Plant production capacity and nutrient mass balance in the PAFF Box, an urban aquaponics module: Preliminary findings
(And its place in human geography research.)

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   STSM - Methods
   - Results

2. Human Geography
   - My own research
The PAFF Box

System details:
1. Fish tanks: 2 x 0.380 m³
2. Sieve gravity filter
3. Biofilter: SHARK BEAD microbead filter
4. Deep Water Growbeds:
   - 2 x 0.275 m³; 65 plants per bed
   - 2 x 0.345 m³; 83 plants per bed (31 pt/m²)
5. Occupies 71.21 m³
6. Total water volume of 2.673 m³

System temperature aim: 25°C

Fish:
Nile Tilapia (*Oreochromis niloticus*)

Plants:
Basil (*Ocimum basilicum* var. ‘Grand Vert’)  
Lettuce (*Lactuca sativa* var. ‘GBP’)
STSM: aims and objectives

Describe:
1) Plant and fish production capacity
2) Water and energy consumption over one season production
3) Analyse all macro- and micronutrient budgets

Additional aims:
4) Experience running aquaponic systems
5) Ethnographic data collection
## Methods:

<table>
<thead>
<tr>
<th></th>
<th>daily</th>
<th>2x week</th>
<th>1x week</th>
<th>1 x per 2 weeks</th>
<th>1 x per cycle</th>
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<tbody>
<tr>
<td><strong>Solution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>TAN</td>
<td></td>
<td>PO4</td>
<td></td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
<td>NO2</td>
<td></td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>NO3</td>
<td></td>
<td>Alkalinity</td>
<td>Mg, Ca, K, Ca, Mn, Zn, B, Mo, Cl, Na, Fe</td>
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<tr>
<td>T°C</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary state</td>
<td></td>
<td></td>
<td></td>
<td>Size stem</td>
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<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass feed</td>
<td></td>
<td></td>
<td></td>
<td>Nutrient content</td>
<td>mass fish</td>
</tr>
<tr>
<td>Fish number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fresh water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>input</td>
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</tbody>
</table>
Cultivation Plan 1.

**Seedlings:**

Sown into Rockwool  
Watered with tap water  
Enter PAFF box after 15 days
Cultivation Plan 2
Results

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>Alkalinity</th>
<th>TAN=NH3-N</th>
<th>NO2-N</th>
<th>NO3-N</th>
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<tbody>
<tr>
<td>Mean</td>
<td>6.64</td>
<td>25.00</td>
<td>0.75</td>
<td>0.06</td>
<td>67.55</td>
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<tr>
<td>SD</td>
<td>0.64</td>
<td>21.02</td>
<td>0.70</td>
<td>0.03</td>
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<tr>
<td>Observation (N)</td>
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<td>13.00</td>
<td>13.00</td>
<td>13.00</td>
<td>13.00</td>
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<tr>
<td>min</td>
<td>5.50</td>
<td>5.00</td>
<td>0.30</td>
<td>0.02</td>
<td>42.60</td>
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<tr>
<td>max</td>
<td>7.53</td>
<td>80.00</td>
<td>2.25</td>
<td>0.12</td>
<td>88.00</td>
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</tbody>
</table>

NO3-N concentration and Water added over time
Results

pH and water added over time

DATE

WATER ADDED (L)

WATER ADDED (L)

pH
Fish production

**Date**
- 1.07.2015
- 22.09.2015
- 29.09.2015

**Mass (g)**
- 30,539
- 43,035
- 44,834

**Total feed (kg)**: 25.4
**Total days**: 91
**Mortality (%/d)**: 5
**FCR**: 3.28
**SGR (%/d)**: 0.47
**GR (g/d)**: 0.90
<table>
<thead>
<tr>
<th>Basil</th>
<th>Observation (N)</th>
<th>32</th>
<th>5</th>
<th>11</th>
<th>5</th>
<th>5</th>
<th>32</th>
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<tbody>
<tr>
<td>Shoot fresh w. (g)</td>
<td>Mean</td>
<td>183.24</td>
<td>16.14</td>
<td>1.55</td>
<td>2.57</td>
<td>0.16</td>
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<td>Shoot dry w. (g)</td>
<td>SD</td>
<td>81.40</td>
<td>9.06</td>
<td>0.10</td>
<td>1.58</td>
<td>0.03</td>
<td>2.52</td>
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<td>Ratio leave/stem (g)</td>
<td>min</td>
<td>61.93</td>
<td>9.01</td>
<td>1.32</td>
<td>1.06</td>
<td>0.11</td>
<td>1.92</td>
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<td>roots dry weight (g)</td>
<td>max</td>
<td>386.68</td>
<td>27.80</td>
<td>1.66</td>
<td>4.43</td>
<td>0.18</td>
<td>11.99</td>
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<tr>
<td>Ratio roots/shoot (g) yields (kg/m²)</td>
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<table>
<thead>
<tr>
<th>Lettuce</th>
<th>Observation (N)</th>
<th>66</th>
<th>16</th>
<th>N/A</th>
<th>16</th>
<th>16</th>
<th>66</th>
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<td>Shoot fresh w. (g)</td>
<td>Mean</td>
<td>173.23</td>
<td>9.35</td>
<td>N/A</td>
<td>0.90</td>
<td>0.10</td>
<td>5.37</td>
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<td>SD</td>
<td>81.61</td>
<td>2.34</td>
<td>N/A</td>
<td>0.18</td>
<td>0.02</td>
<td>2.53</td>
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<td>Ratio leave/stem (g)</td>
<td>min</td>
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<td>5.38</td>
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<td>317.74</td>
<td>13.34</td>
<td>N/A</td>
<td>1.29</td>
<td>0.13</td>
<td>9.85</td>
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</table>
Marx: ‘members of society appropriate the materials of nature through their labour, in the process transforming the environment and simultaneously their own (human) nature.’
Human Geography and aquaponics?

• Belton and Bush (2014)
47 geographic journals articles take up aquaculture

Key findings
• 1) Uneven focus on export species/supply chains destined for Northern markets.
• 2) ‘Everyday practices’ of aquaculture missing.
• 3) ‘Alternative food markets’ require attention.
Ethnography

- Ethno/graphy : culture/writing
- Participant Observation
- Immersive experience
- Learn by doing and sharing
References

