REAL CORP 2015, 5-7 May

PLAN TOGETHER – RIGHT NOW – OVERALL

From Vision to Reality for Vibrant Cities and Regions

Urban Metabolism and Quality of Life in Informal Areas

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PYRAMISA

Cairo 1904, Speltirini

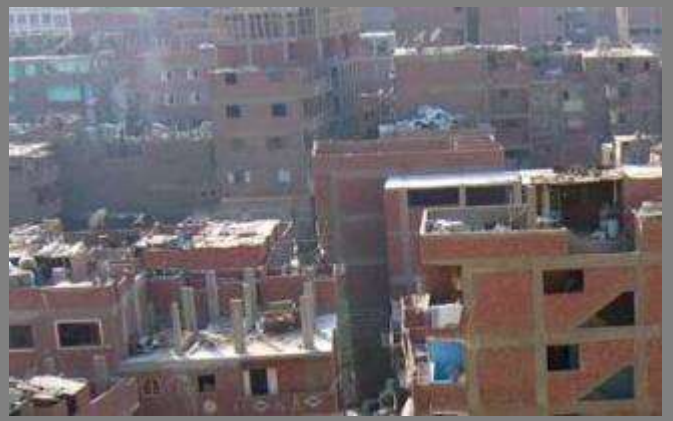
Cairo 2014

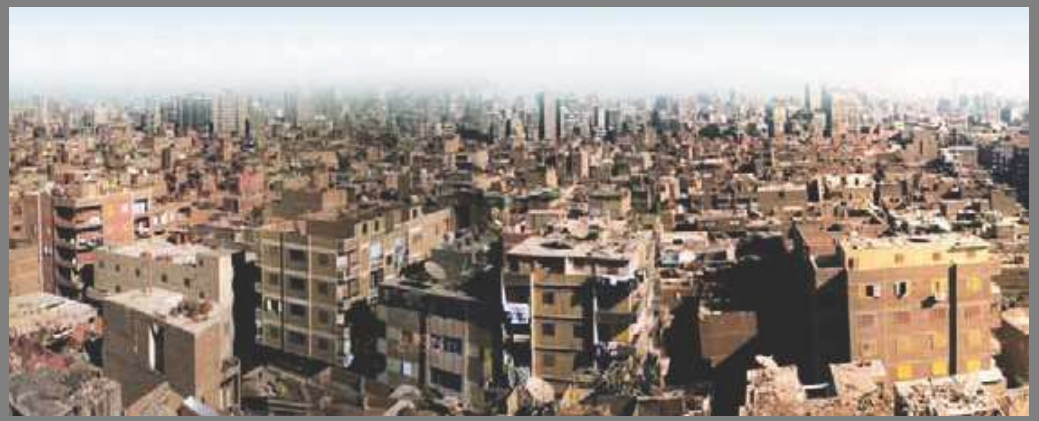
Photo by Heba Khalil

Cairo 2014

Photo by Heba Khalil

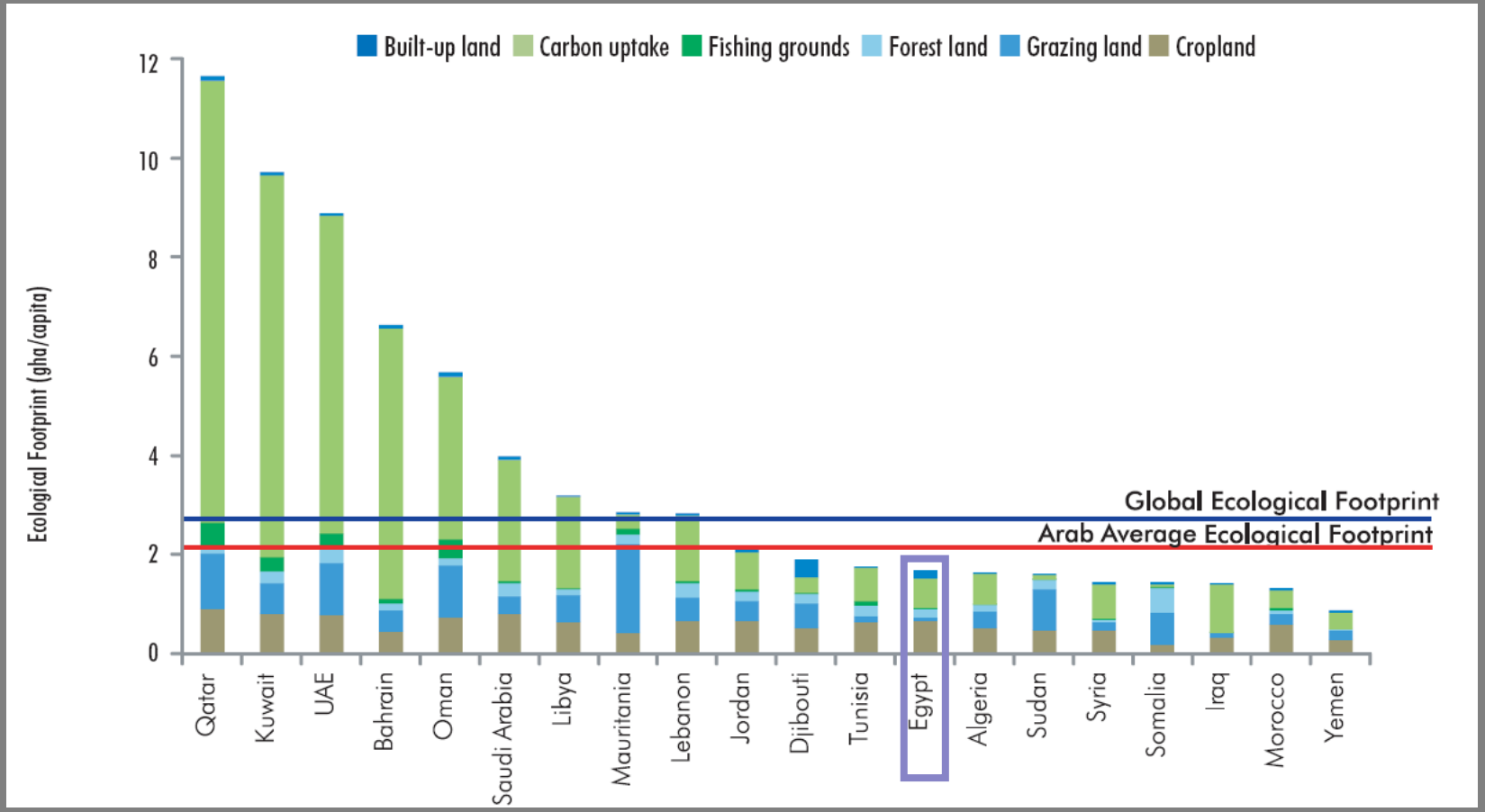
Urbanization or Informalization





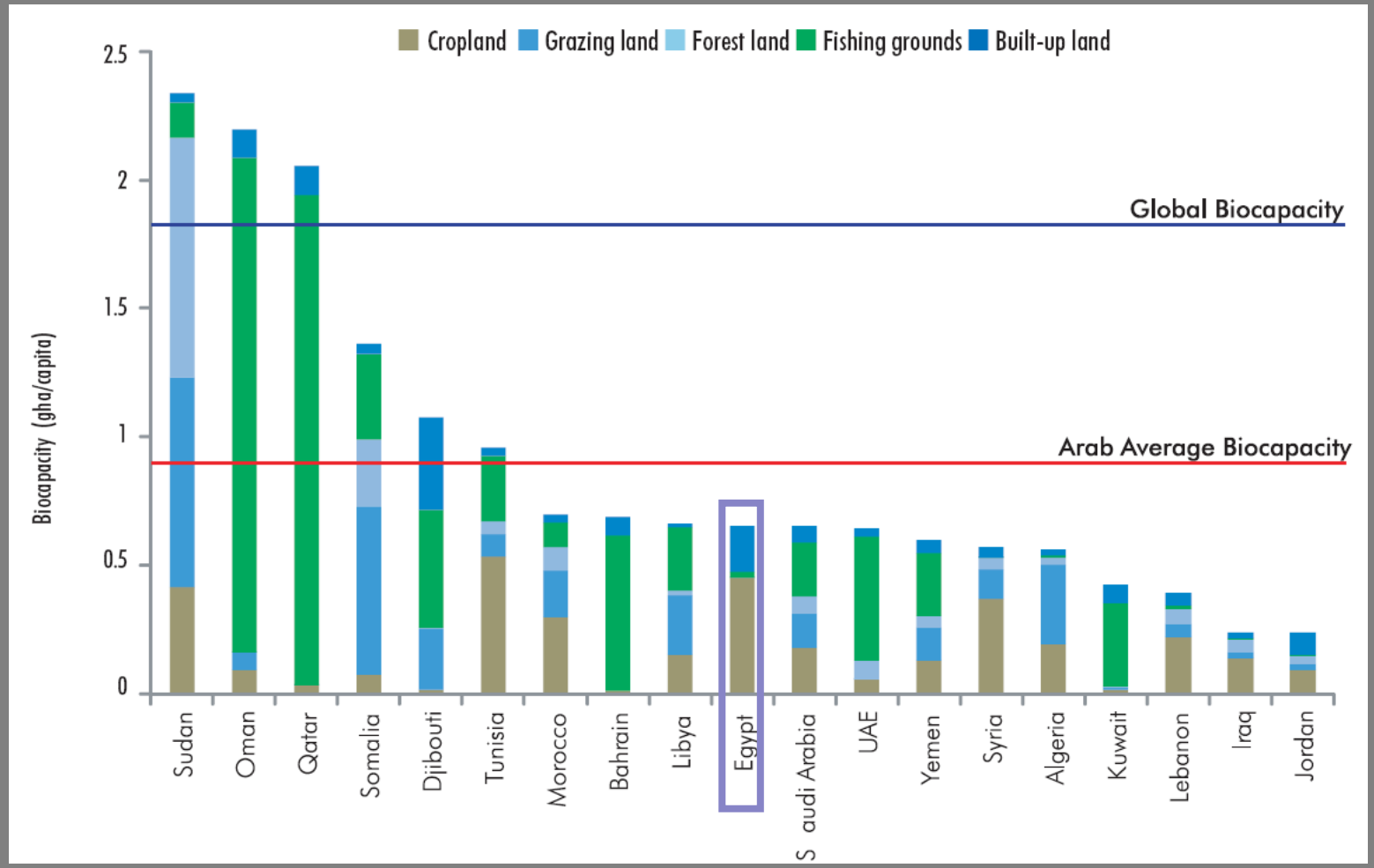
Human development index

Ecological footprint by land use type in Arab countries, 2008



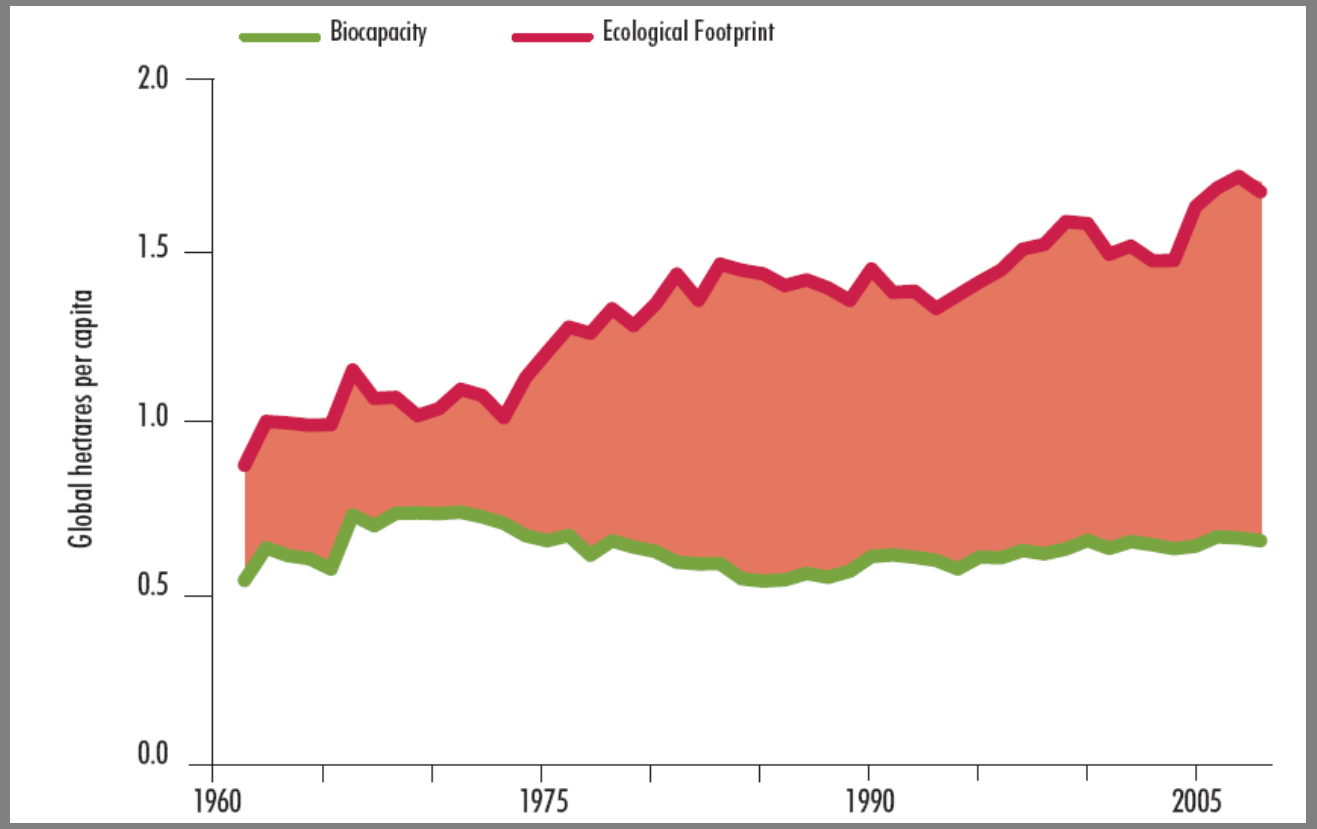
Source: Saab, N. (2012) Arab Environment 5: Survival Options, Ecological Footprint Of Arab Countries, 2012 report of the Arab Forum for Environment and Development AFED

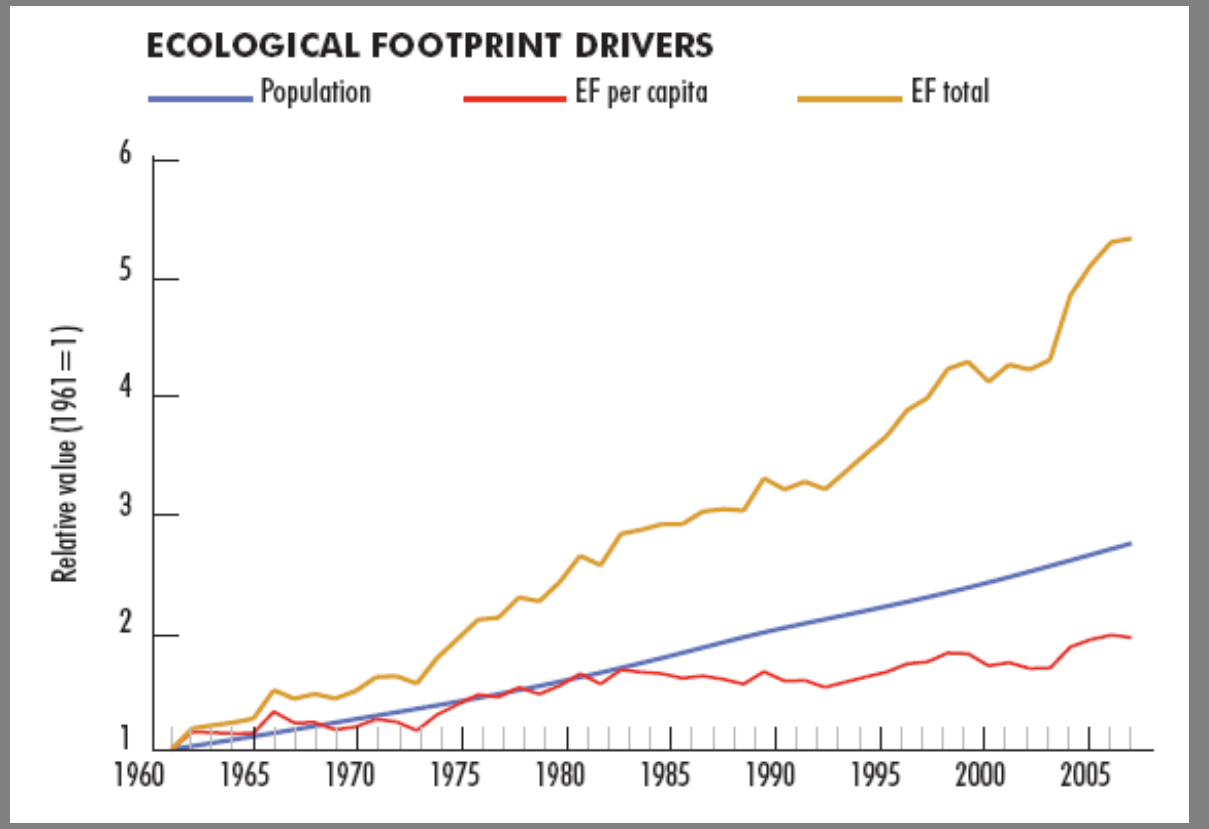
Biocapacity by land use in Arab Countries, 2008



Source: Saab, N. (2012) Arab Environment 5: Survival Options, Ecological Footprint Of Arab Countries, 2012 report of the Arab Forum for Environment and Development AFED

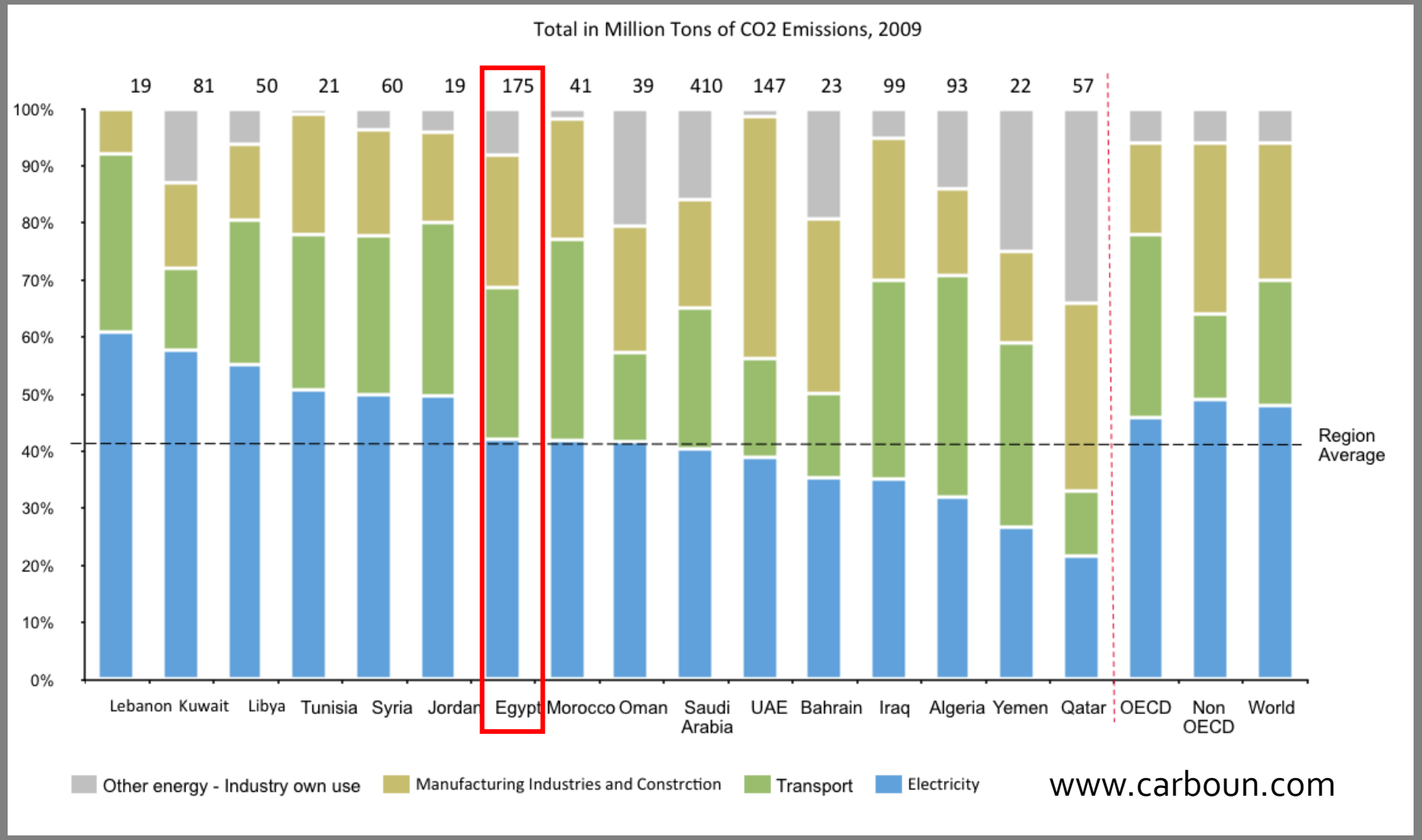
Egypt 1961-2008



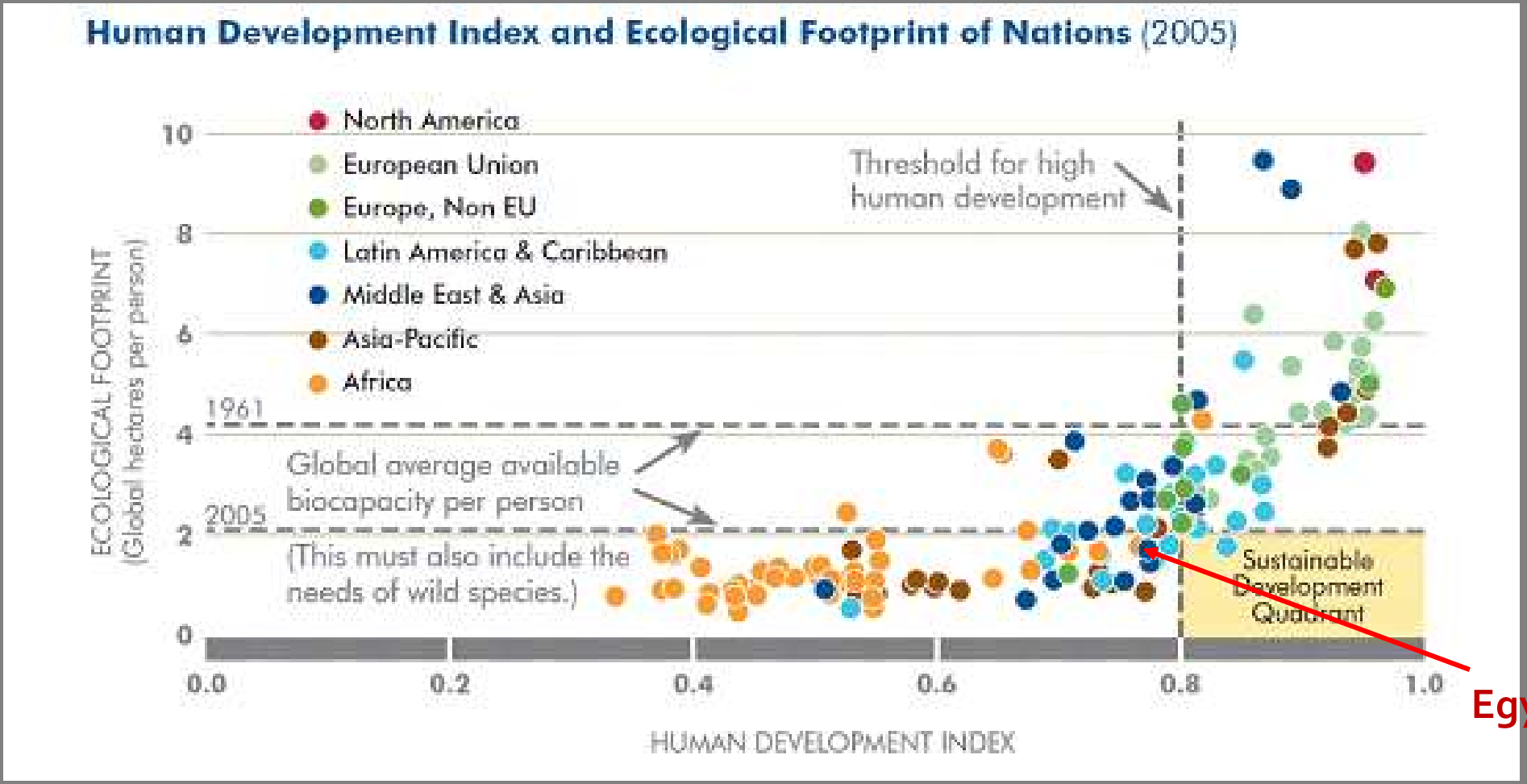


Source: Saab, N. (2012) Arab Environment 5: Survival Options, Ecological Footprint Of Arab Countries, 2012 report of the Arab Forum for Environment and Development AFED

Climate change, CO_2 emissions

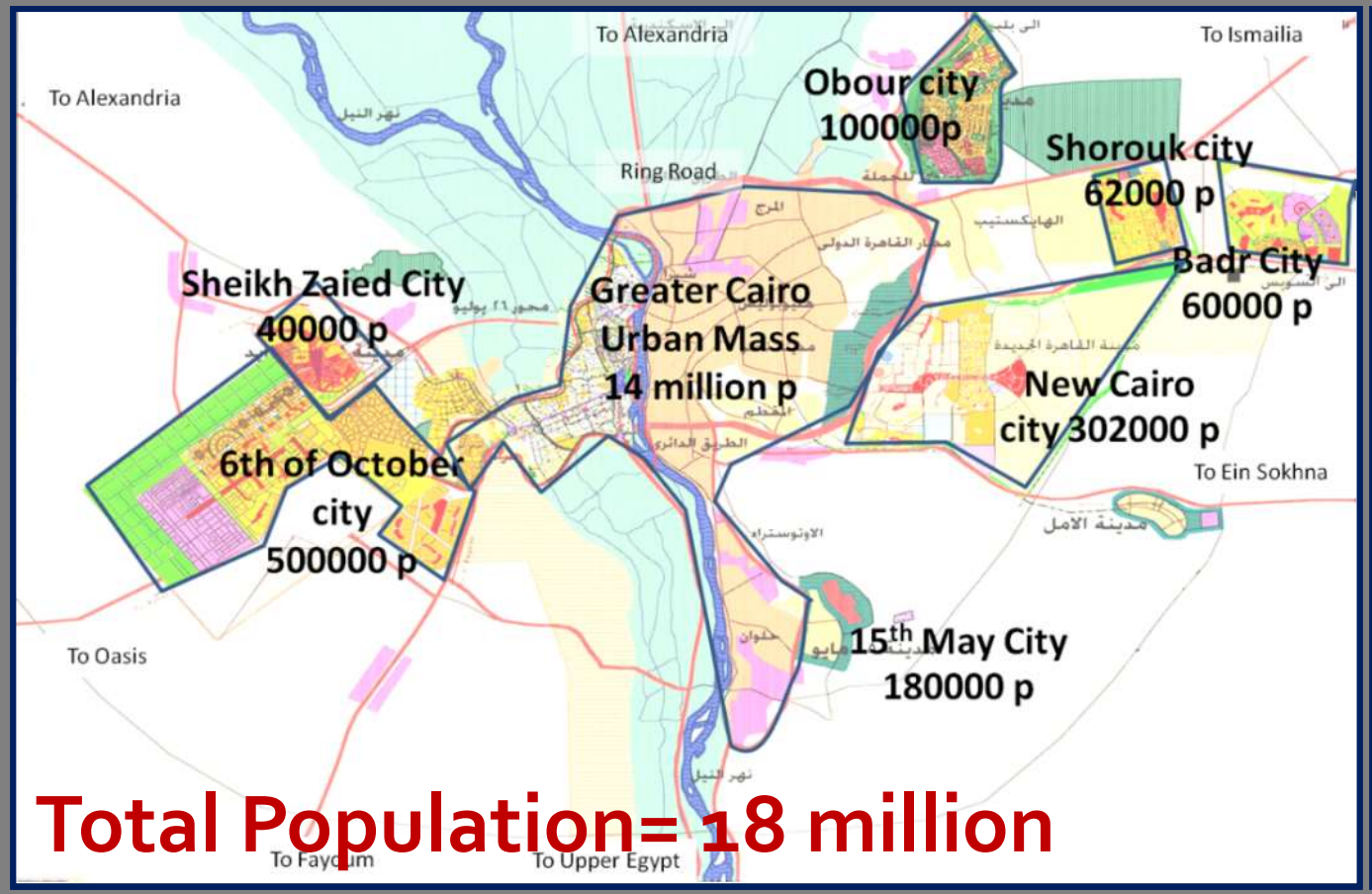


Why Ecocitizen?
A citizen in a climate change era and the need for Sustainable Development

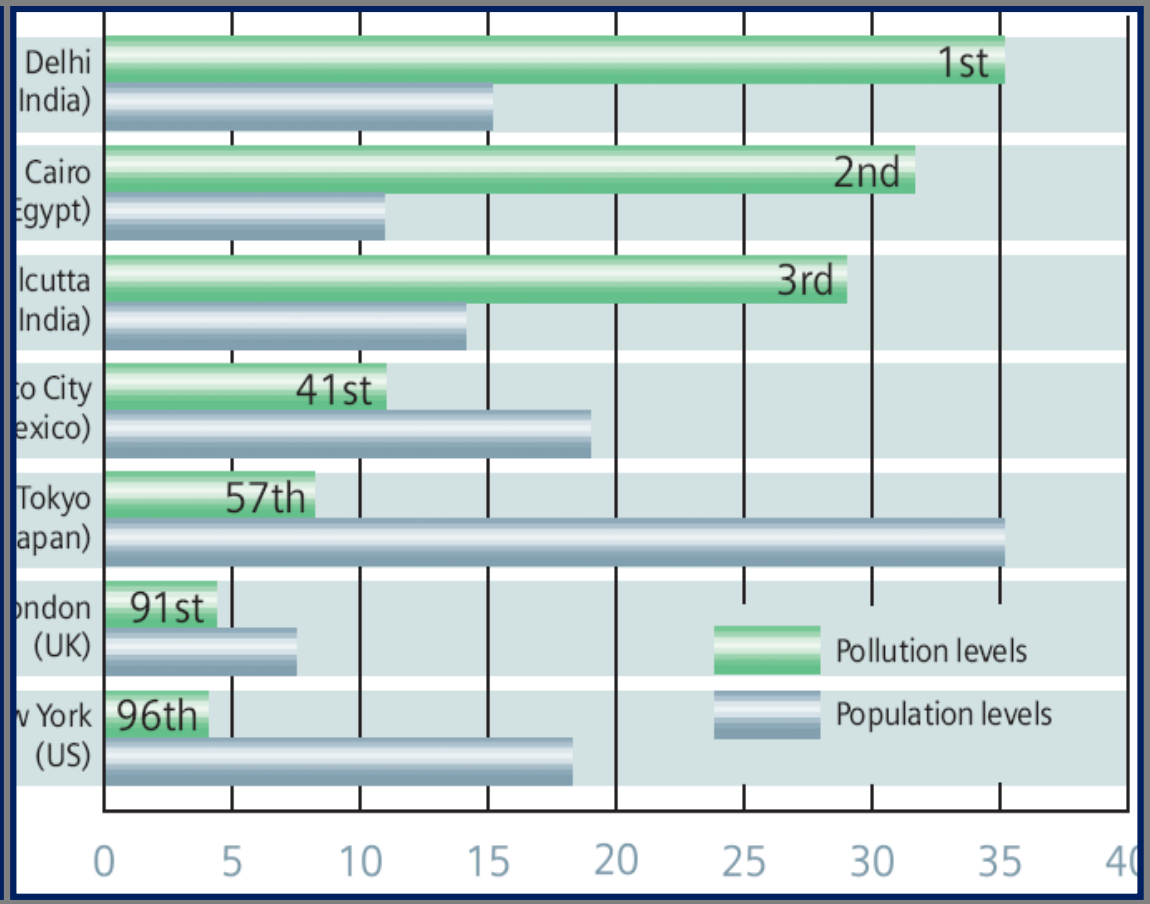


Source: Global Footprint Network, National Footprint Accounts, 2008 Edition; UNDP,2005; Human Development Report, 2007

Cairo



Total Population= 18 million

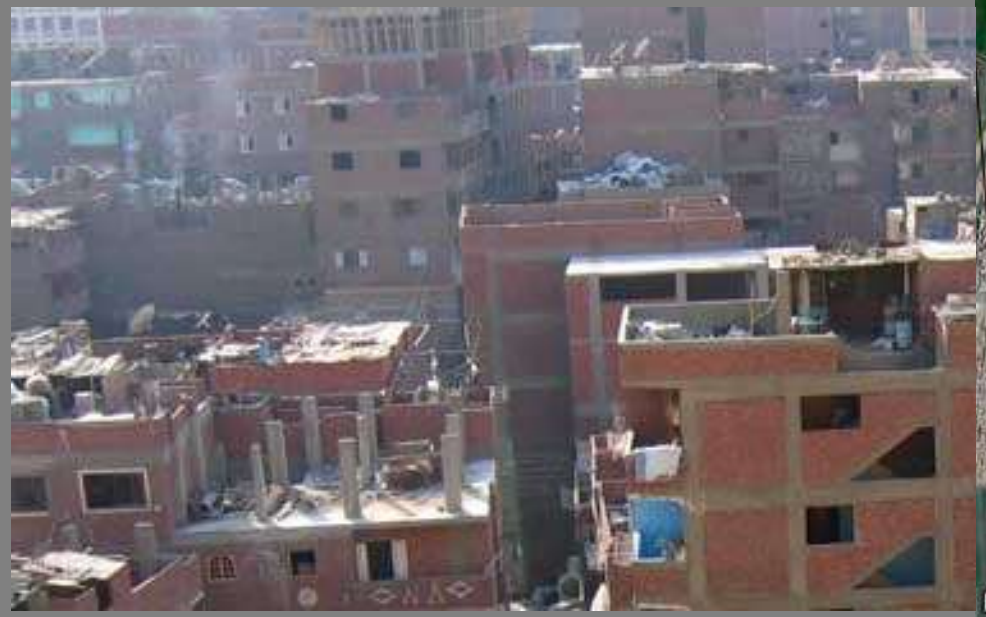


World's most polluted cities, source: The World Bank

Courtesy of Noheir ElGindy

Informal Cairo

Imbaba, Cairo



What is Ecocitizen

- An aware citizen of his/her surroundings and related ecological challenges who will act responsively

How to measure

Quality of Life?

- Quality of Living by Mercer Consultants
- Quality of Life index by The Economist Intelligence Unit
- YOUR BETTER LIFE INDEX by OECD
  - Housing, Income, Jobs, Community, Education, Environment, Governance, Health, Life Satisfaction, Safety and Work-life balance

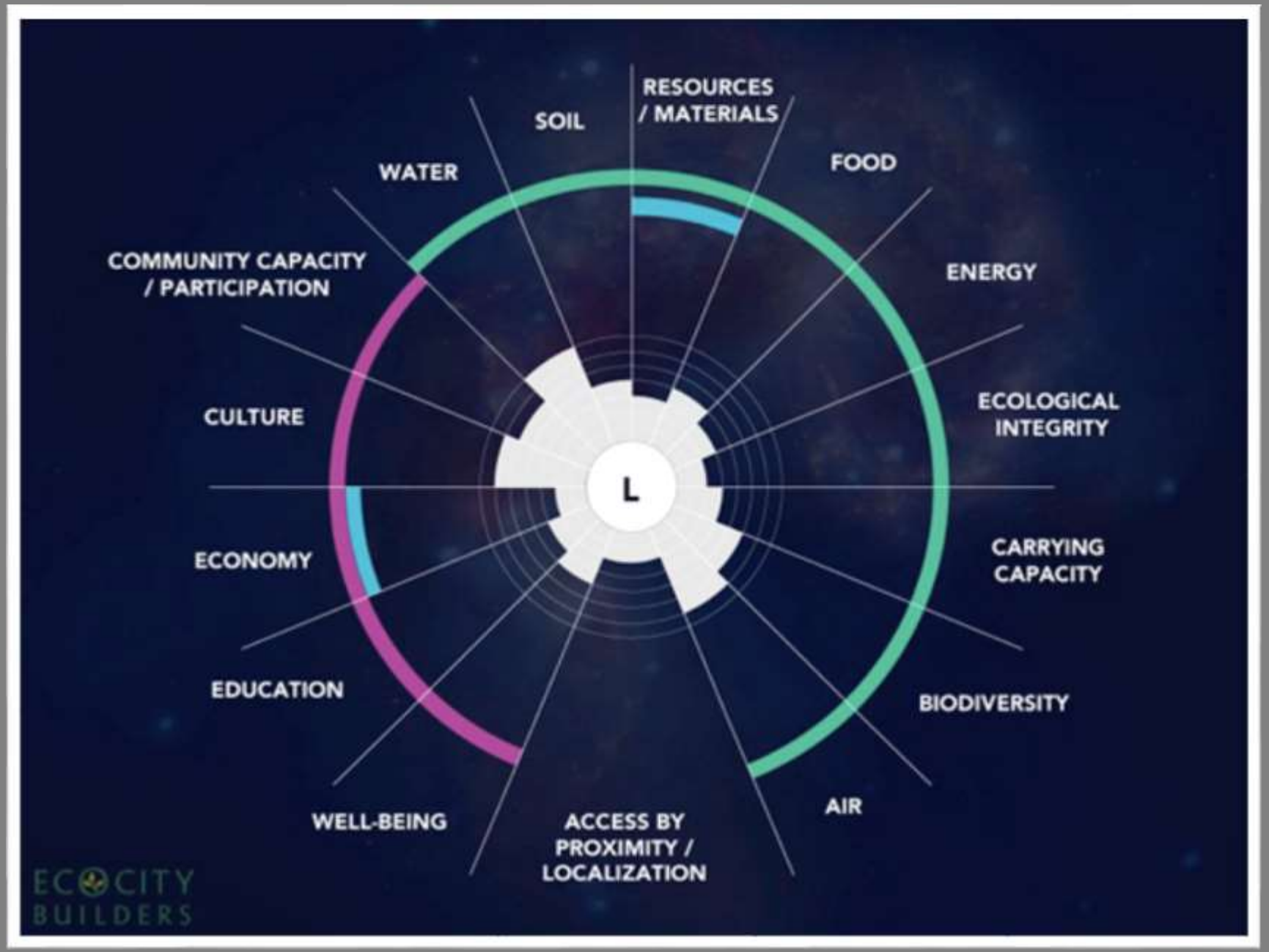
Sustainable City?

- Ecological Footprint EF
- CASBEE for urban development and CASBEE for cities in Japan,
- LEED for neighbourhoods in the U.S.
- Green City Index developed by The Economist Intelligence Unit and Siemens
  - CO_2 emissions, energy, buildings, transport, water, waste and land use, air quality and environmental governance

City prosperity index CPI has attempted to fill the gap in assessment. It has five different dimensions: productivity, infrastructure development, quality of life, equity and social inclusion and environmental sustainability

EcoCity Framework

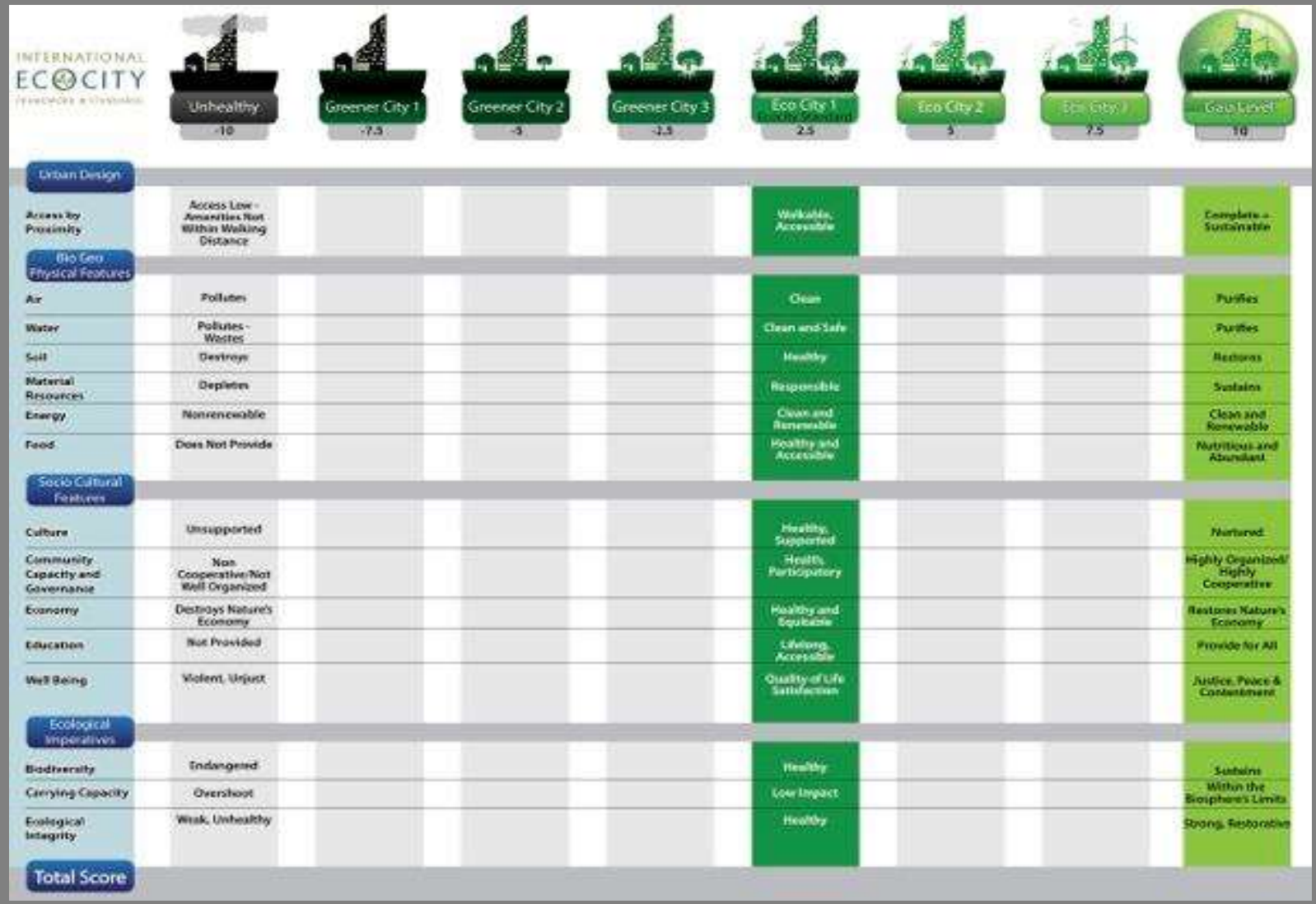
- 15 dimensions (coded for natural capital, social capital and financial capital).



INTERNATIONAL ECOCITY FRAMEWORK & STANDARDS

ECOCITY STANDARDS and MEASURES

To guide and monitor the healthy development and maintenance of the urban eco-system



INTERNATIONAL ECOCITY FRAMEWORK & STANDARDS

http://www.ecocitystandards.org/

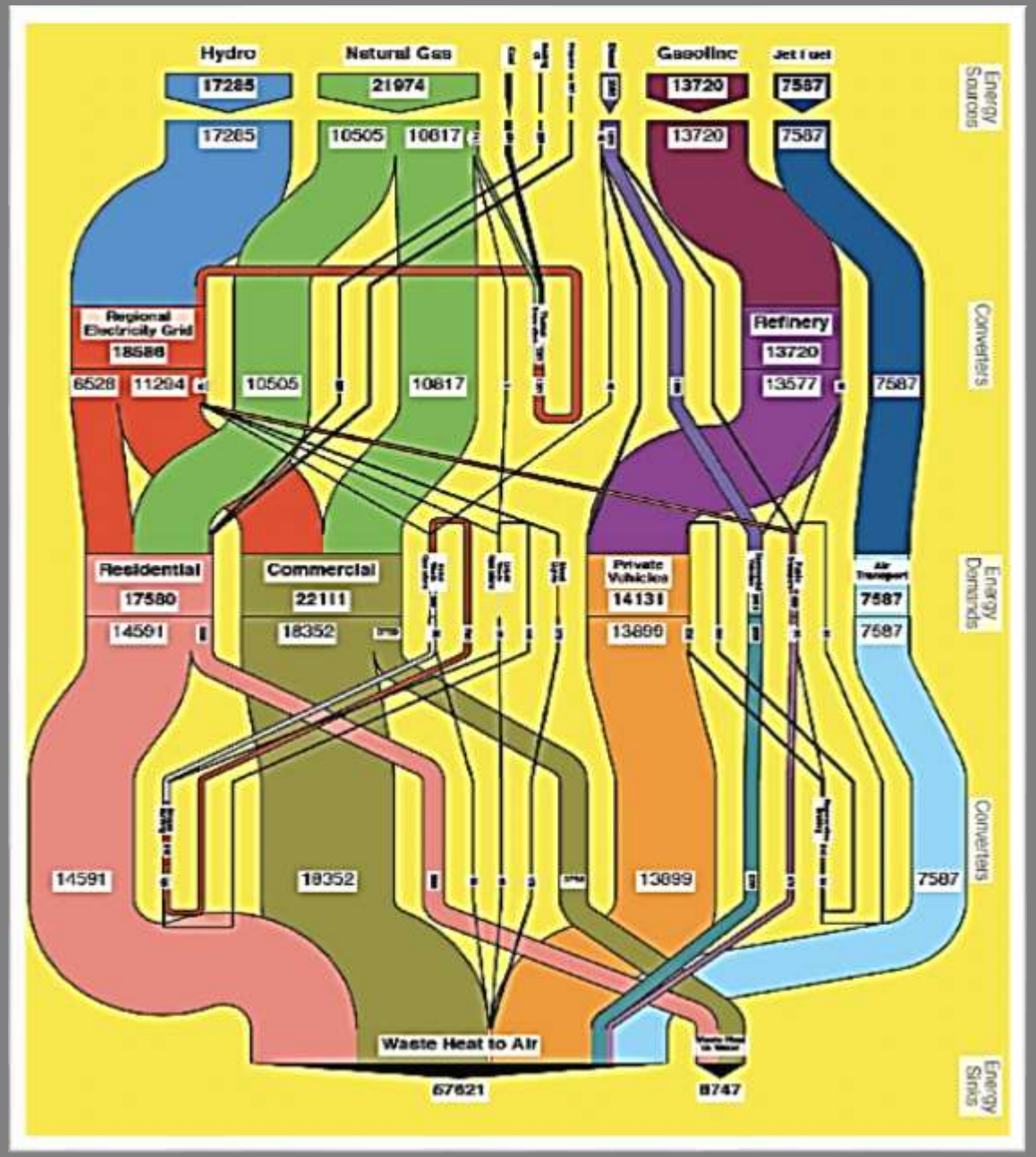
Urban Metabolism

- Energy Flow
- Water flow
- Food flow
- Materials flow
- Mobility flow
- ICT flow

Through investigating:

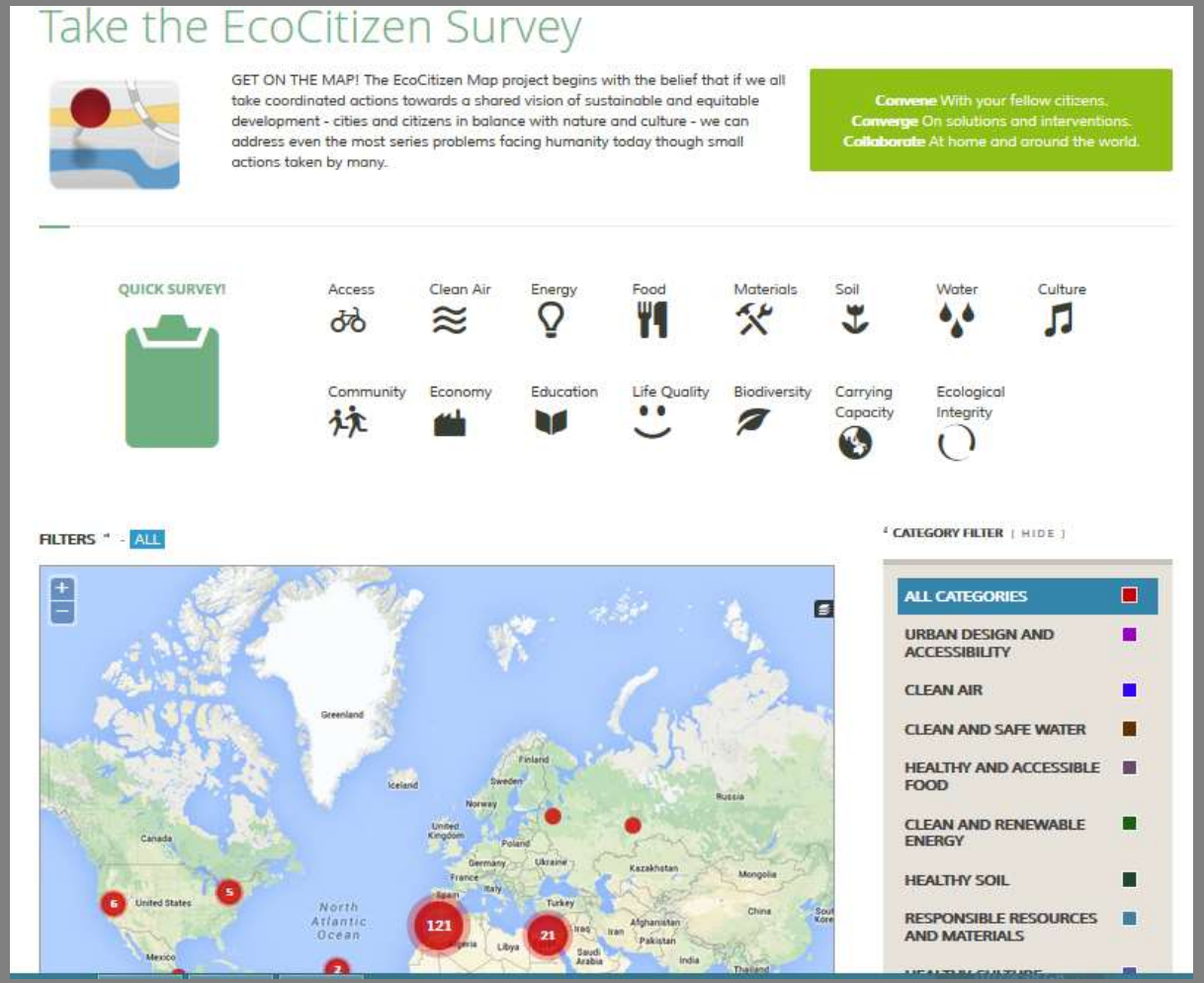
- Upstream
- Dowstream
- Driver:

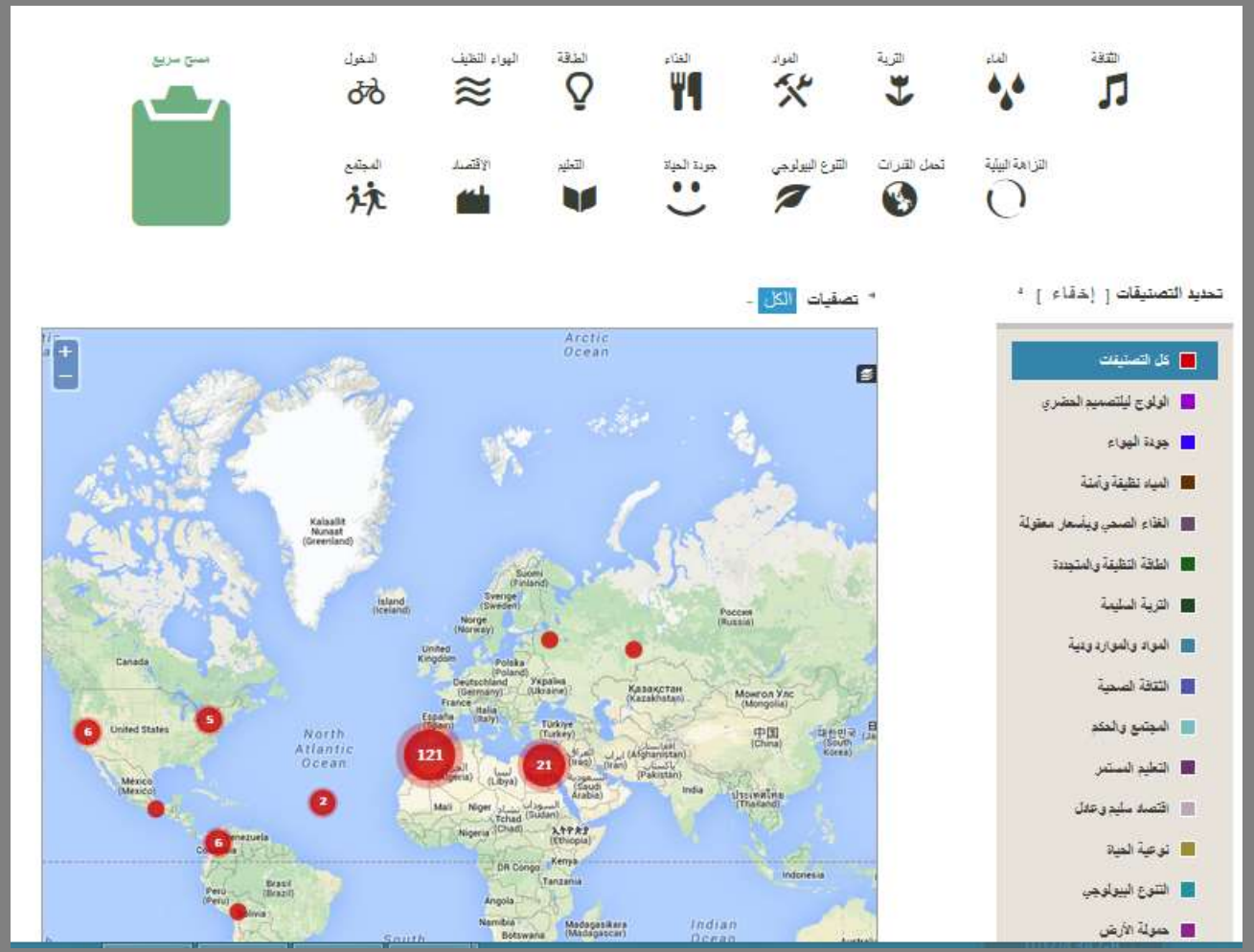
Demand
which is satisfied according to how the system is designed and operated.



Vancouver, Energy Consumption

www.ecocitizenworldmap.org





It supports data crowd sourcing and participatory action research


خريطة المدينة المستدامة
هل تعلم
• كم تستهلك ماء / كهرباء ؟ غاز؟ و غيرها من مصادر الطاقة؟
• كيف تؤثر طريقة حياتك اليومية على البيئة المحيطة؟
• خطوات بسيطة تسهم بها في تحسين البيئة في الحي الذى تعيش فيه؟
• كيف تسهم البيئة في تحقيق حياة التى تتمناها؟
احنا مين ؟
مجموعة من المهندسين مهتمين بتنميه المجتمع و الوصول لبيئة افضل عن طريق دمج المجتمع فى تحديد و حل مشكلاته.
هدفنا؟
– الوصول لبيئة افضل عن طريق ترشيد إستهلاك من مصادر الطاقه و الموارد البيئية .
– تمكين المجتمع من المشاركة فى تحسين البيئة
– التشارك مع القائمين على التنميه العمرانية [مهندسين ، باحثين ، حكومة]
هتشارك معانا ازاى؟
– حدد مشكلاتك [البيئية ، العمرانية ، الإقتصادية]
– توثيق و تحديث البيانات على نظام المعلومات الجغرافية [GIS] لتصل لمتخذى القرار.
– شارك فى اليوم المجتمعى الاثنين والثلاثاء ٢٤ و٢٥ مارس
هل تريد ان تشارك فى تحسين بيئة الحى الذى تعيش فيه ؟
هل تريد ان تعرف كيف تؤثر البيئة على معيشتك ؟
تنقل
بيت
كهربا
مياه
كهرباء
غاز
وقود
استهلاك
للاتصال و المزيد من المعلومات
م.محمود على .... تليفون : ٠١٠٠٦٨٧٠٠٤٠
مؤسسة البلد للتنمية .... بلوك ٨ منزل ٧ مدينة العمال - امبابه
www.ecocitizenworldmap.org
ECOCITY BUILDERS

Direct Benefits: Participatory Planning

Leadership Roundtable

Imbaba 1957

Imbaba 2014

*Goetherd Reinhard,
Kairo - Zur Leistungsfähigkeit inoffizieller Stadtrandentwicklung

Rare Spaces and vegetation

Photos by Research team

Potential roofs

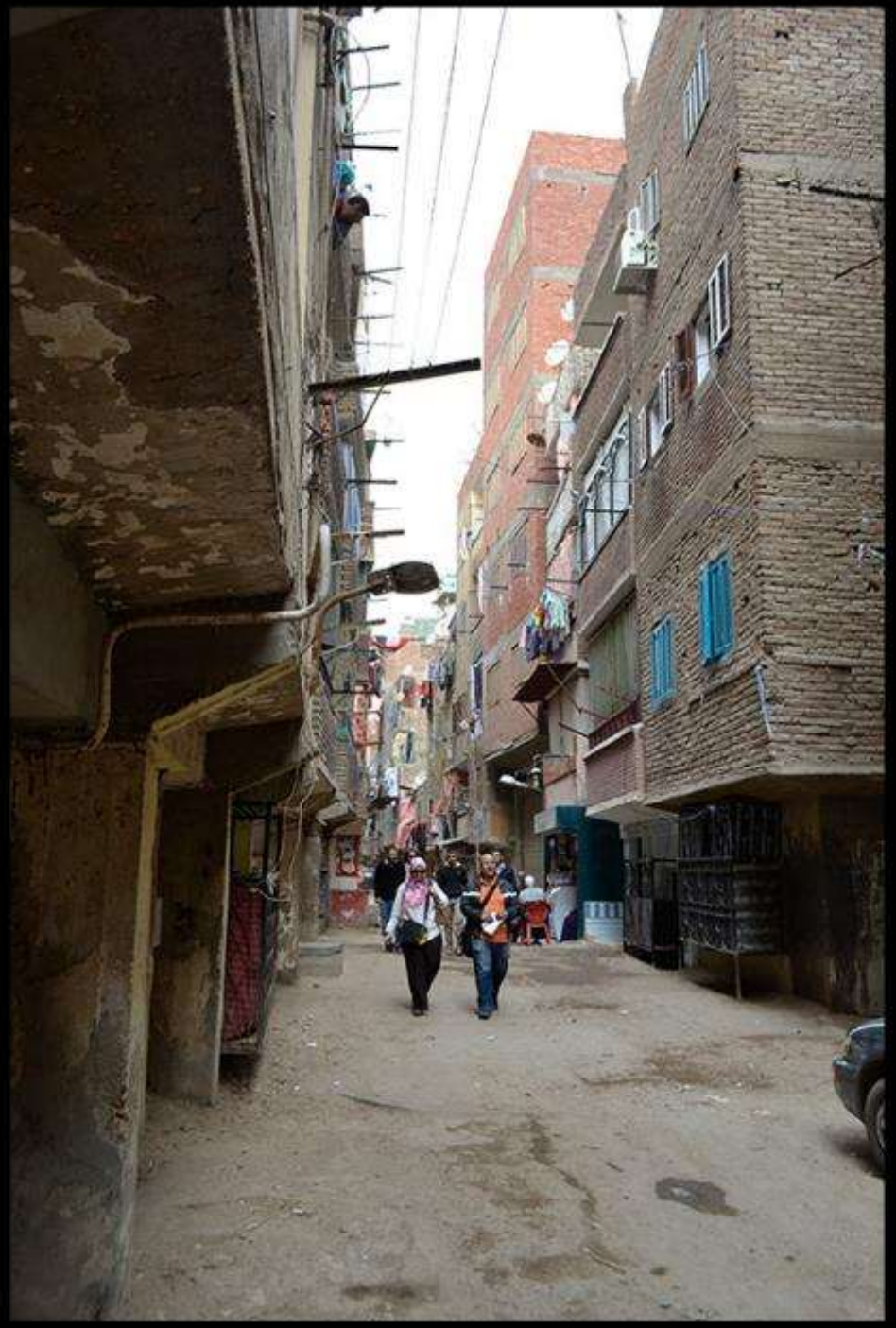
Photos by Research team

Markets

Photos by Research team

Mobility

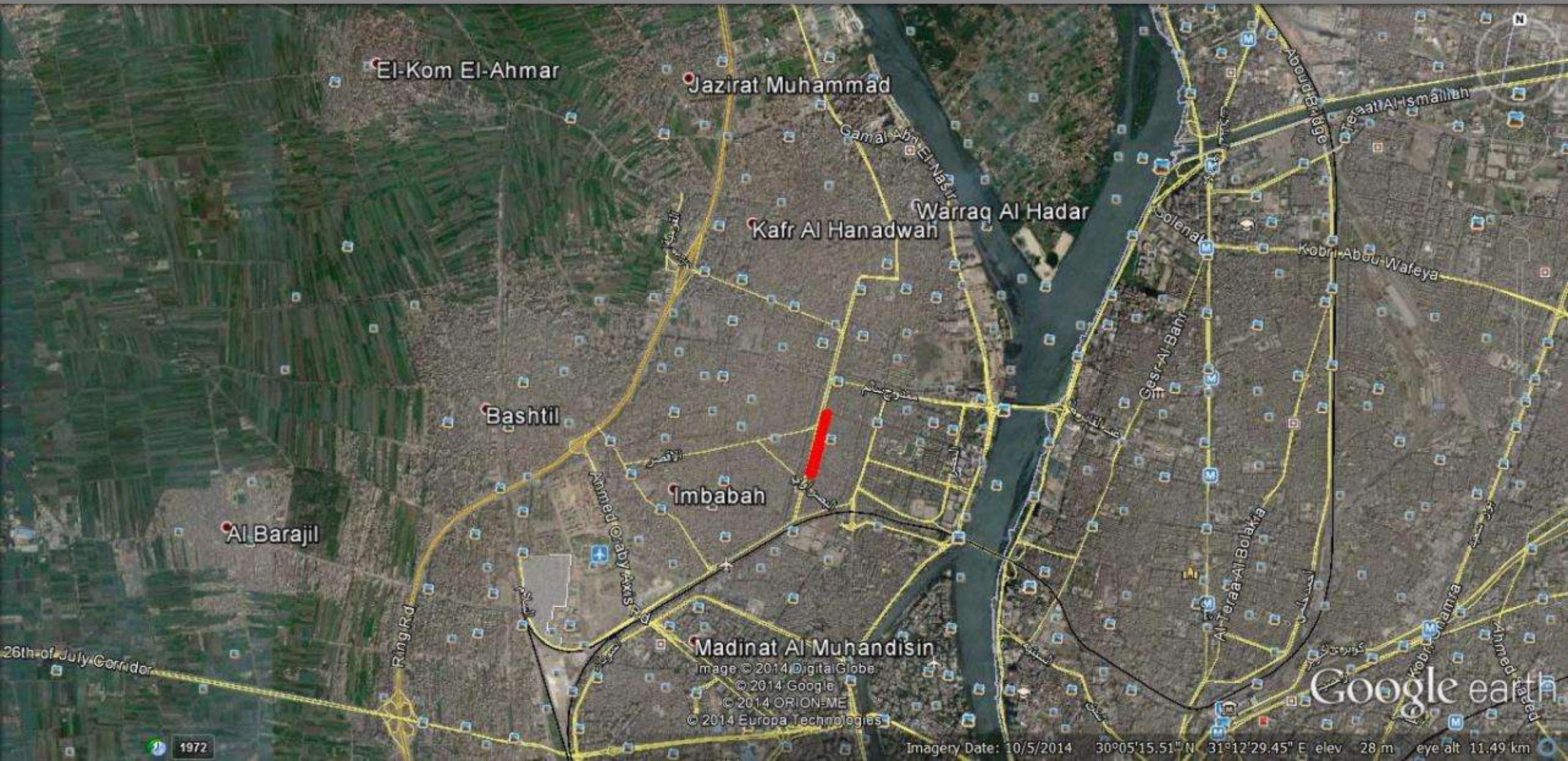
Photos by Research team



Study Area

Photos by Research team

Study Area


El-Kom El-Ahmar
Jazirat Muhammad
Kafr Al Hanadwah
Warraq Al Hadar
Bashtil
Imbabah
Al Barajil
Madinat Al Muhandisin
Ahmed Orabi Axis
Ring Rd
26th of July Corridor
Gesr-Al Bahr
Al Teraa Al Bolakia
Kobri Abbu Wafeya
Image © 2014 DigitalGlobe
© 2014 Google
© 2014 ORION-ME
© 2014 Europa Technologies
Google earth
1972
Imagery Date: 10/5/2014 30°05'15.51" N 31°12'29.45" E elev 28 m eye alt 11.49 km

Character

- Urban Pattern & Informality

Difference between the formal and the informal buildings urban pattern.

- Building Proportions

Shows the shared knowledge and experience between the people

- Green Areas

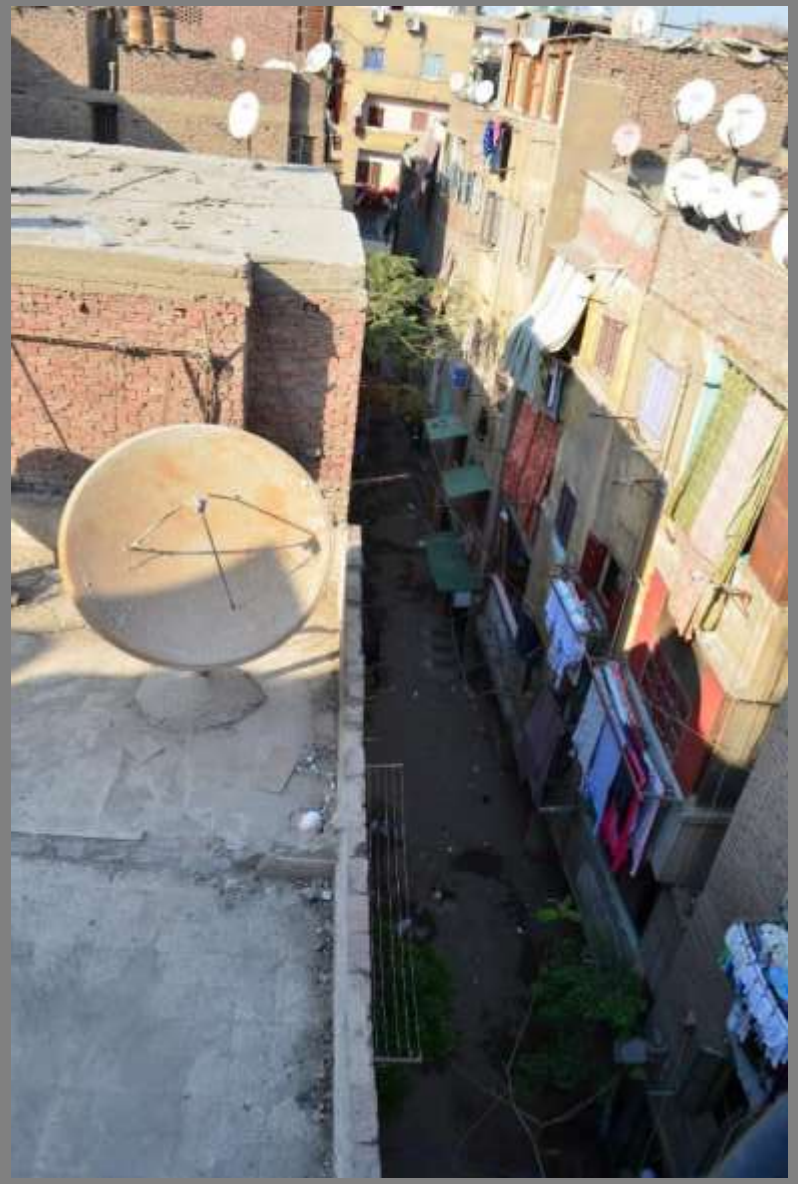
Almost Zero due to the need to satisfy their houing needs

- Landuse

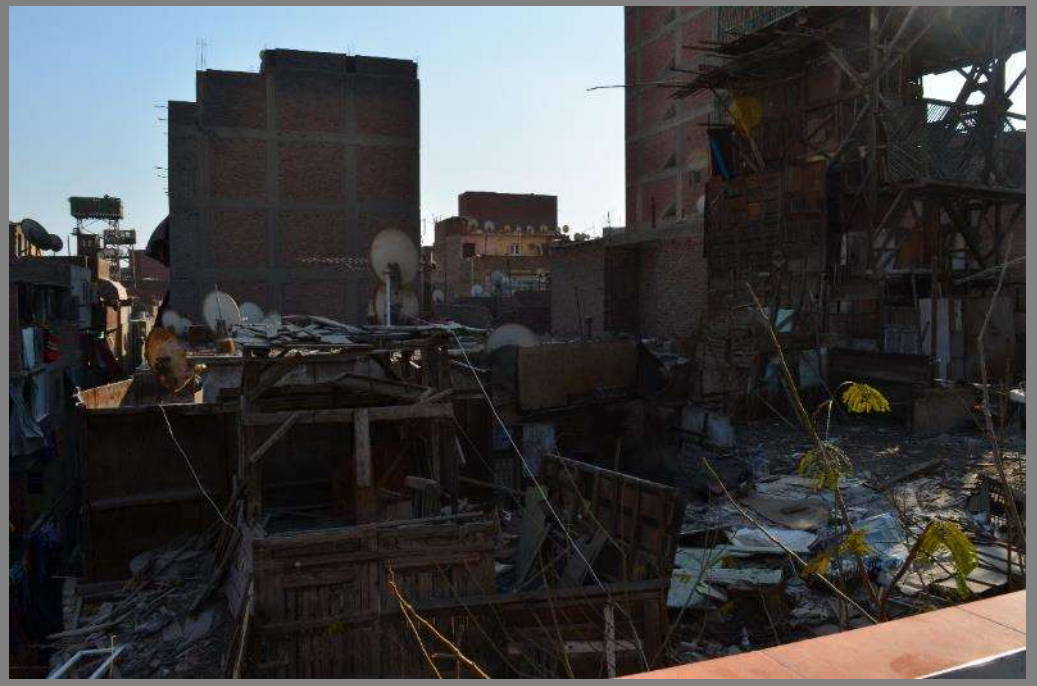
Green Areas Proportions

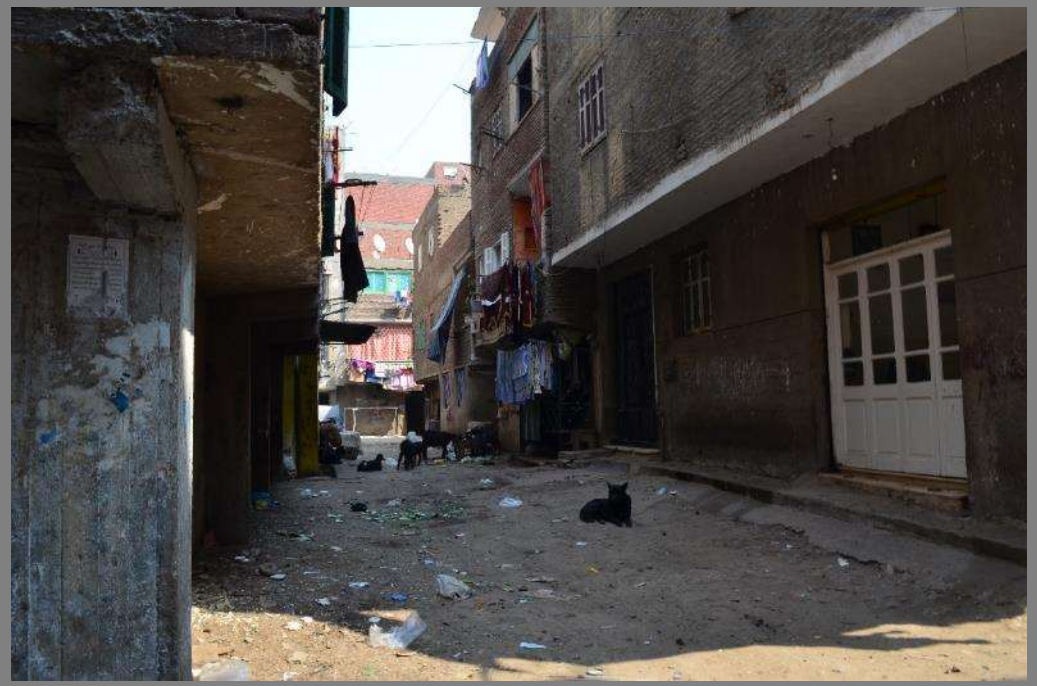
Land Use


Streets and
Circulation
©2007 Google™



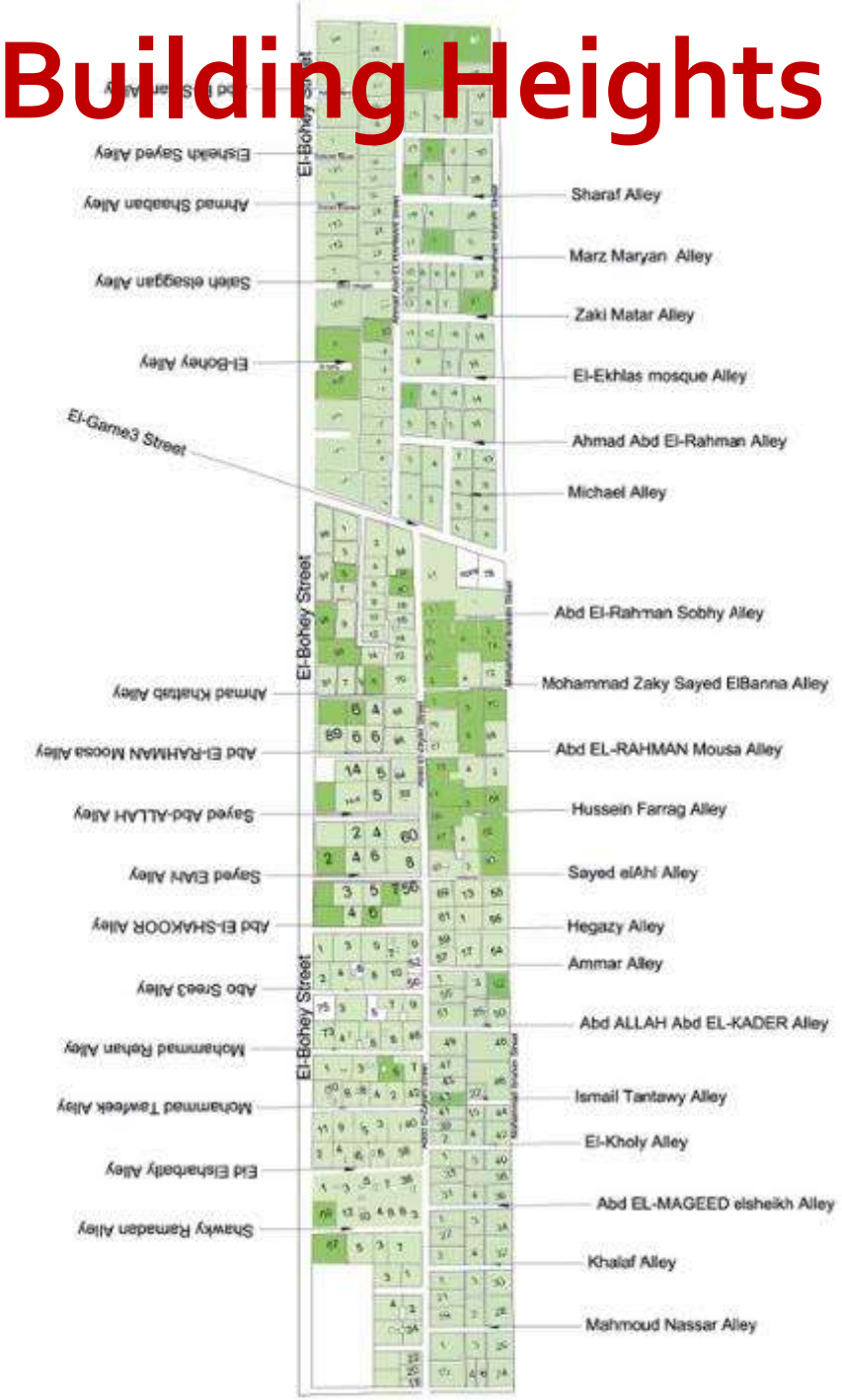
Photos by Heba Khalil



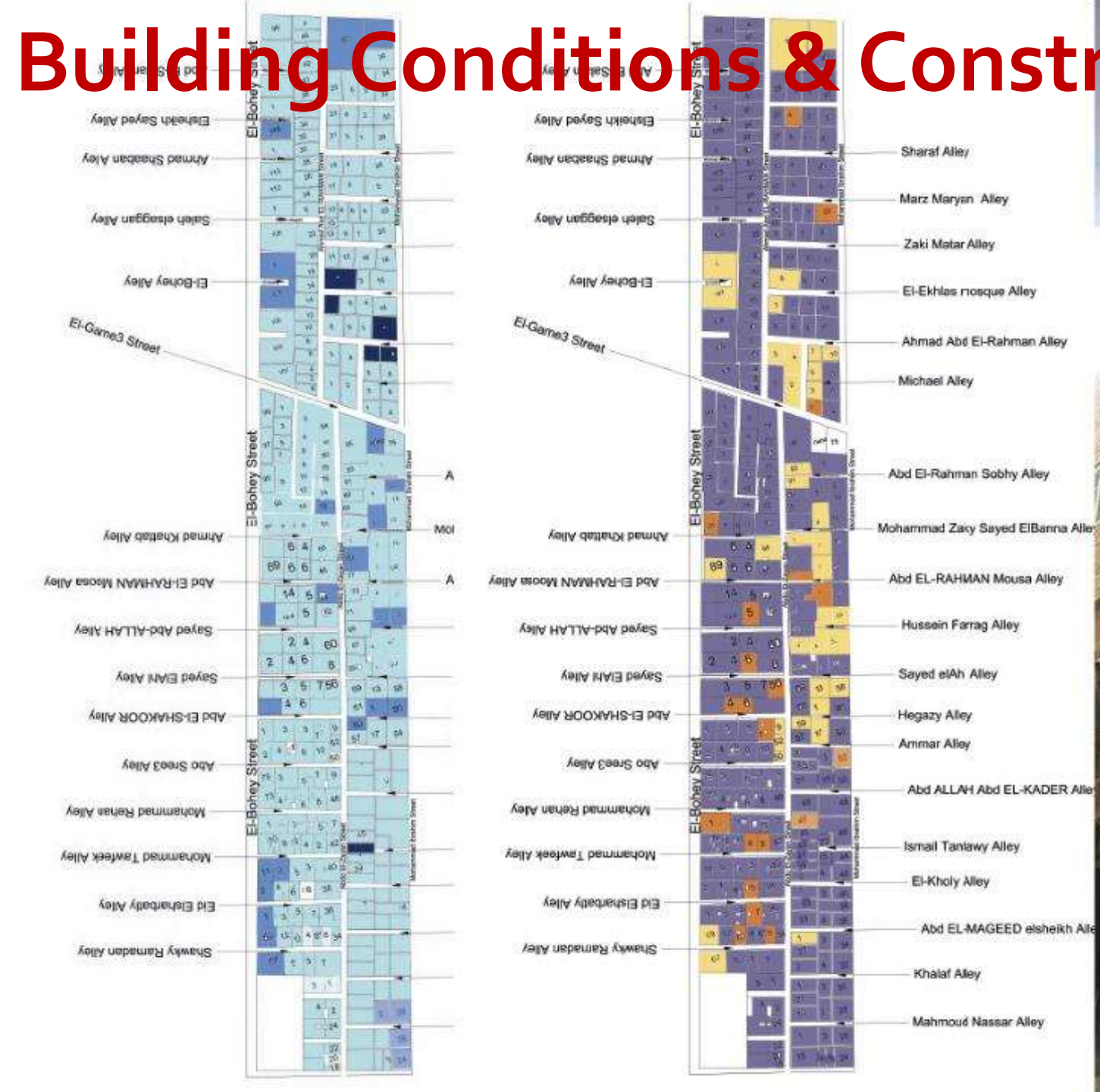


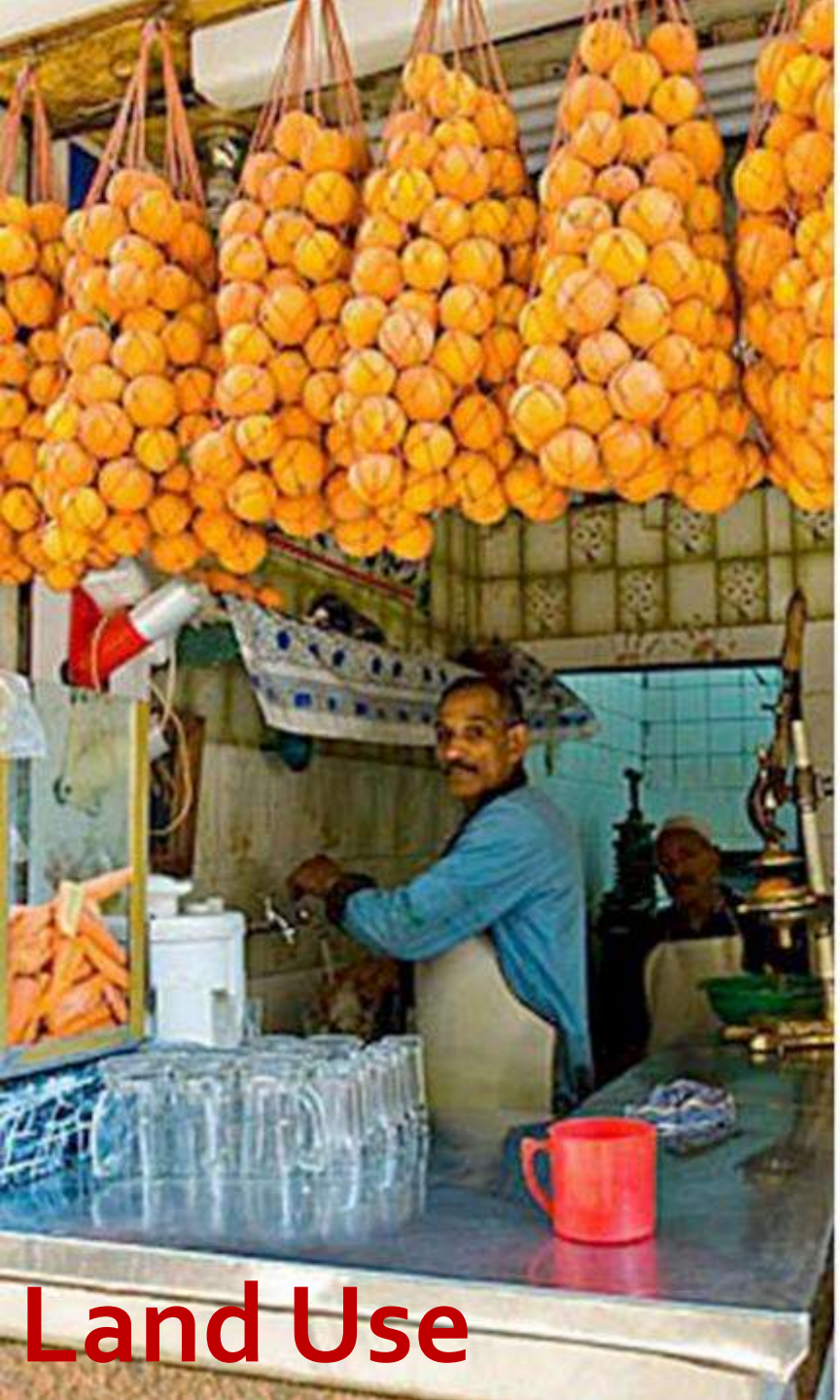
Photos by Heba Khalil

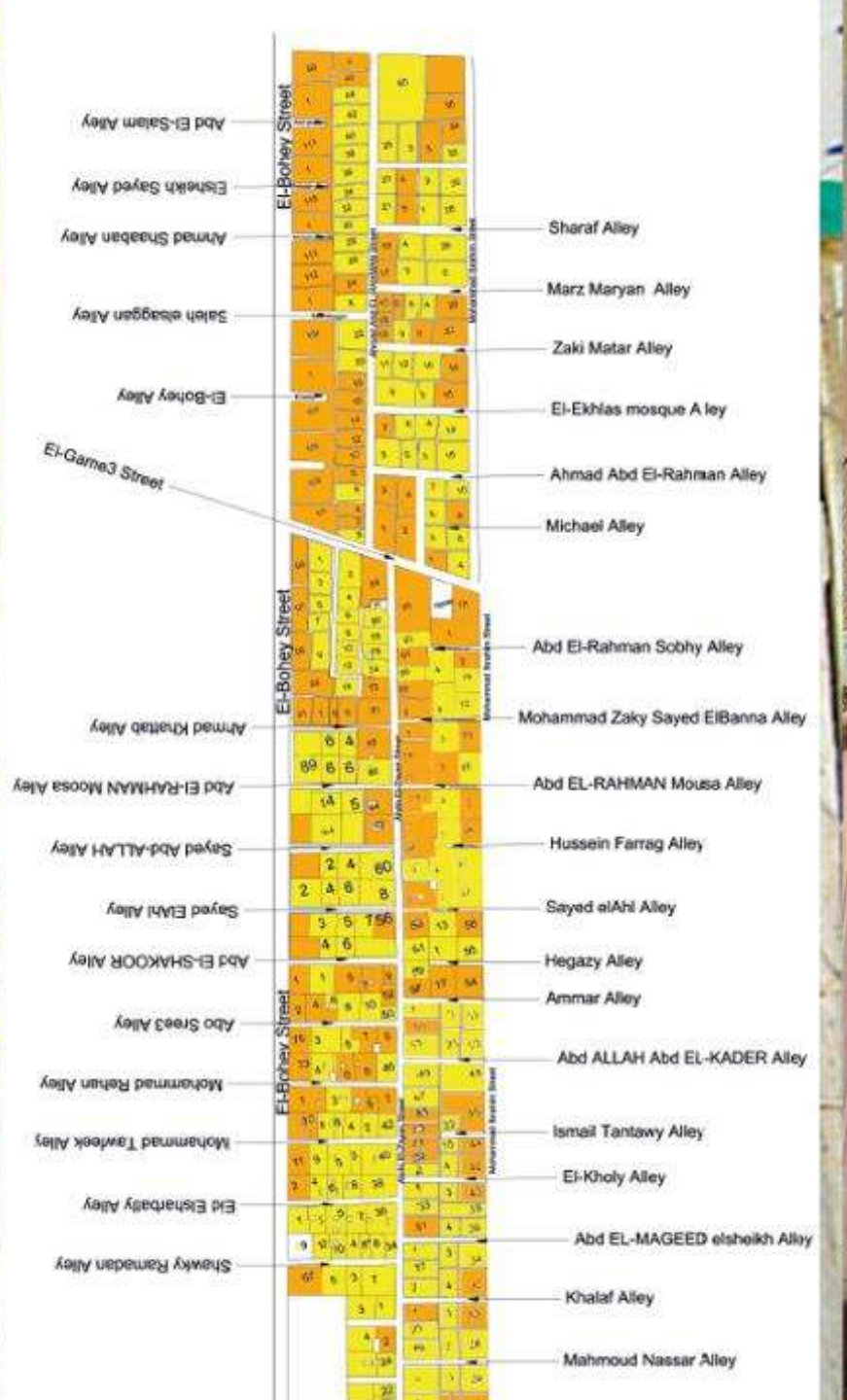
Building Heights



Building Conditions & Construction Materials



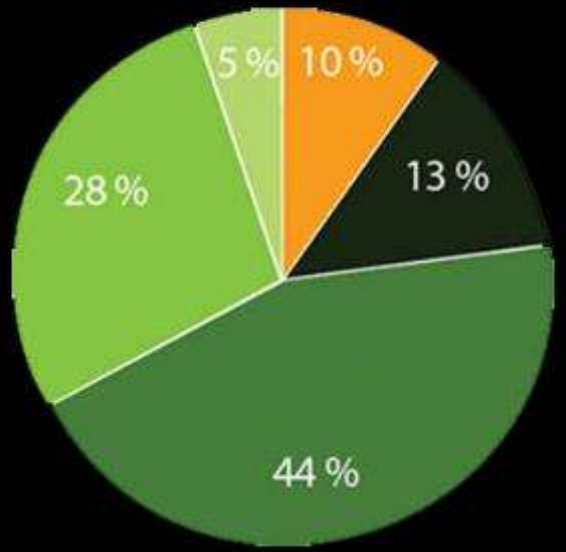




Land Use

Photos by Research team

Dividing into Archetypes & Aggregation



Photos by Research team

Bootcamp activities

Water tests

Question-naires

Audits

Photos by Research team

Boot Camp, Community Engagement

Photos by Research team

Boot Camp, Community Engagement

Photos by Research team

Local CBO leading the process

Photo by Research team

Photo by Research team

Photo by Research team

Water Testing

- Findings & Problems
- Upstream to Downstream
- Conclusion

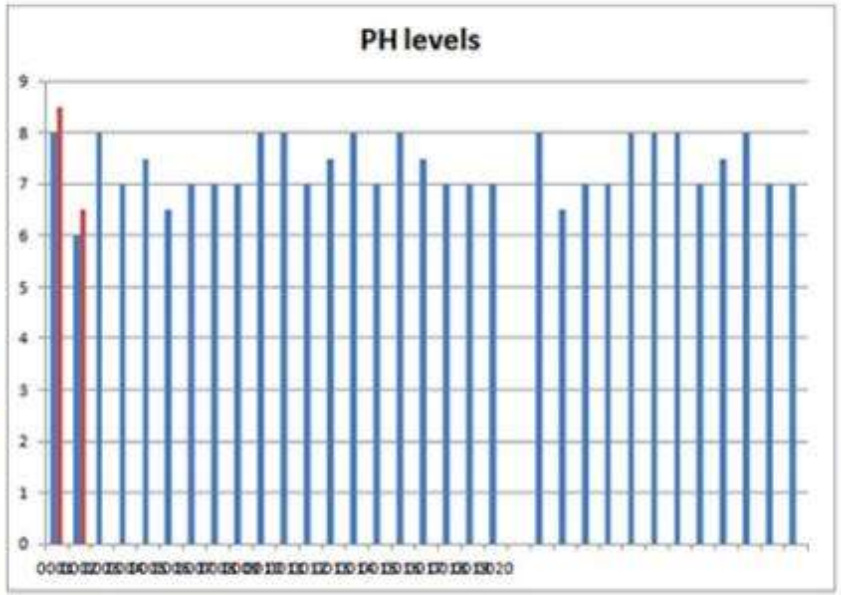
Photo by Research team

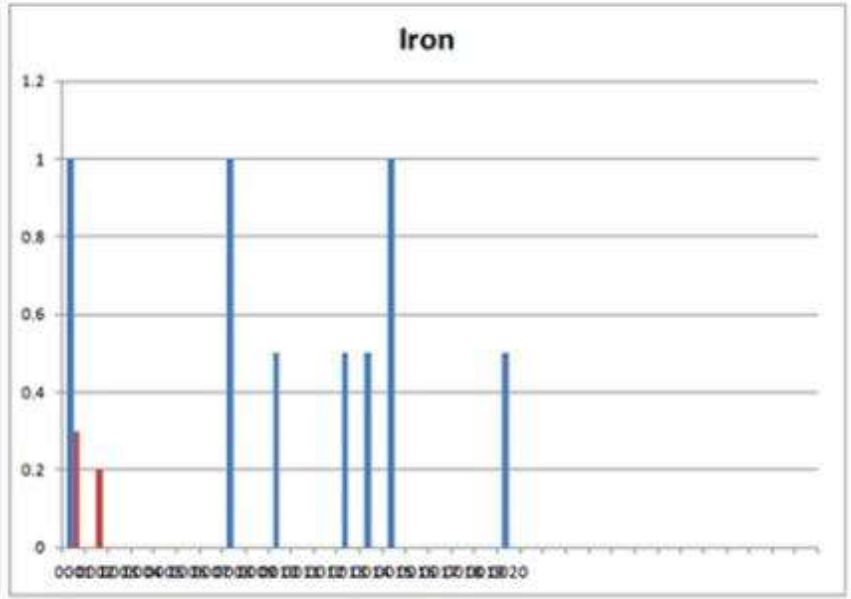
Photo by Research team

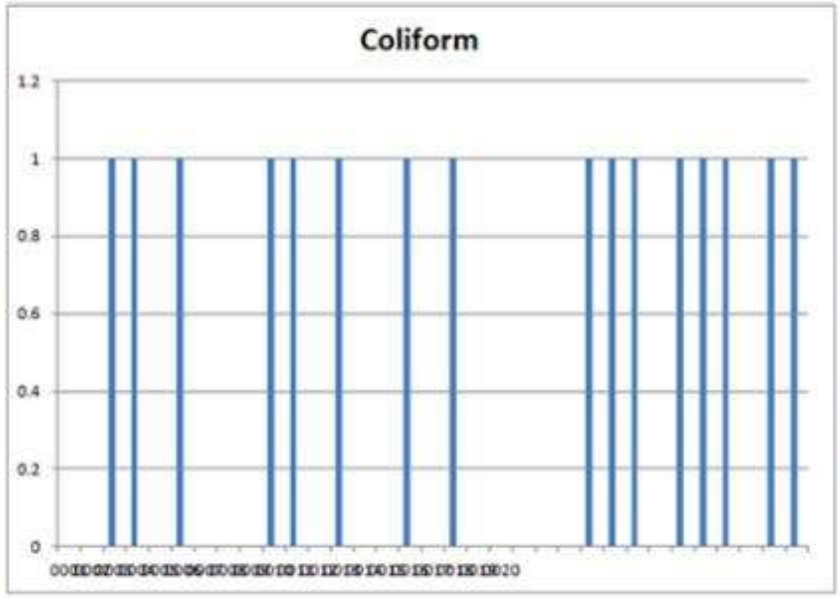
Boot Camp, water tests & training

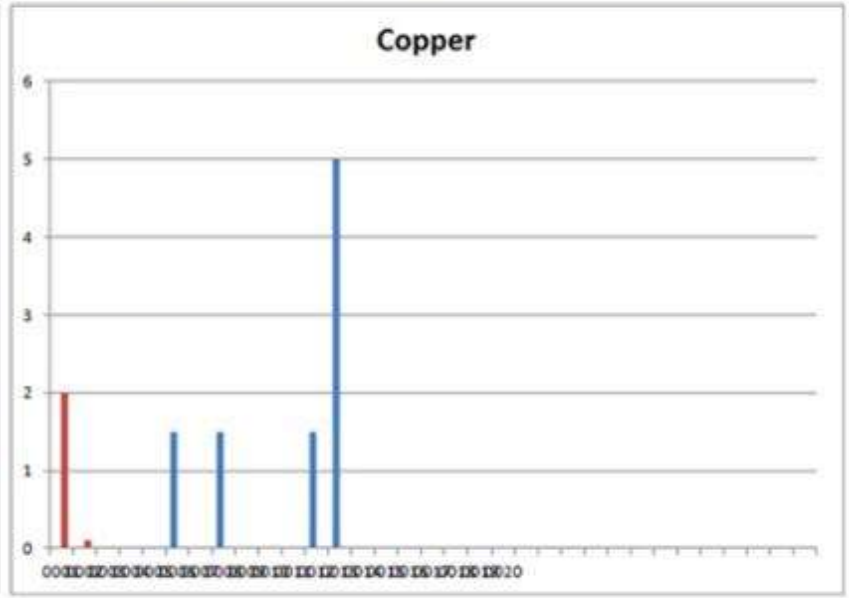
Photos by Heba Khalil


Water
Testing
Results


PH levels
9
8
7
6
5
4
3
2
1
0

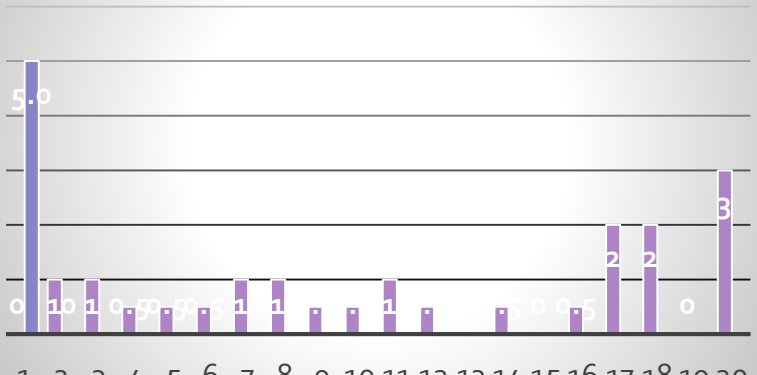

Iron
1.2
1
0.8
0.6
0.4
0.2
0


Coliform
1.2
1
0.8
0.6
0.4
0.2
0

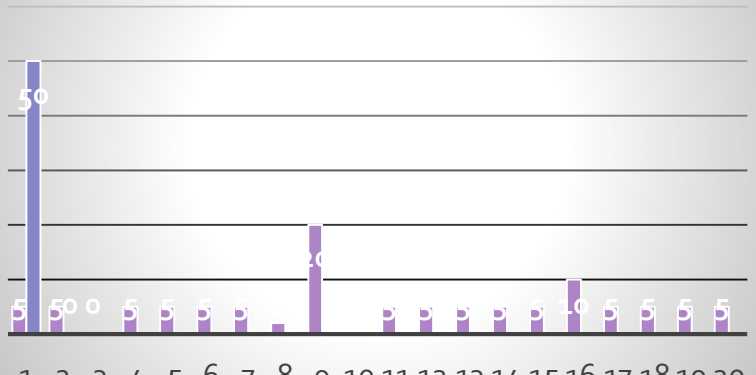

Copper
6
5
4
3
2
1
0

Some Water Quality Results

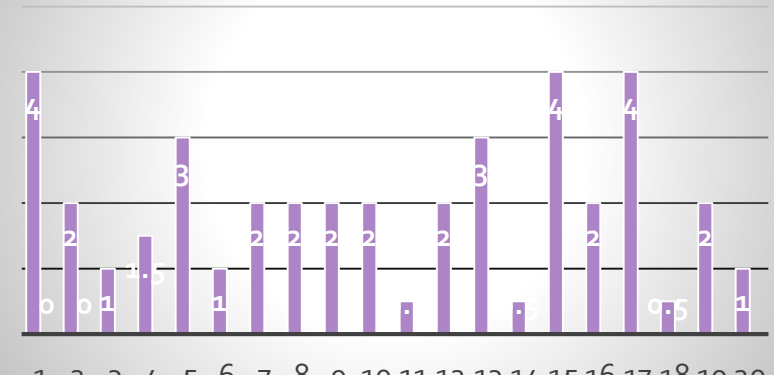
Chlorine



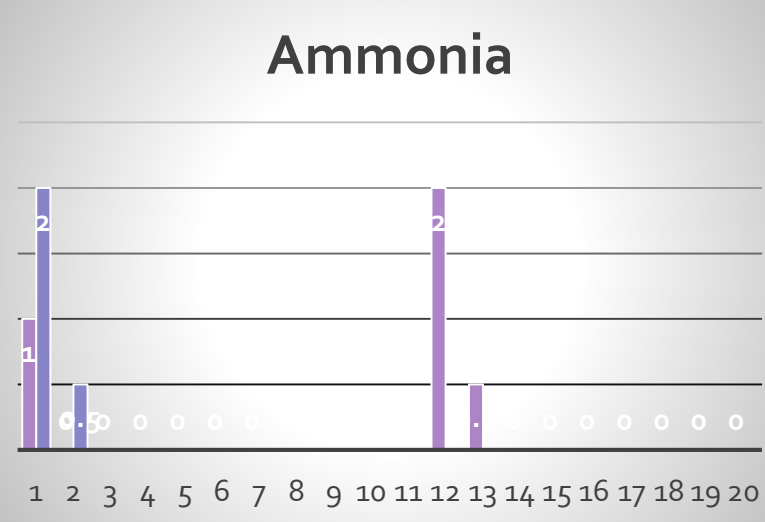
Nitrates



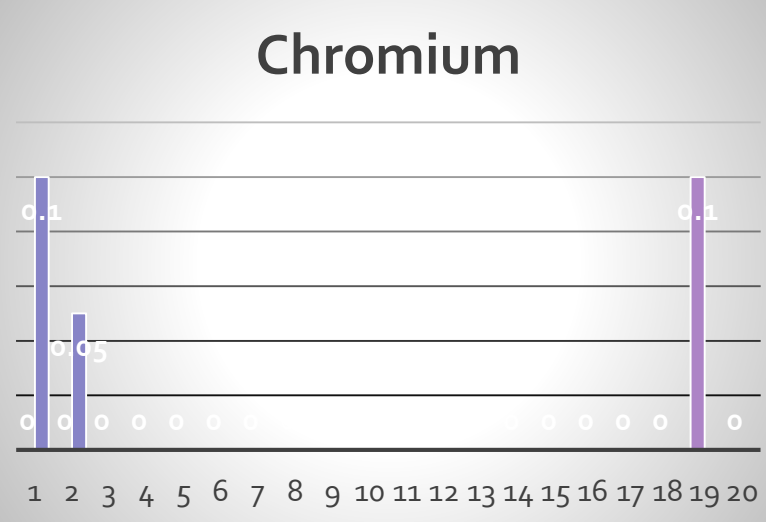
Phosphates



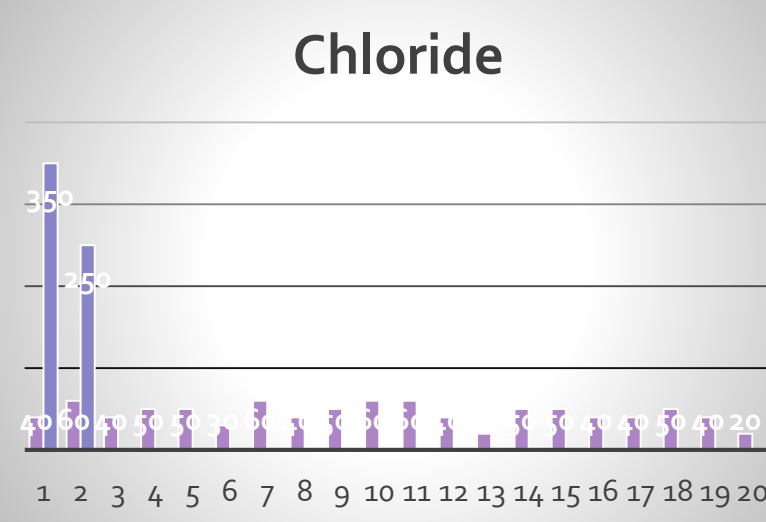
Ammonia



Chromium



Chloride



Estimating the Demand Values for each Junction

in liters per day

Formulas are shown for information only. If a value other than zero is entered directly, then the Demand Criteria for that Junction can be ig

Toilets

Demand Criteria

Calculated from Formula																
420	Formula: average toilet flush volume in liters* persons using toilets daily * flushes per person day															
	Regularly used toilet 1	14	Not applicable	Standard bowl	Water efficient	Super efficien	toilet with wand									
	Regularly used toilet 2	0	0	14	10	6	1									
Known and entered directly	Infrequently used toilet 1	0														
0	Infrequently used toilet 1	0														
Unknown	Total toilets	1														
	Average flush	14														
	Persons using toilets daily	3	effective occupancy	nobody	Persons											
			5	0	1	2	3	4	5	6	7	8	9	10		
	Flushes per person day avg.	6	0	1	2	3	4	5	6	diabetes	avg 8					

Hygiene

Calculated from Formula																
156	Formula: (shower flow in liters per event * shower duration * weekly showers per person) + (bath size in liters * baths per week) + (tap flow rates in liters per minute * number of occupants * tap use per person in minutes per day) / 7 weekdays															
	Shower avg flow liters/minute	8	Bucket and tap on	Low pressure stream	icient spray no	Standard Flow	Power Shower									
			5	4	6	8	12									
Known and entered directly	Typical duration of shower flow	12	Quick	Regular	Long											
0			4	8	12											
Unknown	Weekly showers per person	3	0	1	2	3	4	5	6	7	8	9	10	11		
	Bath volume	100	low	Regular	full	max										
			60	80	100	200										
	Baths per week in total	3	0	1	2	3	4	5	6	7	8	9	10	11		
	Minutes of tap flow per person vi	6	none on-site	morning & night												
			0	2	4	6										
	Flow from tap during ablutions	4	weak or intermittent	steady	high		4.5									
			4	6	8											
	No. of occupants using washroom	3	effective occupancy	nobody	persons											
			5	0	1	2	3	4	5	6	7	8	9	10		
	No. Of visits to washroom per oc	8	0	1	2	3	4	5	6	7	8	9	10			

Kitchen

Calculated from Formula																
646	Formula: person meals per average day * water use for cooking a meal + water use per day for dishwashing one load of dishes * number of loads per day															
	Qty of individual meals per day	3	0	1	2	3	4	5	6	7	8	9	10	11		
	Water for preparing each meal	2	0	1	2	3	4	5	6	7	8					
Known and entered directly	Dishwashing water per load	80	low	Regular	full	max										
0			60	80	100	200										
Unknown	Loads of dishes per day	8	meals per standard load													
		avg 20 dishes	4	6	8											

Laundry

Calculated from Formula																
193	Formula: persons using laudry facilities * loads per week on average per person * liters per load / 7 weekdays															
	Persons using water for laundry	3	effective occupancy	nobody	Persons											
			5	0	1	2	3	4	5	6	7	8	9	10		
Known and entered directly	Loads per week per person	3	0	1	2	3	4	5	6	7	8	9	10			
0	Water consumption per load	150	Off premises	Basin	Full size stnd top loading	load on short cycle	Compact top loading	Compact front load short	Advanced water efficient	Other						
Unknown			0	3	200	150	120	80	75	0						

Drinking

Calculated from Formula																
	Formula: persons using bottles or tap water from household * drinks per person day * liters per drink															
20	Persons drinking water on-site da	13														
Known and entered directly	Average quantity of drink (liters)	0.5	glass	tall glass	bottle	Large bottle										
			0.25	0.4	0.5	0.75										

Water audits

-Describing parcels

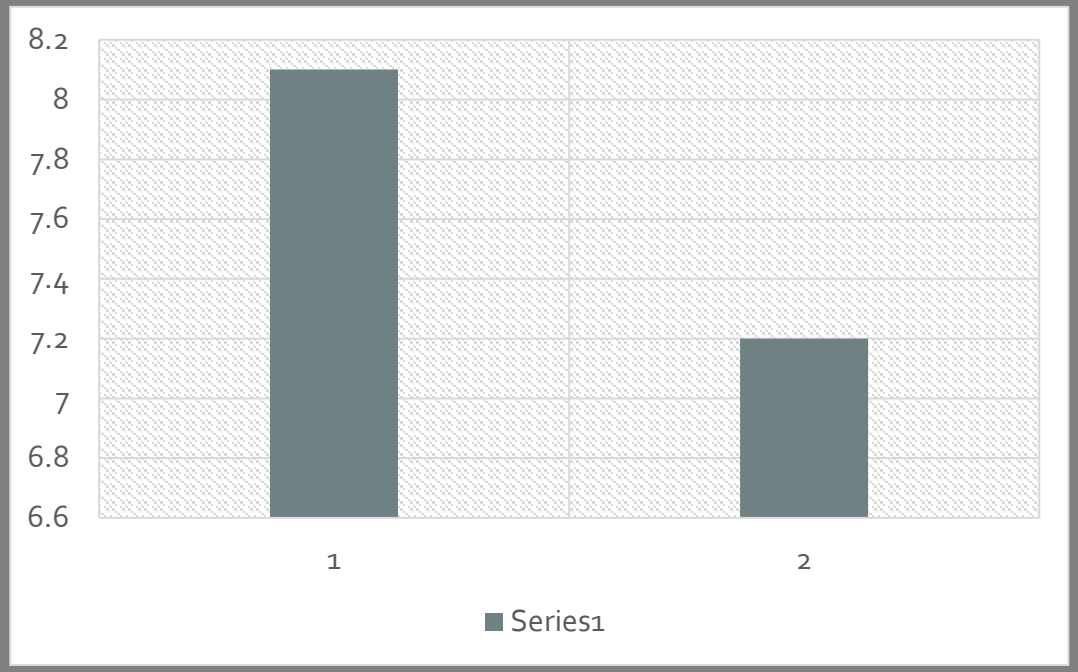
-Estimating demand

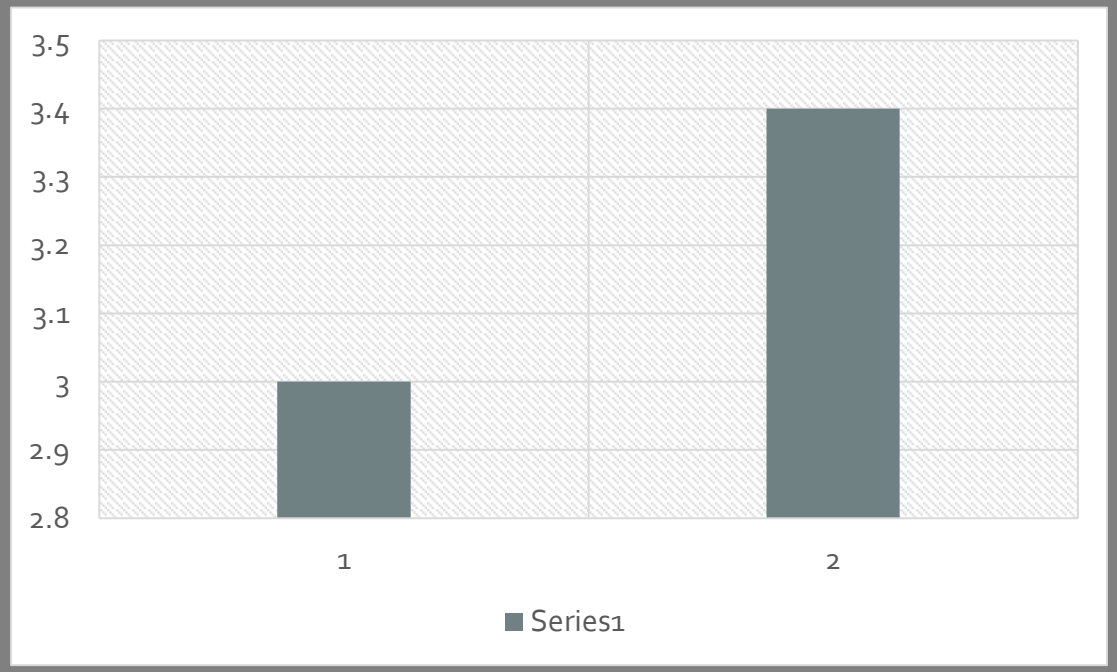
Foundation

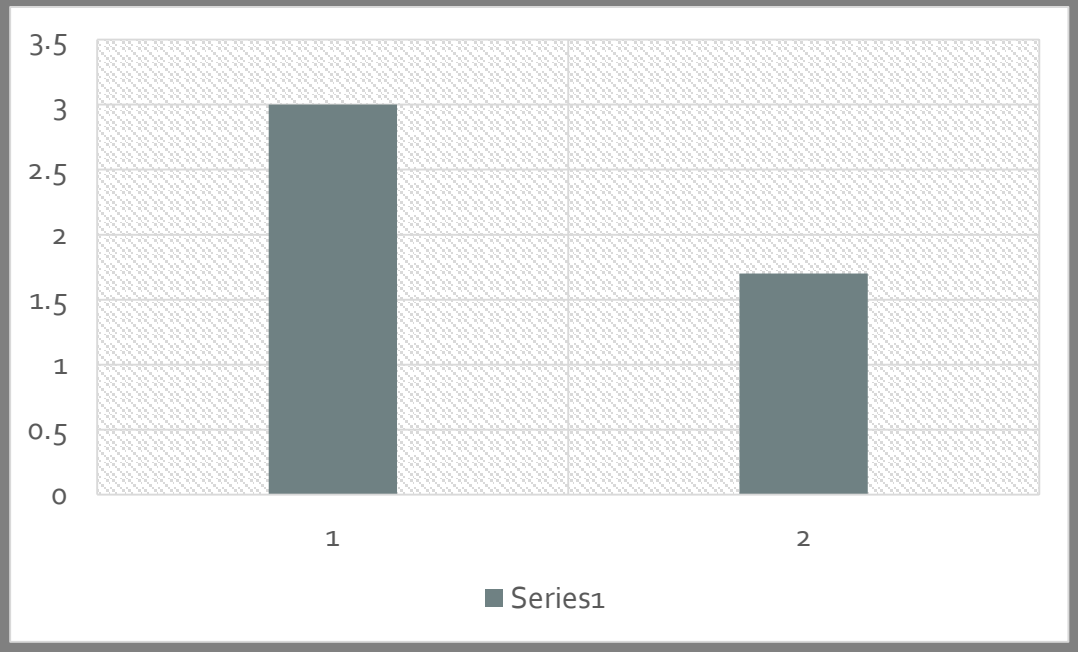
upstream & downstream analysis

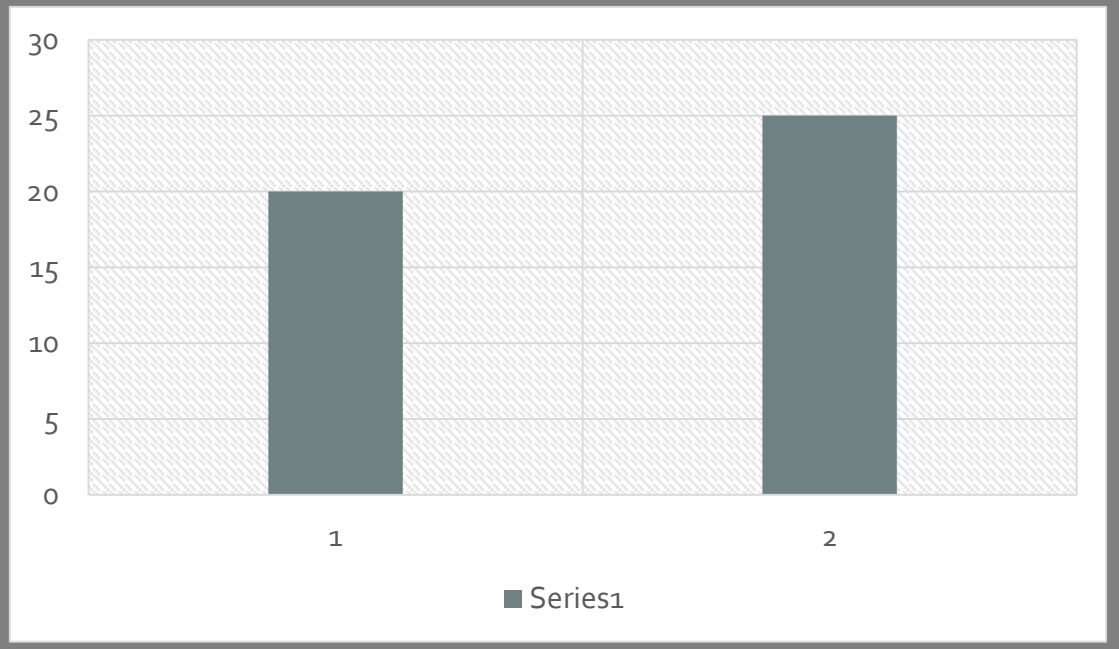
Photo by Research team

Photos by Research team

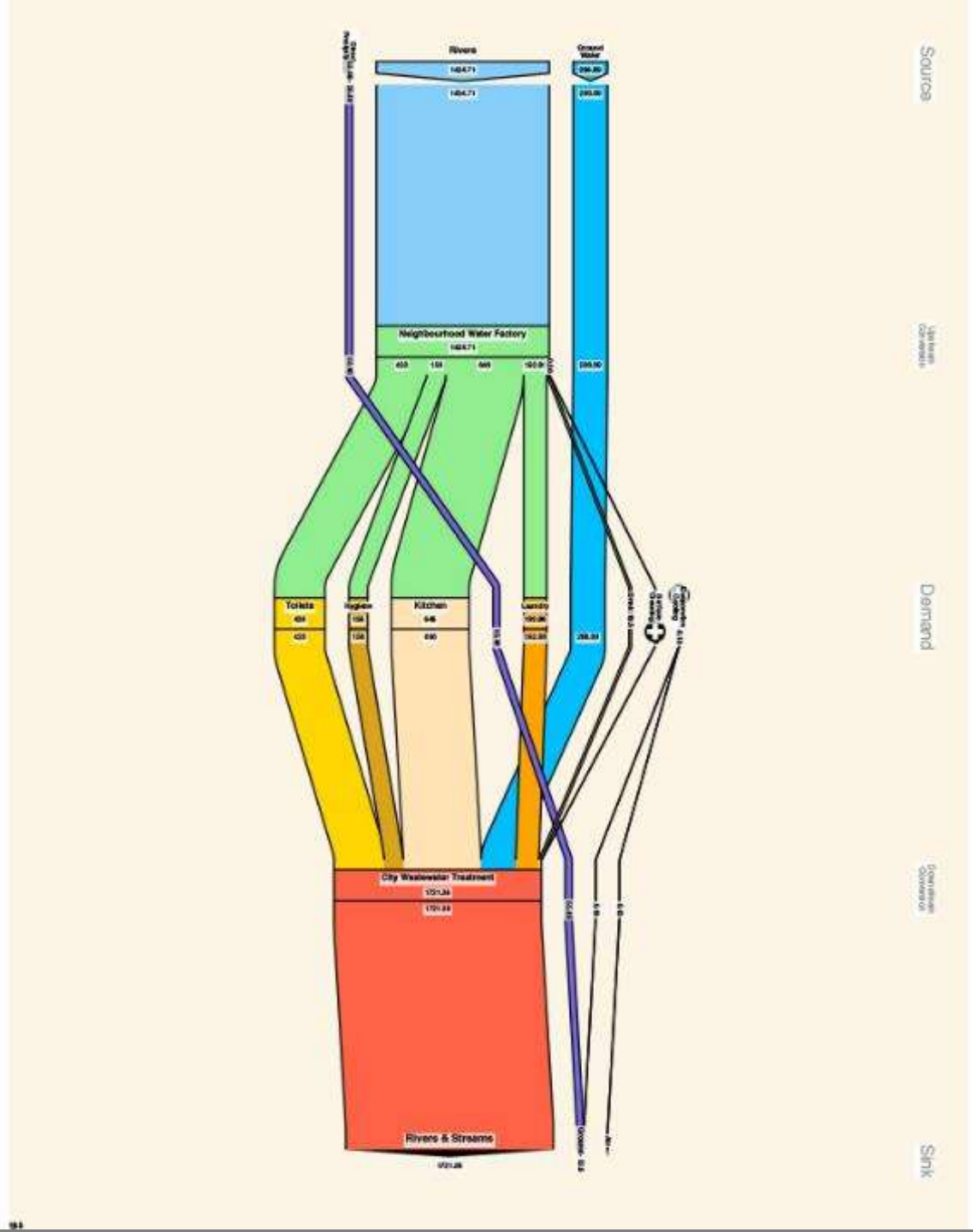

8.2
8
7.8
7.6
7.4
7.2
7
6.8
6.6
1
2
Series1


3.5
3.4
3.3
3.2
3.1
3
2.9
2.8
1
2
Series1


3.5
3
2.5
2
1.5
1
0.5
0
1
2
Series1


30
25
20
15
10
5
0
1
2
Series1

Water flow in Imbaba



Feedback with community

Photos by Heba Khalil

أستنونا أول يوم العيد

فريق كلية هندسة القاهرة ومؤسسة البلد

تنظيم ألعاب للأطفال

اعاده استخدام

العاب ذكاء

العب واتعلم "

فصل مواد

العاب ترفيهية

جامع البدر- شارع البوهي - بعد صلاة العيد

البلد

ECOCITIZEN WORLD MAP PROJECT

Photos by Research team

Some findings

- The water quality in the area is very low with high concentrations of iron, phosphate, coliform and copper in some samples
- Very high water bills with no regards to real consumption in some cases.
- High consumption of water was recorded which in part is due to behaviour but also due to leakages in the water pipes
- Very high electricity bills due to continuous operation of water pumps to compensate for low network pressure.
- Good air quality in the inner streets due to absence of CO_2 emissions from cars (it is almost entirely pedestrian area)
- However, in the main streets air quality is typical to Cairene streets.

Some outcomes

- Promoting participatory development
- Raising environmental awareness (how much earth are you consuming)
- Interventions to improve water and subsequently energy consumption
- Investigate other flows: energy, materials
- Conduct environmental analysis: inside units and outdoor spaces

هنحل التلوث ازاى؟

الموضوع سهل و بسيط و ميخضش ، على حسب نوع التلوث ممكن :

- نركب فلتر مياه فى البيت
- نهتم بنظافة الخزانات بتاعتنا
- نغير مواسيرنا النحاس القديمة

و نعمل دايما تحليل اول ما نحس ان فى حاجة غريبة.

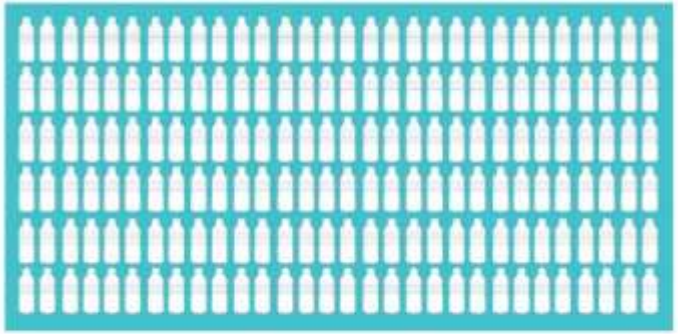
لو عايز اعمل تحليل اعمل ايه؟

بتاخد عينة من المياه عندك تقريبا بنملى نص ازازة المياه الصغيرة ونروح بيها على الجمعية بتسيب اسمك و عنوانك و تليفونك و احنا حنعملك اللازم.

عملنا ايه كمان؟

حسبنا استهلاك المياة

كل واحد بيستخدم فى بيته حوالى ٢٨٠ لتر فى اليوم (١٨٠ ازازة كبيرة)



الرقم دة اقل من دول تانية لكنه برده اعلى من اللى الناس بتستخدمه فى دول كتير زى: المانيا و الدنمارك و الهند و الصين و اثيوبيا و ...

معظمهم فى الحمام و المطبخ

عايزين نعمل ايه بعد كدة؟

نحل التحديات فى الكهرباء و المواصلات و الاكل ..

ازاى ممكن نحافظ عالمياة القليلة الموجودة و اللى بتقطع علاطول ؟

ديه شوية نصائح ممكن تقلل استهلاك المياة والتالي هتقلل فاتورة

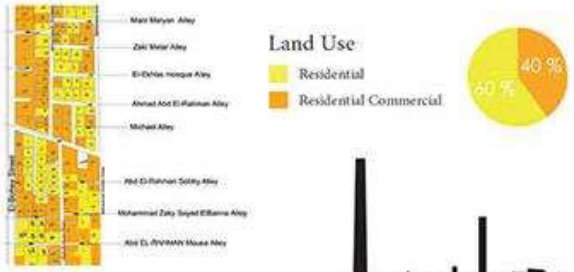
2

In the 1960s, owners began to subdivide the plots and Build houses on it .The area is similar to many other informal areas, that have the same origin and suffer now from similar problems.

The Issues at the study area (Imbaba) :

- Informal Residential area built on agriculture land.
- The area is adjacent to the old location of El-bohey canal that was improperly buried in the last 20 years. Now underground water leaks into the ground floors of nearby buildings.
- Potable water network was made from asbestos-cement that is porous and has poisonus effect.
- Water pressure is low , and if the water pressure increased the pipes will explode.
- There is a garbage collection problem.

After discussing with the local CBO (El-Balad Foundation) the typical neighborhood study area was chosen. We prepared base maps of land use, heights, age & conditions of construction.



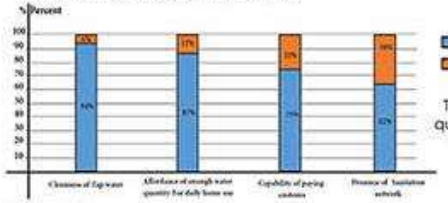
3

We first introduced our concepts to the community through flyers & posters then through a bootcamp in the area with the residents.

During this bootcamp we tried to mobilize the residents and stakeholders to participate in the project activities

After introducing our concepts to the community, we were divided into 3 teams:

The first team did 2 questionnaires to determine:
- Quality of life.
- Individual's ecological footprint.

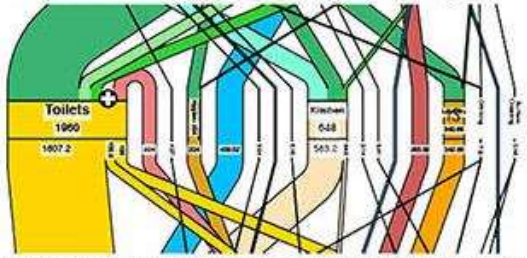


This grapgh measures quality & affordability of Water services

Conclusions
- Water systems are rickety & old with low quality.
- Lack of health care services .
- Few employment opportunities, mostly found in nearby shops.
- Lack of entertainment facilities

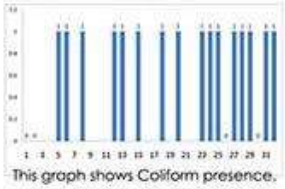
4

The 2nd team Studied the area's water flow by determining water demands, sources and ends in differnet buildings.

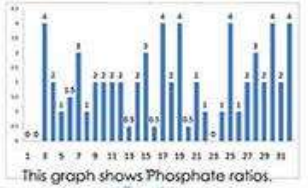


- Above is a part of a sankey diagram showing different relative amounts of water use in one of the area's houses ,most of the use is in toilets and Kitchens.
- In addition, water flow from source to sink was studied.

The 3rd team was responsible for testing the water quality (acidity - copper - iron - nitrate - phosphate - chloride - chlorine - lead - chrome - Ammonia) and comparing them with WHO global standards .



This graph shows Coliform presence.



This graph shows Phosphate ratios.

Conclusions for most of the units:
- High ratios of Coliform Bacteria
- High copper ratios.
- High phosphate ratios.

5

By El-Fitr Feast, before studying the materials' flow we organised an awareness raising event

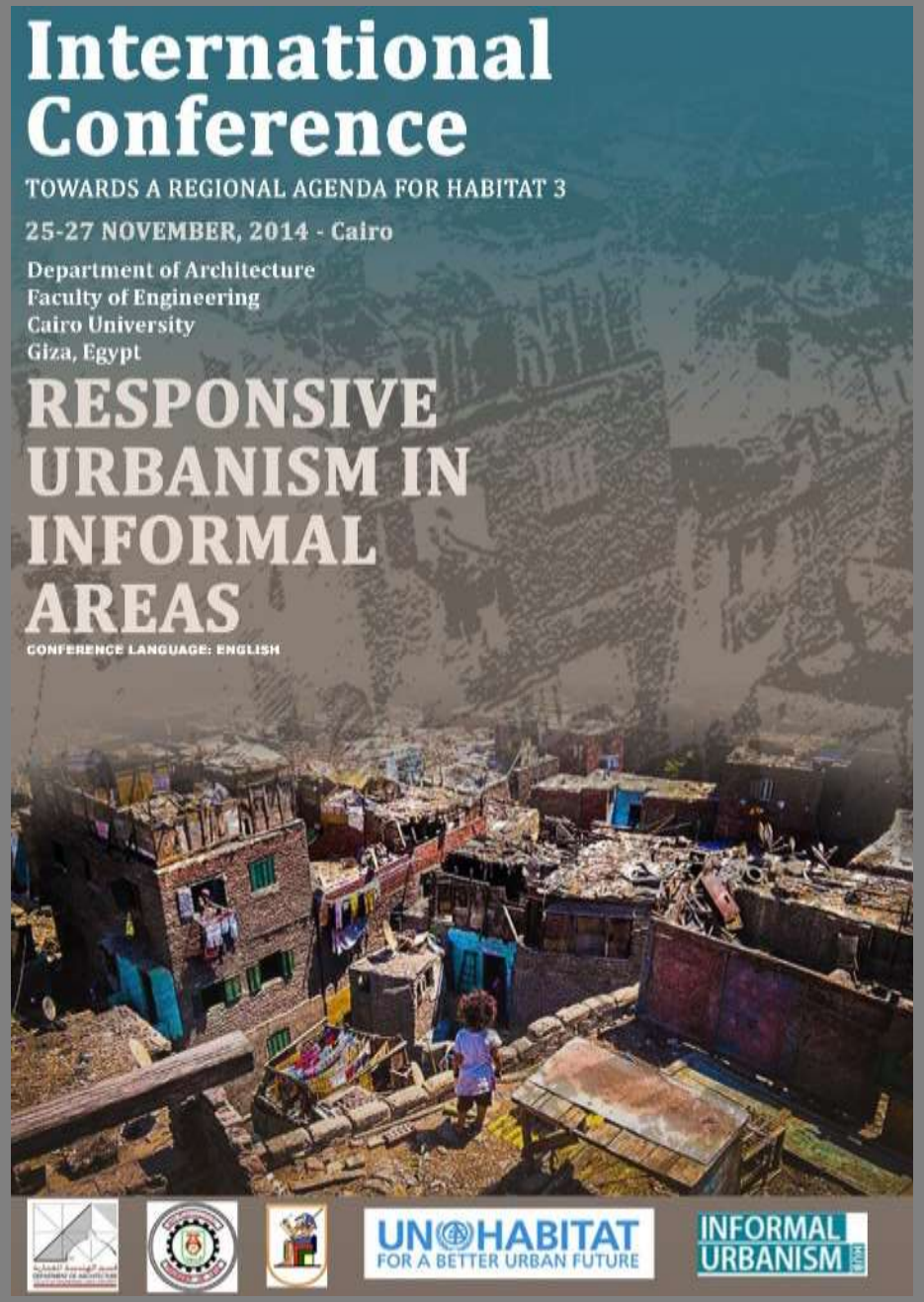
So, In order to increase people's awareness of recycling and the benefits of reusing materials, we started an event where people could play with the recycled toys made by the team, to help them recognise the benefits of recycling and decrease our material need.

Next steps :

- Measuring and aggregating community consumption through
  - o Energy audits
  - o Food audits
  - o Material audits
- Analyzing the audits and define consumption problems
- Recommending and specifying solutions for the problems .
- Contacting Government's ministries, stakeholders and CBO to participate inimplementing recommendations.
- Proposing consumption solutions.
- Settling for a sustainable strategic plan for a pilot project on the level of imbaba.
- Conducting awareness campaigns regarding consumption behavior.

Engaging Stakeholders

- GIZ
- AB-CCC
- International Conference
- Implementing a project in another area



A way forward: Initiative for a pilot project

- First, on the neighbourhood level, changing the water network in the area, which is rather a governmental responsibility
- **Second, on the buildings and units' level, replacing deteriorated water pipes, adding water filter and installing grey water system.**
- Third, on the individual level, promoting efficient use of water through behavioural awareness and education.
- If the treated grey water quality permits, it can be used in roof planting. This will need accurate testing of the treated water to ensure adequacy

More flows

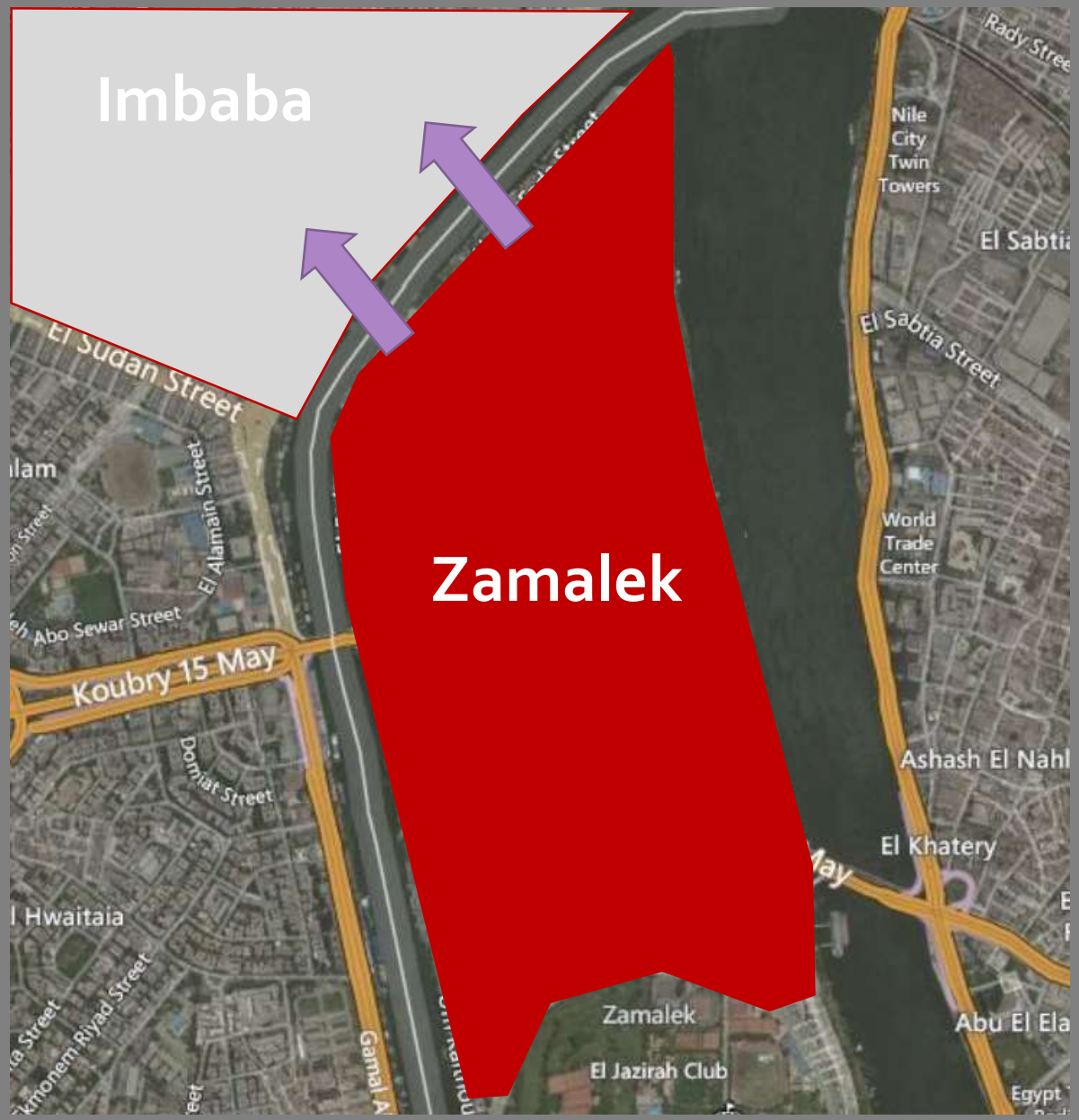
Next phase, March-May 2015

- Energy (audits already done)
  - The use of **solar energy** should be encouraged, especially because we have very good solar exposure
- Waste (materials)
  - Encouraging **garbage separation and recycling** would preserve resources and maximise the benefit from latent energy used during initial manufacturing.
  - The use of **reused/ recycled** materials in improving outdoor spaces design

More Areas

- Formal Areas
- New suburbs around Cairo

New pilot area, Zamalek



Conclusion

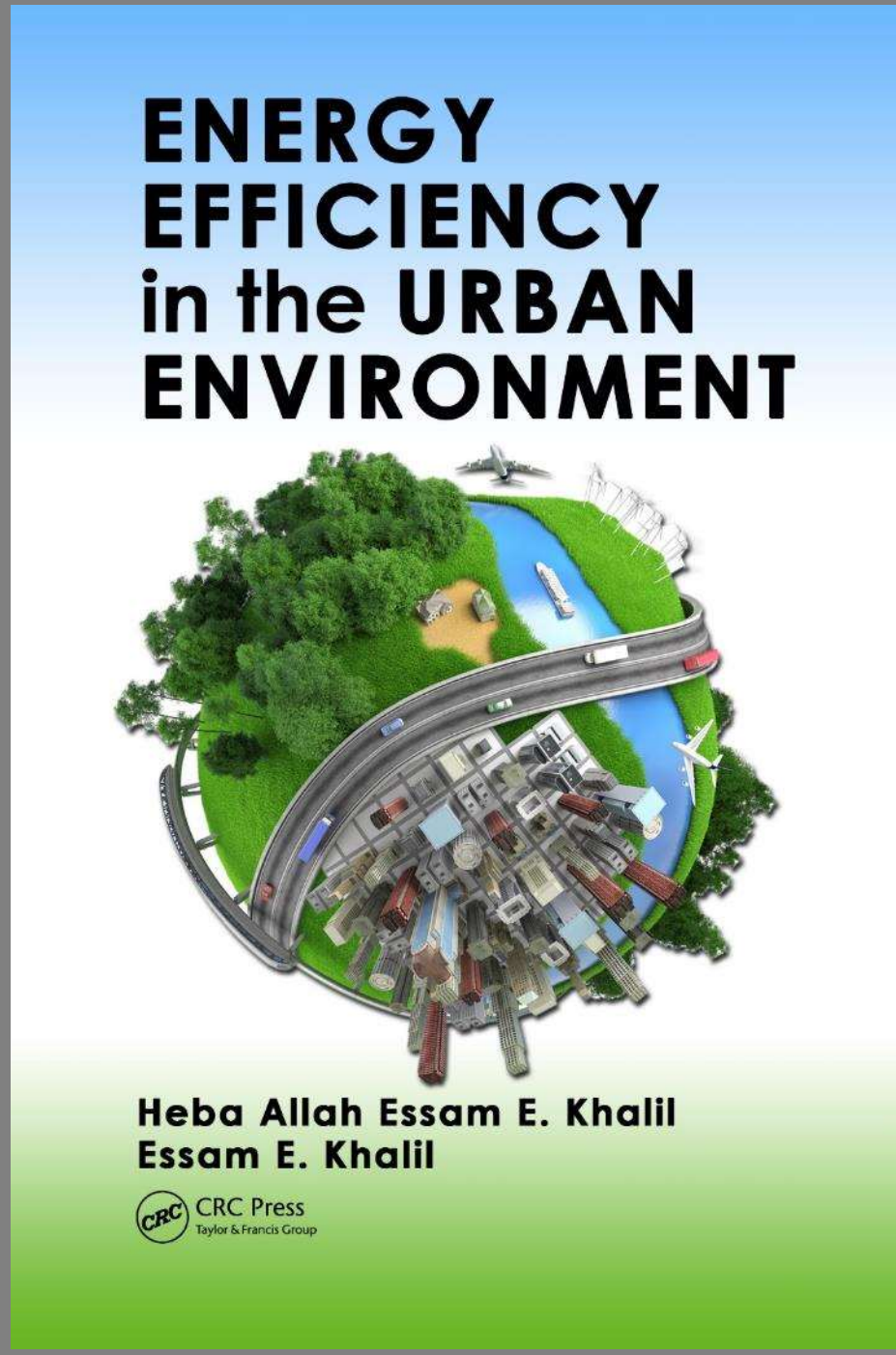
- Urban metabolism is becoming not only a quantifying, or analysing tool, it has the potential to influence the sustainability of districts and neighbourhoods
- This would imply new approaches, methodologies, and techniques while dealing with new factors that were not tackled in the current state of the art
- There is big problem in consumption of resources, mainly water in the case of Imbaba that necessitates a prompt response from various stakeholders on different levels.
- The problem was easily communicated through the tools used including GIS, UMIS and the produced maps, charts and Sankey diagrams.
- The partnership between different stakeholders can provide an adequate platform for promoting the methodology and the results onto tailoring locally appropriate solutions
- The study of other resources would also provide insights to minimize consumption and promote looping and cascading to maximise the value added of limited available resources

Other related research

- Khalil, H. and Ron, D. (2015) Citizen-led mapping of urban metabolism in Cairo, *Second Assessment Report on Climate Change and Cities (ARC 3-2)* ARC3-2 Case Study, Urban Climate Change Research Network
- Results of the 2 phases will be presented at the Eye on Earth Summit 2015 and Ecocity Summit 2015, Abu Dhabi, UAE.
- Joint Innovative Projects Fund (GERF) September 2014-2016

  Improving Environmental Performance in Informal Areas and Reducing Urban Heat Islands Phenomenon

  - Cairo University PI: Assoc. Prof. Heba Khalil
  - FU Berlin PI: Prof. Kosta Mathey
- Khalil, H. & Khalil, E. (2015) Energy Efficiency in the Urban Environment, CRC Press, Taylor & Francis.



THANKYOU FORYOUR ATTENTION

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