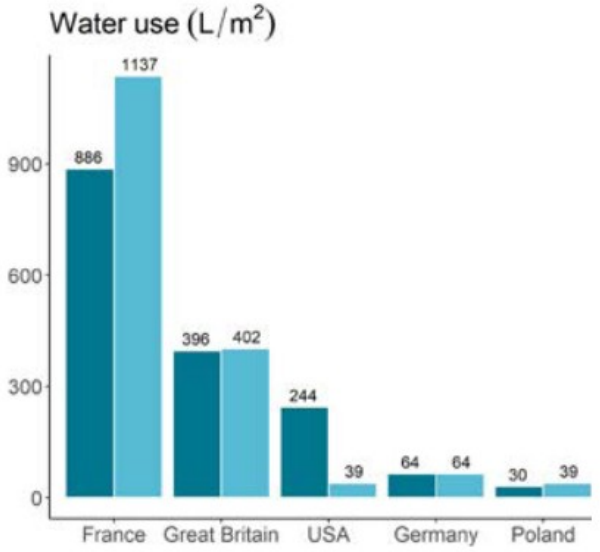



Figure 2b

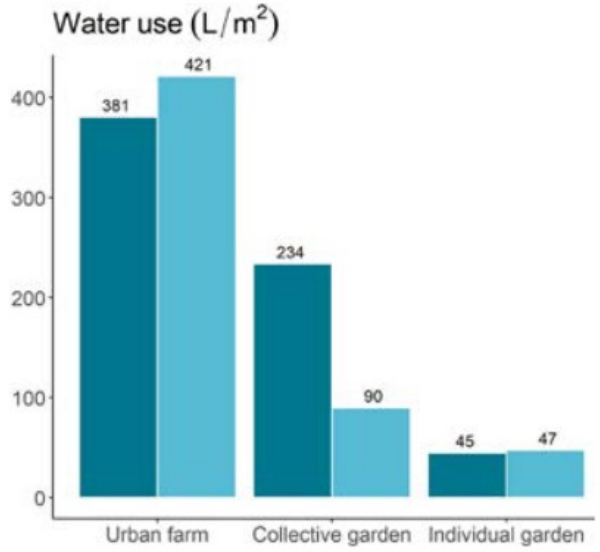
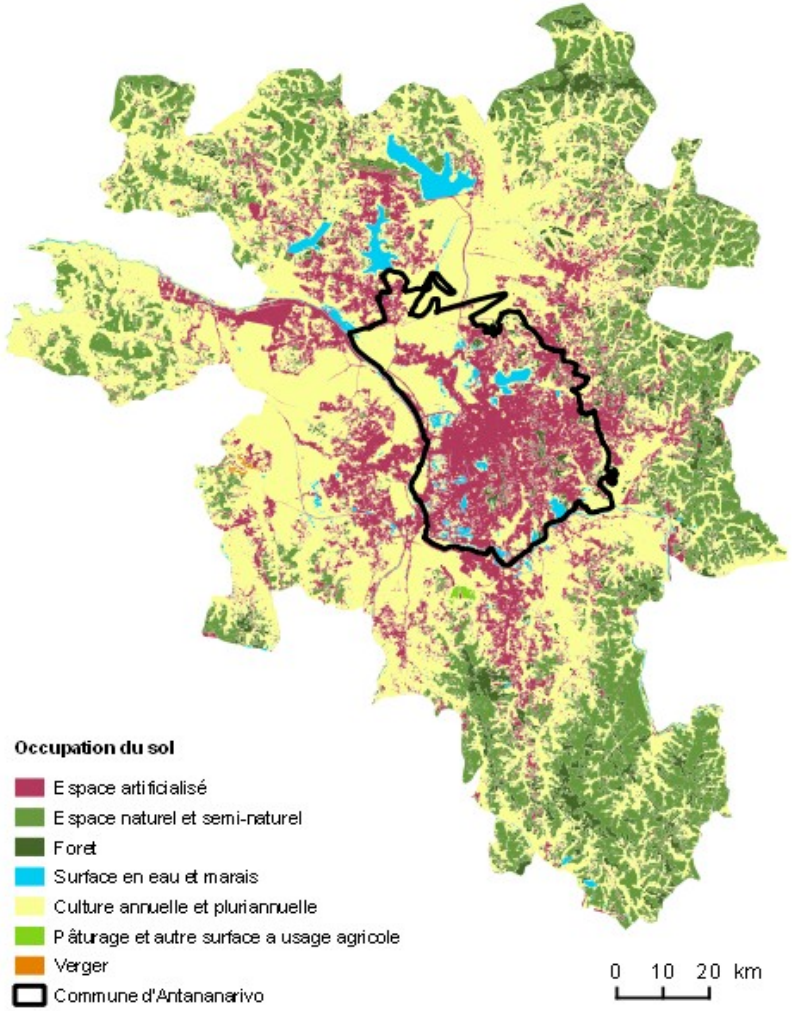



Figure 2a/b Water used a) per country and b) per garden/farm type (in 2019 and 2020).

**From a roof to a district or a city ?**

**A need for agro(eco) urbanistic research !**

# 2. Interests and adaptation of Urban agriculture to flood : a malagasy experience




*Defrise, 2018*
*Andriamanga AV et al, 2024*

Antananarivo

Three rivers, an historical Rice Plain

- 40% of the territory (70500 ha) under agriculture in 2022 (44% in 1999)
- 33% in the city itself ; 60% in plain and valleys (16750 ha)

A threatened but dynamic Urban and Periurban agriculture

**For food reasons**
(Dubbeling et al, 2010)

80 to 100% of vegetables (tomatoes, lettuce, cabbages, carrots, herbs

- > 90 % of eggs, milk > 80% of chicken meat
- >25% for rice

And an increasing role

*Dabat et al, 2006, Aubry et al, 2012, Defrise et al, 2020*

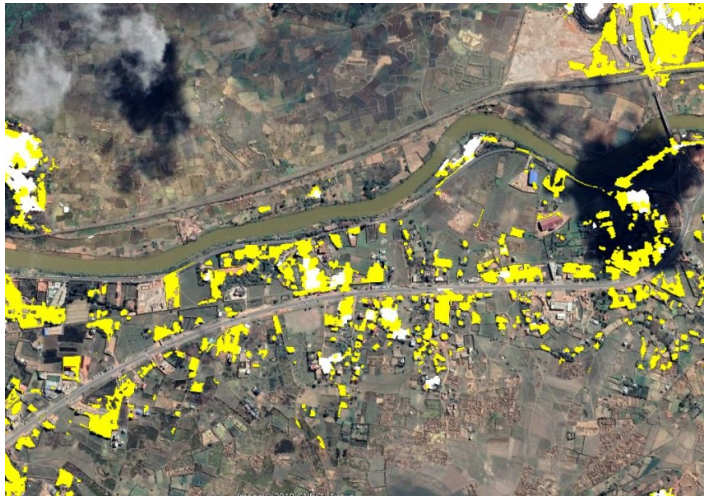
**Instead of a fast and badly controlled urbanisation**

Building goes on
2003-2017 : +3,2%/year

Population grows 5 to 8%/year in teh same period

2003

2017



# UA : an anti-flood role ?

Intra urban valleys may stock  several days of tropical rain (Andriamalala 2006)

Rice plain (intra and Peri) too

BUT

Brick activity for farmers : a very efficient  but not sustainable way of making money

AND

In PUDI 2006-2008 : « *UA is the most efficient and the less expensive way to control flood* »

Aubry C et al, 2012

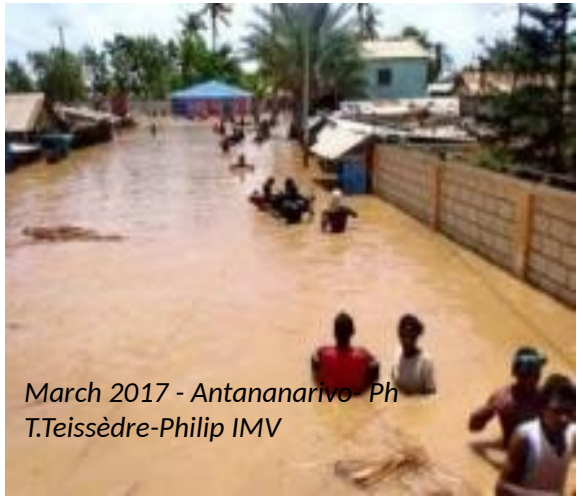
**2000 ha of the Rice Plain « forbidden for building « Our Buffer Zone » in 2008**

## After the PUDI 2006-2008 …

**Building still goes on**
**2003-2017** : +3,2%/year

And **dramatic flood too** !

With ***higher and later risks now*** than at the beginning of the century



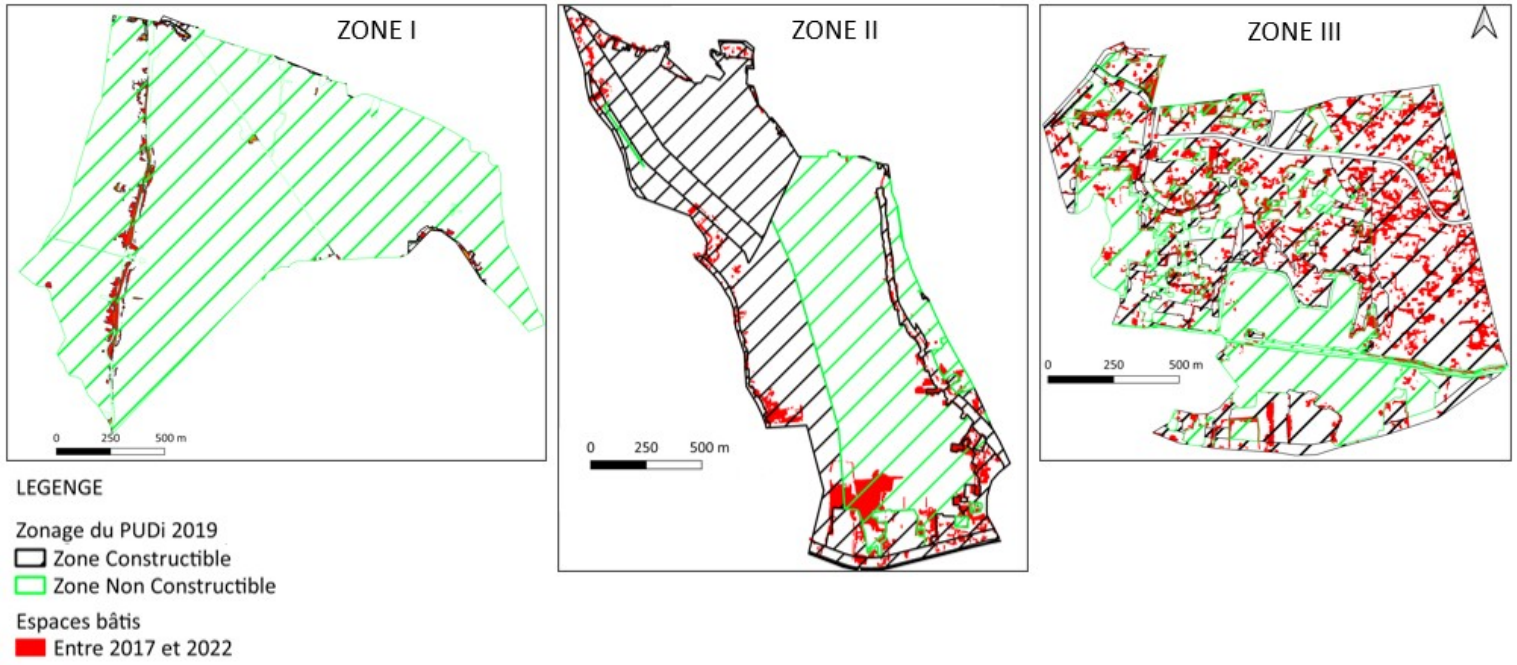
*March 2017 - Antananarivo- Ph T.Teissèdre-Philip IMV*

In 2019 a New PUDI « to manage Flood facing climatic changes »

*Redefine and precise the level of flood risks inside and near the city*

BUT

2017-2022 : + 5,08% /year



Some agricultural adaptations

Bacteriological and fecal pollutions DCO/DBO 2,7 (>0,5 WHO)

50

Rice to water cress

An adaptation to quantity but chiefly (BAD) water quality

In the Rice plain

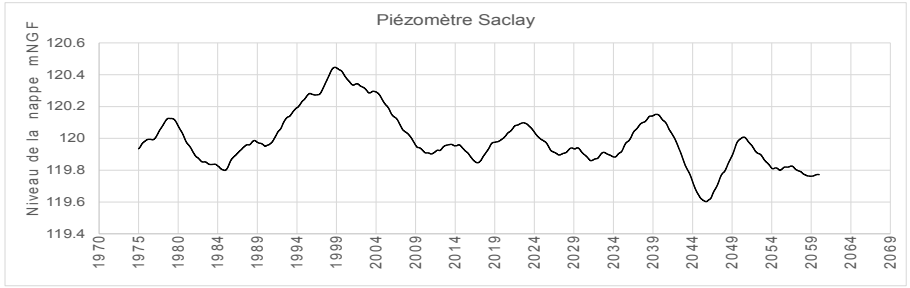
Increasing Fishes/Rice systems « rizipisciculture »

Market vegetables on the edges of fishes basins

# 3. Using Flood to enhance agricultural production ? The case of market vegetable farming in the Parisian Region

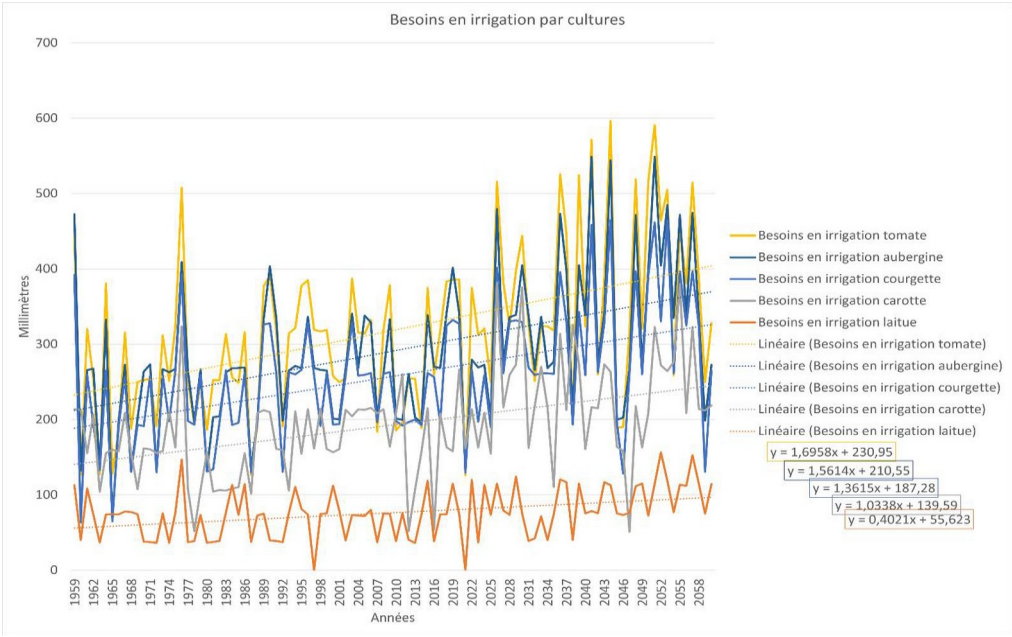
**Climaleg Eau (2021-2024)**
(Touili et al, 2024)

More intense Rain in Winter-spring
More drought in spring Summer fall
a trend to uncertainty to refill Ground Water




Vegetables
Autonomy 10% Now

Increasing needs for irrigation >= 20%




Flood Manageme
protecting Paris !

SEINE GRANDS LACS

Marne Flood 2018

Dpt des Yvelines, 2022

Agricultural Ponds


Thank you for your attention