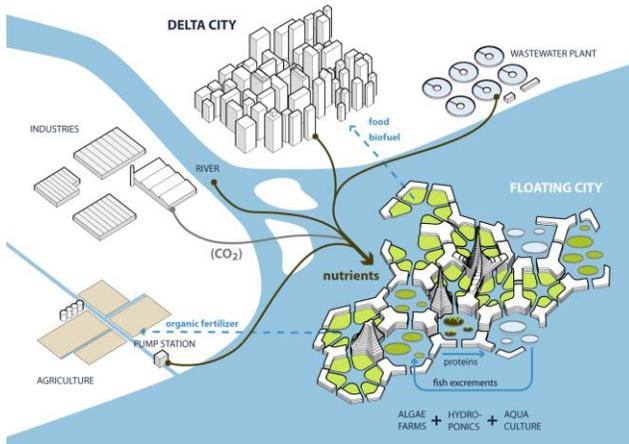


# BLUEREVOLUTION

Potential of floating urbanization and food production for coastal/delta cities



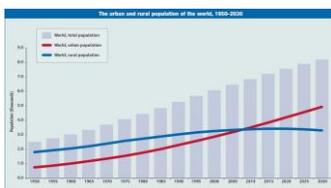
Rutger de Graaf  
 Bart Roeffen  
 Barbara del Bo Zanon  
 Karina Czapiewska  
 Hannah Haertwich

Deltas in Times of  
 Climate Change II

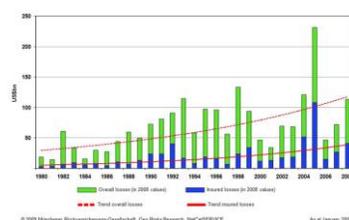
26 09 2014

## Urban challenges of the 21st century

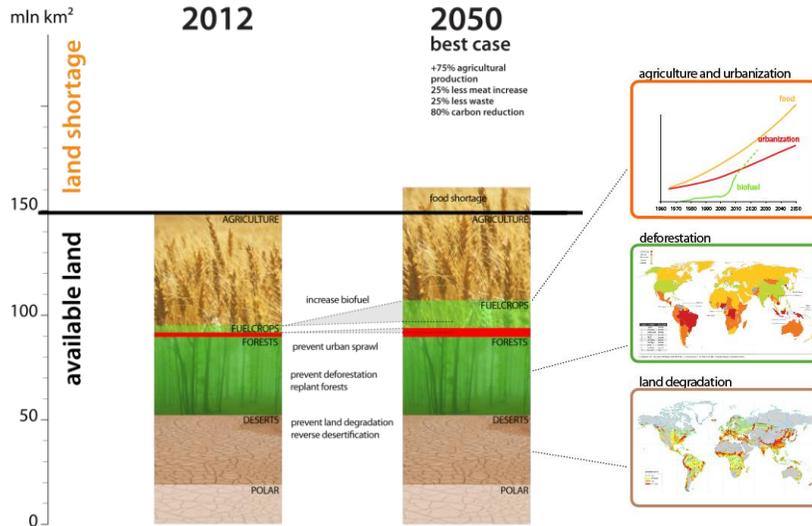
### Urbanization



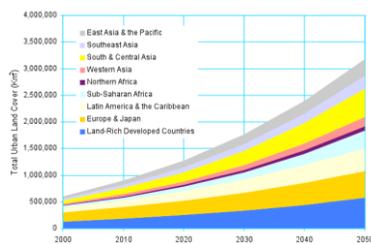
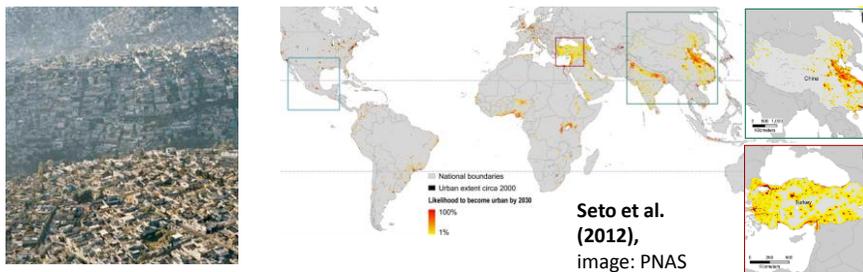
### Flood risk / Climate change



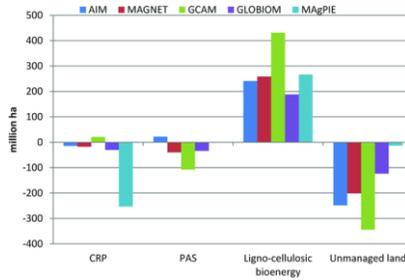
# Global risk of land scarcity



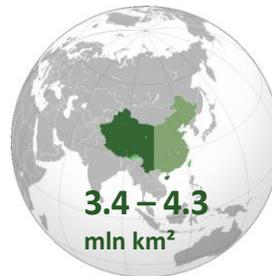
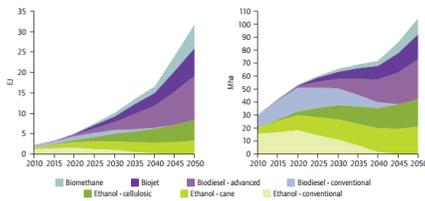
# Urban expansion



## Additional land for biomass/biofuel



Lotze-Campen et al. (2013),  
image:  
Agricultural Economics



BLUEREVOLUTION

delta sync  
WATER-BASED URBAN DEVELOPMENT

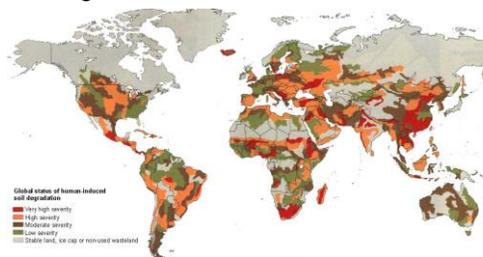
## Additional land for food production

### Population growth

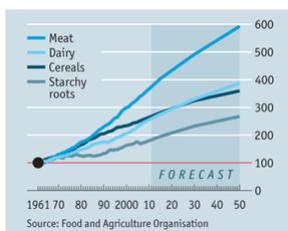
Years when world population reached increments of 1 billion



### Soil degradation



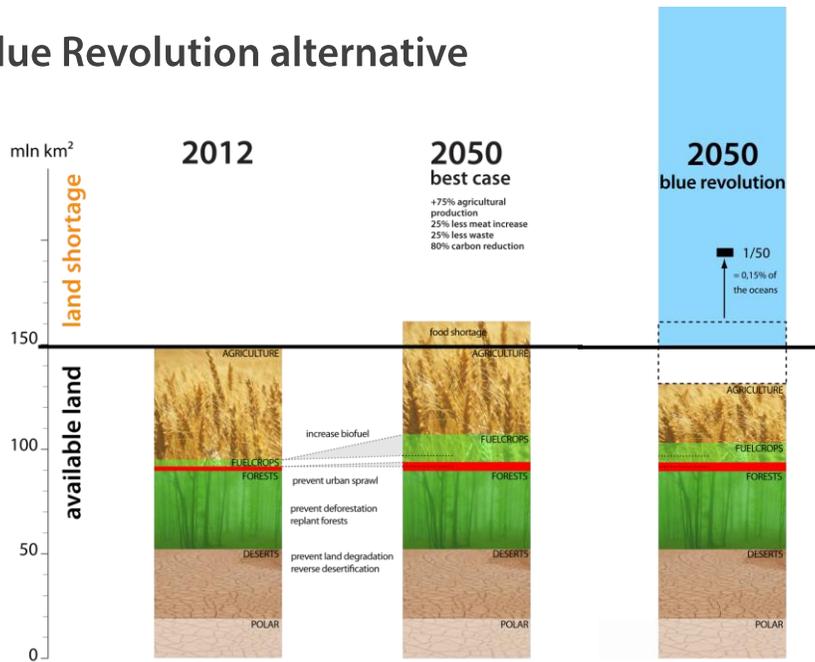
### Nutrition



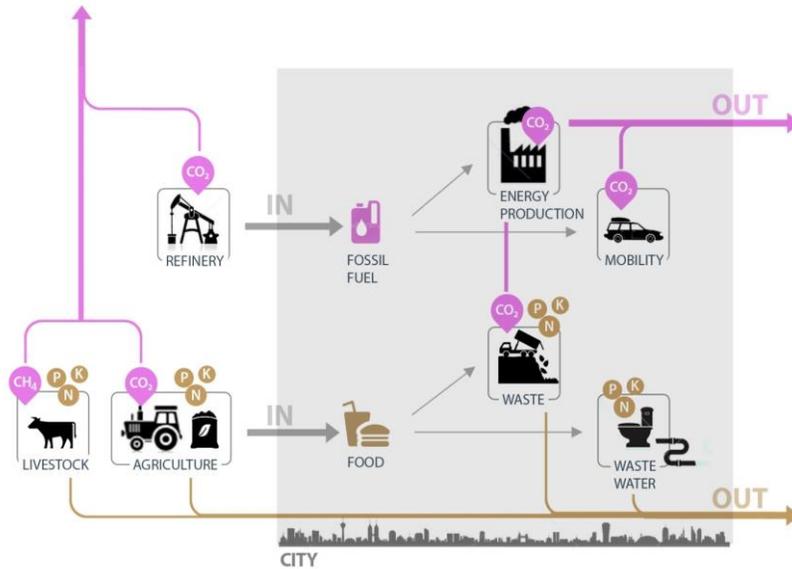
BLUEREVOLUTION

delta sync  
WATER-BASED URBAN DEVELOPMENT

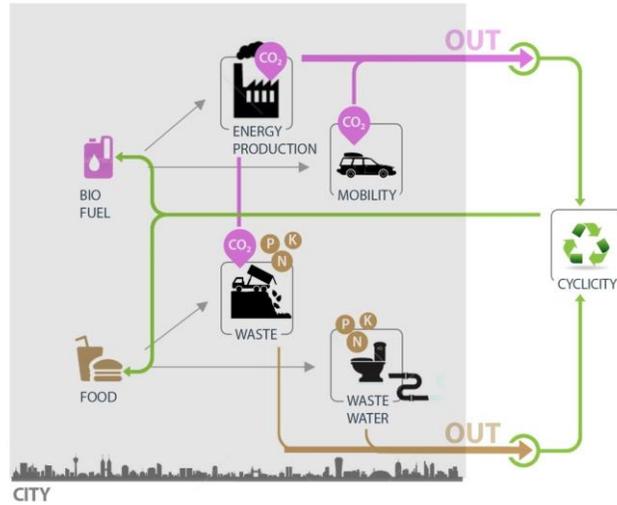
## Blue Revolution alternative



## Urban Metabolism | CONVENTIONAL



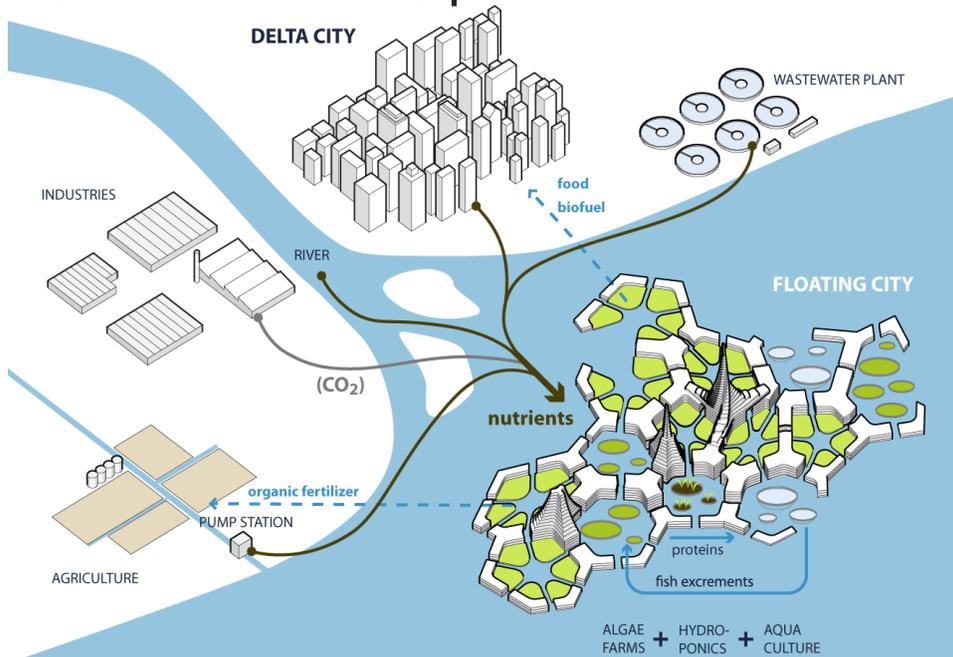
# Urban Metabolism | CYCLICAL



**BLUEREVOLUTION**

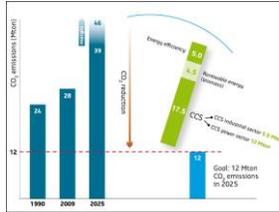
**deltasync**  
WATER-BASED URBAN DEVELOPMENT

## BlueRevolution concept

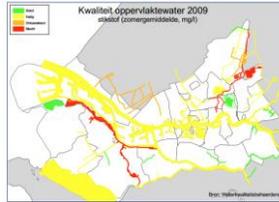




## Rotterdam challenges | EMISSIONS



**CO<sub>2</sub>**  
EMISSIONS



**NUTRIENT**  
EMISSIONS

**BLUEREVOLUTION**

delta**sync**  
WATERBASED URBAN DEVELOPMENT

## Rotterdam challenges | SUMMARIZED

**TOO MUCH**  
**WATER**

**TOO MANY**  
**NUTRIENTS**

**TOO MUCH**  
**CO<sub>2</sub>**

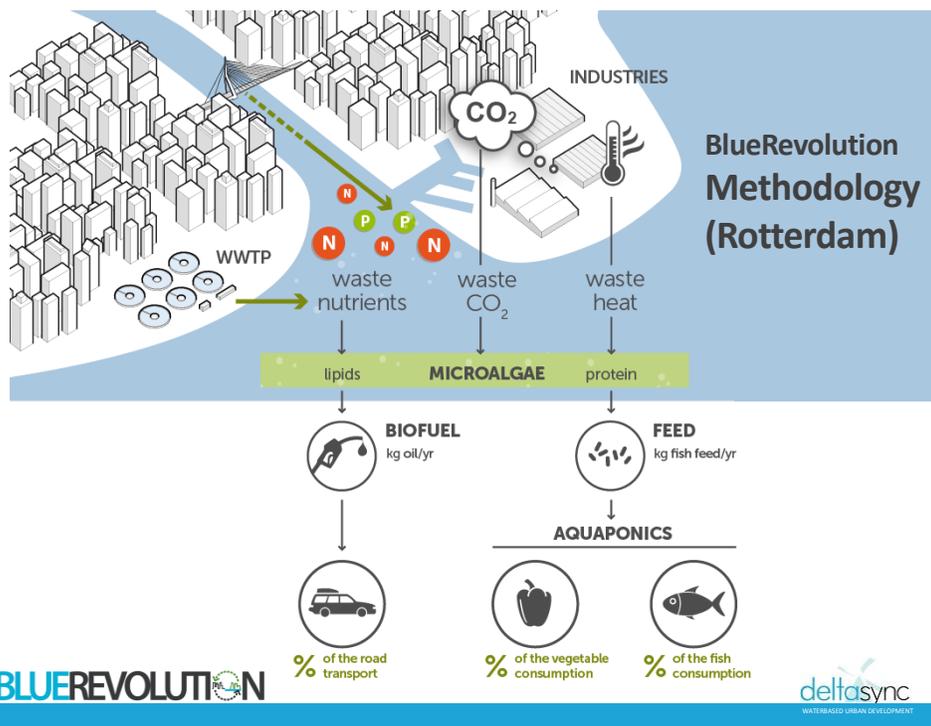
**BLUEREVOLUTION**

delta**sync**  
WATERBASED URBAN DEVELOPMENT



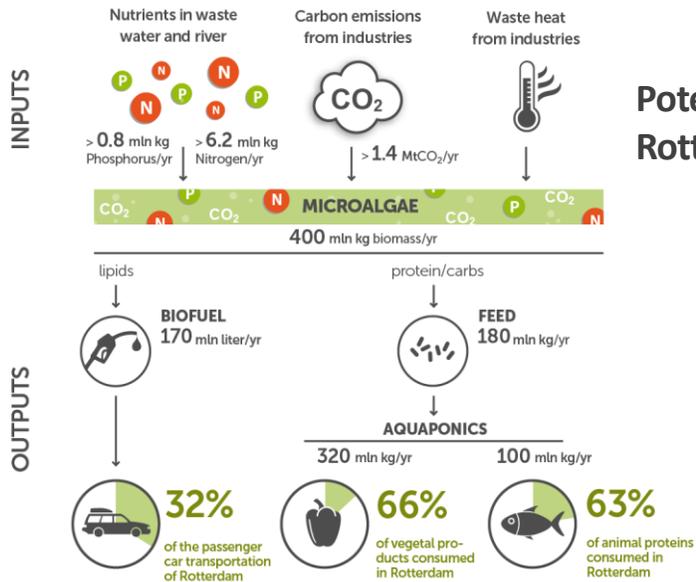
**BLUEREVOLUTION**

**deltasync**  
WATER-BASED URBAN DEVELOPMENT



**BLUEREVOLUTION**

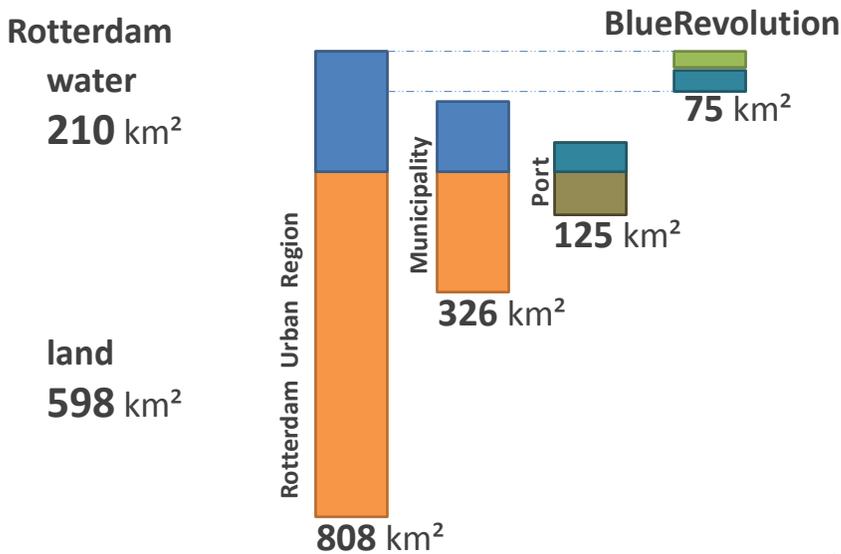
**deltasync**  
WATER-BASED URBAN DEVELOPMENT



**BLUEREVOLUTION**

delta sync  
WATER-BASED URBAN DEVELOPMENT

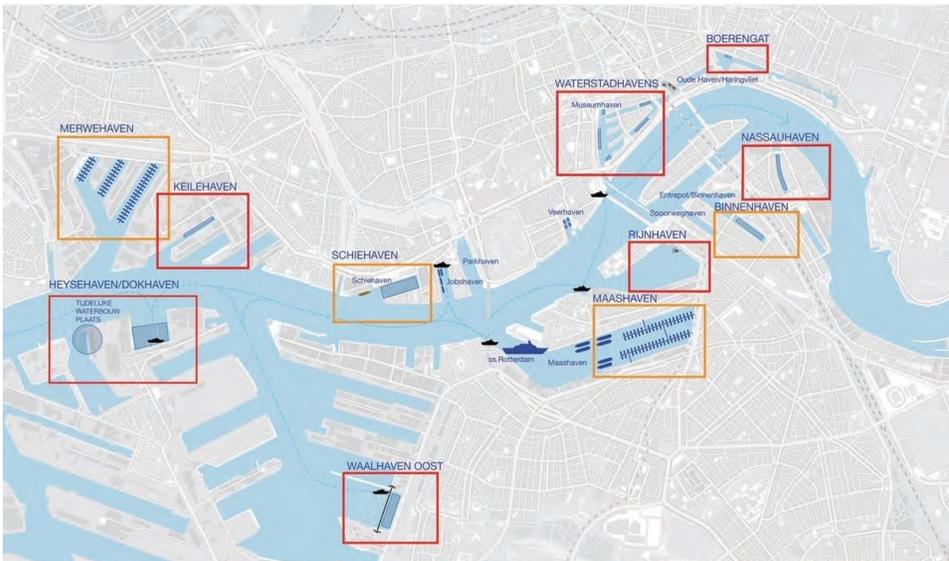
### Space requirements



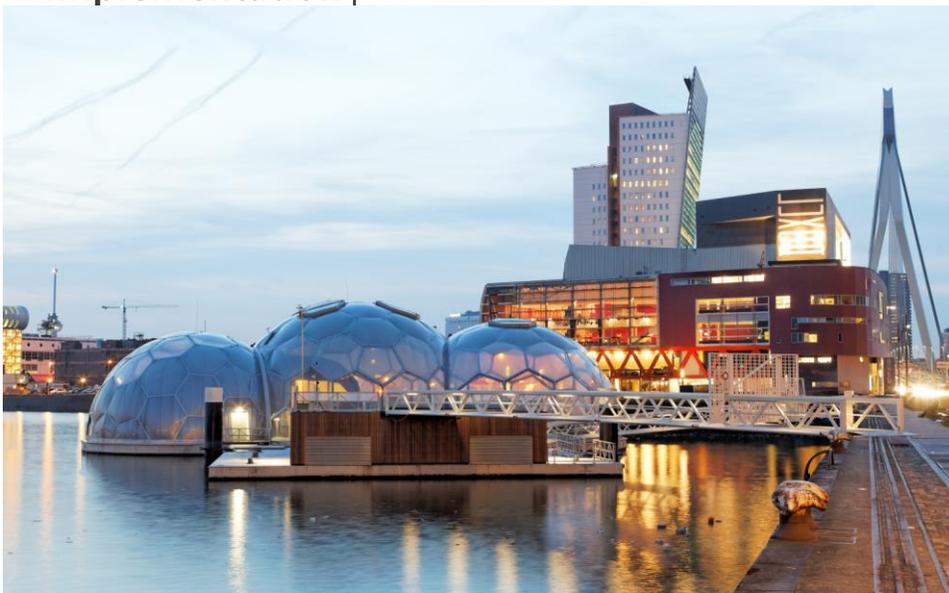
**BLUEREVOLUTION**

delta sync  
WATER-BASED URBAN DEVELOPMENT

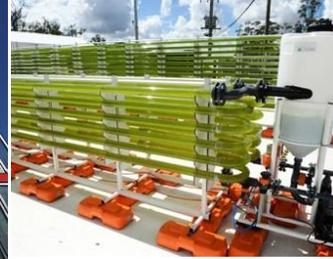
## Implementation | SMALL SCALE PILOTS



## Implementation | SMALL SCALE PILOTS



## Implementation | SMALL SCALE PILOTS



### Algae Facade

source: [www.fastcoexist.com](http://www.fastcoexist.com) / ARUP



## Implementation | SCALING UP



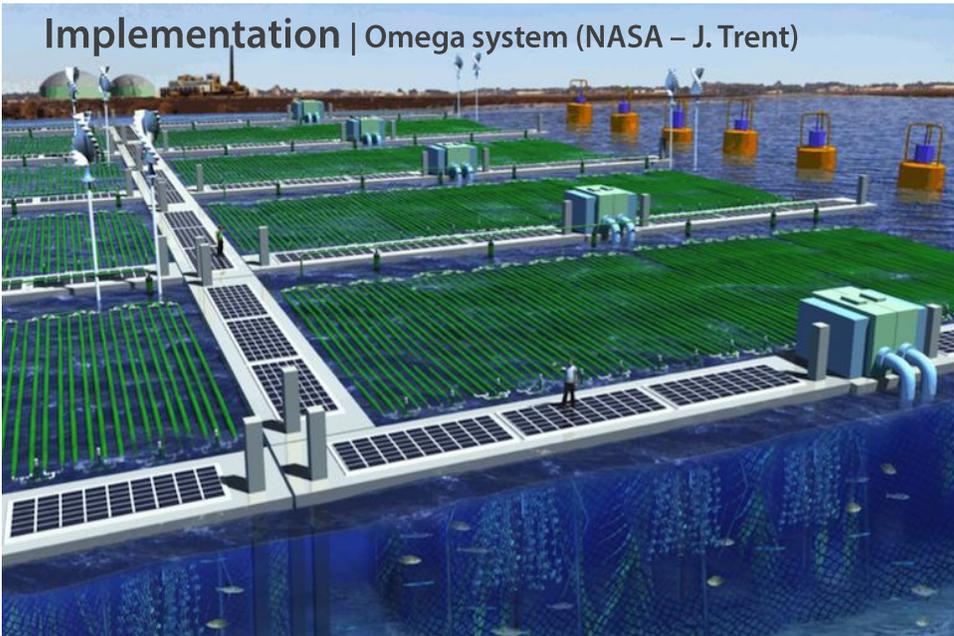
## Implementation | SCALING UP



**BLUEREVOLUTION**

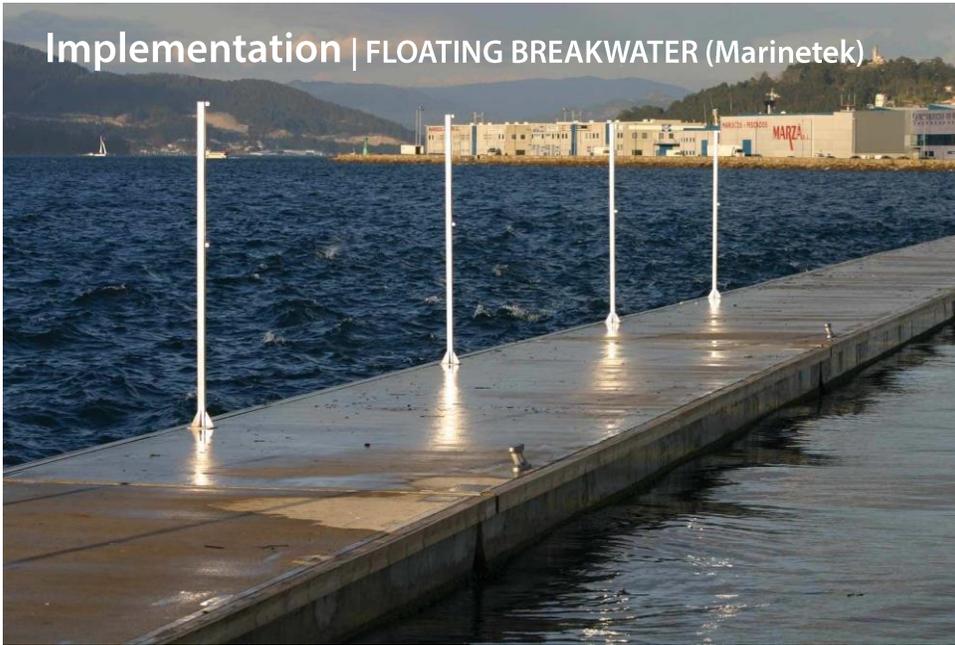
**deltasync**  
WATER-BASED URBAN DEVELOPMENT

## Implementation | Omega system (NASA – J. Trent)



**BLUEREVOLUTION**

**deltasync**  
WATER-BASED URBAN DEVELOPMENT



Implementation | FLOATING BREAKWATER (Marinetek)

BLUEREVOLUTION

deltasync  
WATERBASED URBAN DEVELOPMENT

Blue Revolution benefits

Improving Resilience



32%  
of the passenger car transportation of Rotterdam



66%  
of vegetable products consumed in Rotterdam



63%  
of animal proteins consumed in Rotterdam

Mitigation of Emissions



7.5%  
reduction  
(rotterdam+port)



60%  
reused

Reducing Fish Depletion

replace 40%  
of wild caught fish  
(Dutch annual quota)

BLUEREVOLUTION

deltasync  
WATERBASED URBAN DEVELOPMENT

## ...more benefits

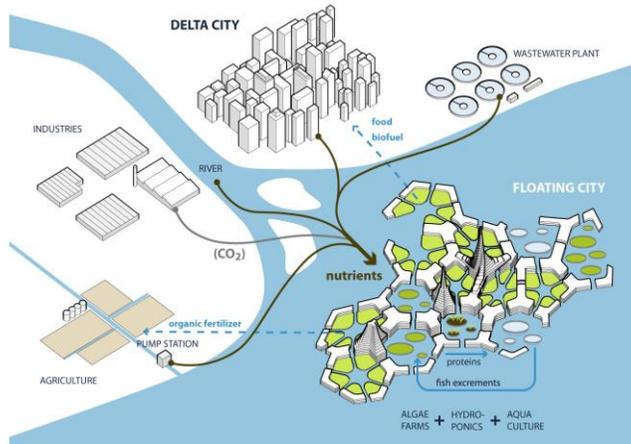
- Creates extra space without land
- Creates safe, green and climate-proof expansion
- Provides economical benefits and jobs

## Applicability and limitations

- Results are the maximum potential, based on all available nutrients
- Further research should point out how much can be captured
- Limitations of reusing waste water that is possibly contaminated
- Commercial feasibility

# BLUEREVOLUTION

Potential of floating urbanization and food production for coastal/delta cities



More info:

[www.Blue21.org](http://www.Blue21.org)

[www.deltasync.nl](http://www.deltasync.nl)