

ISIS: Information System for Informal Settlements

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INFORMATION SYSTEM FOR INFORMAL SETTLEMENTS ©

A Co-operation Project in Urban Research
Participatory Urban Management Programme (Ministry of Planning & German Technical Co-operation)
& Observatoire urbain du Caire Contemporain (OUCC) in the Centre de recherche et de documentation Economique, Juridique et Social (CEDEJ)

Prepared by Eric Denis and Marion Séjourné

April 2002

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- The aim of this project is to build the framework for a GIS database focusing on informal settlements in the Greater Cairo Region, but also considered in their context as a part of the general land use of the region;
- Secondly, it gives a first detailed analysis on recent trends of physical transformations, growth and changes of space used from 1991 to 1998 within the Greater Cairo Region, linked with demographic trends. (See Annex 1 for technical details for these two parts of the activities of co-operation);
- Thirdly, it proposes a typology to develop this first product in more detail and to extend the analysis and promote an approach in terms of informal settlement development and upgrading of disadvantaged areas. It has been developed in co-operation with David Sims (see D. Sims working paper titled: “Upgrading Disadvantaged Areas, Greater Cairo Mapping Project”).

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GENERAL RESULTS:

PRESENT SITUATION AND TRENDS:

- **A major loss of open land and opportunities of public intervention in the popular outskirts of Cairo**
    - 27 sq/km have been illegally built between 1991 and 1998:
    - For comparison, 27 sq/km represents an area equivalent to the inhabited part of Madinet Nasr, a formal area that started to be built in the 70's.
    - 11.3 sq/km of wide open spaces mainly cultivated pockets have been densely built without any reservation of area for public facilities;
    - After the Ring Road achievement, 13 sq/km of agricultural land have been converted in green pockets that are clearly in process to be densely settled without any plan to manage their integration in the urban fabric and infrastructure.

- **IS growth location**
    - Most of the IS 27 sq/km extension's between 1991 and 1998 occurred in the western part of the city (Giza governorate), and the northern part of Greater Cairo (Qalyubiya governorate) and somewhat less in the south of Cairo governorate.
    - 58% occurred in Giza, 23% in Qalyubiya and 19% in Cairo. In 1998, 33% of informal areas were located in Cairo governorate with 40% of IS inhabitants, Giza represented 51% of the total IS area with 44% of the population, and Qaluybiya respectively 15% and 17%.

- **A dramatic share of informal areas in the total regional agglomeration**
    - 43% of the Greater Cairo residential built-up area and its surrounding villages, excluding extensively occupied new cities areas;
    - 57% of the Greater Cairo Region population.

- **Informal settlements densities**
    - The informal settlements are very dense with an average of 680 inhabitants/Ha in 1991 and 640 in 1998, while the average of the whole city core is about 385 inhabitants/Ha. The older districts (in the north of the city –Sharabiyya, Zawiyyat al Hamra, Sahil…- and the mature areas on the west bank like Imbaba, Bulaq al

Dakrour…) are even more densely populated. Some of these have densities that reach more than 1500 inhabitants/Ha.

- Regarding the annual growth rate of the densities between 1991 and 1998, the pressures appear in the fringes of the agglomeration; for example the western *qisms* of Umraniyya, al Haram, Waraq, and markaz Imbaba in Giza, and northern-east districts of al Marg and Khanka in Qalyubiya.

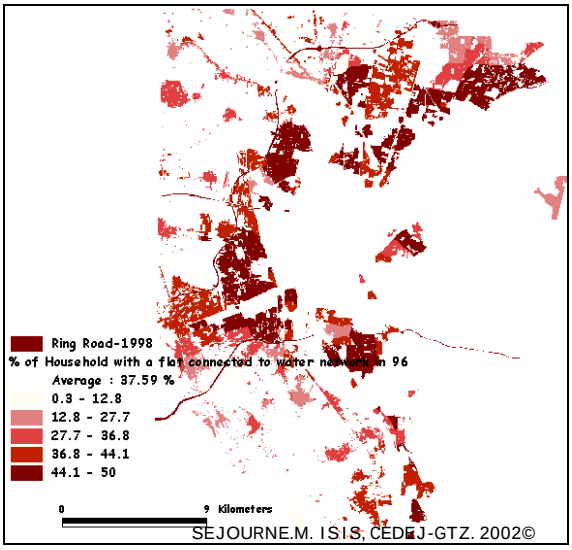
- **The share of IS is coming dominant**
  - With a population annual growth rate and residential area growth rate of respectively 3.4% and 3.2% between 1991 and 1998, population and IS physical encroachment could doubling within 20 years;
  - By 1990 the population of IS had become the majority of Greater Cairo and IS built up areas will form the majority by 2012.

- **The open space opportunities will disappear quickly without public intervention:**
  - With the same rhythm of loss, 10% per year, green area pockets identified in 1991 and still present in 1998 (10 sq/km or less than 50% of the pockets existing in 1991), will have completely disappeared by 2006, thus loosing opportunities for introducing needed public services;
  - The 13 sq/km of green area encapsulated inside the ring road will be completely urbanized by 2010, if we considered an average rhythm of loss of 5% per year between the IS one and the green pockets one. It could be even quicker if it disappears at the green pockets rhythm (-11% per year)!

- **Services and infrastructure in the informal settlements**
  - Only 37% of the households living in informal settlements have their dwelling units connected to the public water network. And there are significant disparities around the city. The “recently” set up settlements, especially in the squatted districts on public land and in the distant villages, a large majority of households are not connected to the public network. The source of water is still located outside their building. This is true for most of the settlements of the markaz al Giza and for Ezbet al Haggana. Furthermore, these data do not say anything about the bad performance of the public water network; about the low pressure, the long cuts the microbial and heavy metal contamination.

- The other main infrastructure elements follow the same trend. This is especially the case for sewage networks. Not only does this lead to poor sanitation, it also causes heavy pollution of agricultural fields near expanding informal settlements.
- Most of the IS, and especially those established "recently" (from the last 10 to 20 years), are suffering from a huge lack of infrastructure, public facilities and basic services (sewage, gas network, sports and youth infrastructures but also paved roads…etc.).

Map 1: IS Connection to Water Network in 1996



- **IS capture and shelter most new families**
  - The informal settlements sheltered an additional 1.4 million inhabitants between 1991 and 1998. Their populations were about 5.4 million inhabitants in 1991 and reached more than 6.8 million in seven years, with an annual growth rate of 3.4%.
  - This means that IS annual sheltering capacity is almost to 200.000 inhabitants per year or 42.000 families;
  - As formal areas (excluding the new desert settlements) are sheltering less than 20.000 new inhabitants or 5.300 families per year, it can be said that IS meet the shelter needs of 90% of new families.

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- **IS have still a wide potential for growth**
    - In 1998, IS contained more than 580.000 empty dwelling units, that is to say, 44% of the GCR empty units stock.
    - In theory, this means, were there a perfect housing market, that for the next 14 years the growth of the GCR population could be totally accommodated in IS without any new housing being built! In formal areas, if the family growth rate is stable, the existing housing stock can shelter the coming population for the next 130 years! And even more as the population in these areas is decreasing.

- **General conclusions**
    - The main trends of urban growth in Greater Cairo have been characterized more by the saturation and the completion of inner built up areas than by urban sprawl;
    - There is clearly no control and utilization of rural pocket open space for the development of public services;
    - Urbanization pressures occur and will continue to occur mostly in the popular outskirts of the metropolitan area;
    - IS are clearly the predominant place of living in Greater Cairo;
    - There is no credible alternative to the popular IS, especially considering that all valuable desert land has been allocated to develop exclusive private housing. Even major public project already planned, like the second Ring Road, will be difficult to settle regarding the present land use that get out of any master plan.

1 GENERAL ANALYSIS: A DENSIFICATION WITHOUT STRUCTURE

1.1 Our approach compared to recent studies of IS phenomena

All recent studies about the physical and demographic trends of Greater Cairo point to lowered pressure on agricultural land a better mastering of land use around Cairo. On the other hand, our approach shows a dramatic dynamic of urban densification and popular (auto-construction) encroachment on rural land, mainly agricultural, with a detailed and precise localization of the phenomenon.

Most recent studies refer to the fact that the ring road should permit the control of informal settlements inside and outside it's borders, as for example has been mentioned the 1994 report "*Giza: a comprehensive urban planning policy, desert development and informal areas planning*" prepared by GOPP and IAURIF. More recent studies insist that the Prime Minister's decree of 1996 (decree n°1 and 2 of the year 1996) had a positive impact on preventing informal construction, by strictly forbidding the establishment of any building on agricultural land.

The various attempts to evaluate GCR physical extensions by comparing satellite images have not given clear results, due to poor image resolution, strict application of automatic interpretation and analysis, absence of complementary ground surveys and poor knowledge of the field and existing documentation. Paradoxically, the best and more realistic observations were based on a fieldwork approach done by IAURIF and GOPP for the Giza region (*Giza, a comprehensive urban planning policy*, 1994). Notably they show clearly the importance of inner IS opportunity for densification, with 30% of unbuilt areas inside the ring road, and were alarmed at the speed of the transformation of cultivated areas to the more mineral environment of GCR.

IAURIF and GOPP produced in 1990 a report funded by French cooperation which concluded that only 4,2 sq/km of GCR growth has occurred on green areas between 1986 and 1989! Considering that the rate of demographic growth of the metropolis was higher during this period than during our own (2.5 % per annum versus 1.9%), it seems that these results are grossly under estimate the phenomenon. We found 3,4 sq/km of annual illegal extension on green land whereas they found only 1 sq/km– more than three time less.

The IAURIF study was presented as utilizing the state of art in remote sensing[1], and it has been used widely to show the global mastering of physical IS extension, the success of the ring road as a strict limit, and even the capacity of new cities and settlements to deflect to desert demographic pressures in the GCR.

[1] They explain that they used the European program "Corine Lancover" methodology; nevertheless a small technical remark indicated that the build-up extension on green land was underestimated.

The general scale of the IAURIF study, 1/50.000, gives such a result. The technique could be used to give a global land use but not to analyze transformation, especially in an extremely dense area such as GCR where most of the growth is absorbed by densification and changes of inner city land uses. Nevertheless, at the same scale, because it was based on an excellent knowledge of GCR field, the ILD/ECES study give a clear, methodologically founded and credible evaluation of IS extension. But it couldn't answer to the central question of growth trends that are based on an accumulation of micro-development and densification processes. A scale of around 1/5000 is needed to tackle and evaluate the IS dynamic and produce a dynamic typology.

In the early 1980s, the National Urban Policy Study compared Landsat images of 1972 and 1978 at a scale of 1/500000 and found an annual physical extension of built up on the Nile valley of 2,1 sq/km; In spite of the quality of the data, the dated technology, and the wide scale of the research, it give a more credible results than IAURIF-GOPP[2]. Obviously they couldn't tackle the inner built up densification and disappearing of green pockets.

1.2 Absorption of green land a tremendous process

A much more recent study produced by our colleague, Michel Chesnais, gives a serious estimation of land use changes in GCR between 1986 and 1994[3] using an automatic procedure with correction on the field. He found that 29 sq/km of the valley's green area have been absorbed by the Cairo agglomerate or 3,6 sq/km per year, which is almost the same result than our study for the period 1991-1998. But, due to the scale, Chesnais approach couldn't determine the share of inner built up densification. The congruence of Chesnais analysis and ours, based on different and more detailed satellite images, is a clear sign of the consistence of the results. It gives an excellent independent cross checking.

We should assume, regarding the older approaches and their technical defaults, that there has been absolutely no indication of a slowing down of metropolitan agglomerate extension on the valley's green land. Furthermore, it seems that some local acceleration could be identified (cf. IS growth location and trends, below).

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[2] Adivisory Committee for reconstruction, 1982. *Egypt, Urban Growth and Urban Data Report*, Ministry of Development & PADCO Inc. Washington DC, pp. 256-271.

[3] Chesnais M. 1998. "Croissance urbaine du Caire et télédétection". *Revue de géographie de Lyon*. N°73/3, pp.259-266.

***Table 1:** Changes between 1991 and 1998*

	Area (sq/km)
Green Area to pockets	12,7
Pockets to Built-up	11,3
Green Area to Built-up	15,5
Desert to Built-up	13,9
Total	**53,4**

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Map 2 : Sample of Changes between 1991 and 1998

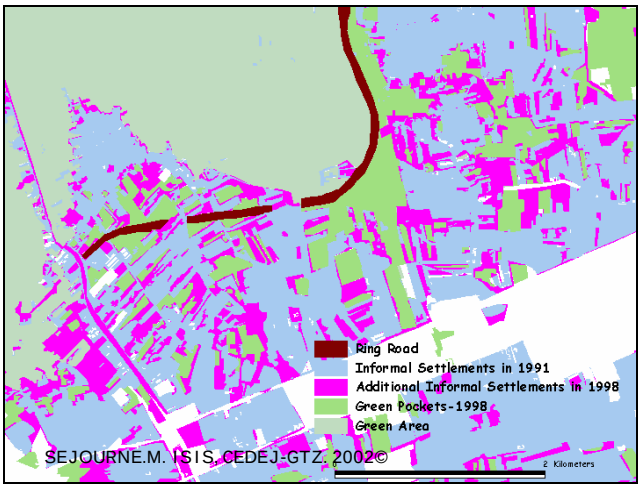


Table 2: Average Annual Loss of Agricultural Land 1976 – 1992

Area (sq/km)	Eroded Area	Agricultural Land Made Barren	Agricultural Land Lost to Urbanization	Total lost for Agricultural Use	% of Total
Giza	5,9	3,6	13,7	23,1	11,1
Qalyubiya	3,0	1,2	19,1	23,2	11,1
Cairo	0,1	1,8	8,9	10,7	5,1
3 GCR Governorates	8,9	6,5	41,6	57,1	27,3
Total for Egypt	39,9	68,5	100,5	208,9	100,0

Source: Ministry of Planning, Participatory Urban Management Programme, 1999.

Data produced by the Ministry of Agriculture and distributed by the Ministry of Planning seems to underestimate the phenomenon compared to our and Chesnais results. The Ministry of Agriculture registered for Greater Cairo 42 sq/km of agricultural land lost to urbanization between 1976 and 1992. This means 2.6 sq/km per year versus 3.8 for us, but for a shorter and more recent period. The 42 sq/km lost represents 40% of the phenomenon in Egypt for 25% of the population[4]. An underestimate of more than 30% is a big gap, suggesting that some important errors exist in the system of land lost registration, especially given that the area considered is wider than the GCR (includes all of Giza and Qalyubiya governorates). We should also consider that some built up extension could occur on open land that is not classified as agricultural even they though it appears green, cultivated and free of any construction. Land inside the "cordon,"

[4] The total of 3 governorates (Cairo, Giza & Qaluybiya) was represented 25% of the whole Egyptian population in 1996, but GCR is only 22% and the metropolitan agglomerate 19%.

meaning incorporated within the built up administrative limits, is widely neglected and considered as already lost by the Ministry of Agriculture. However, these areas are precisely the most dynamic in term of mineralization and dense urbanization of the valley.

Table 3: Land use in 1998 and changes 1991-1998

	Area Sq/km	Repartition of the built up %	Changes from 1991 to 1998 Sq/km	Annual Growth Rate 1991-1998
Built-up	298,1	39,6	38,1	1,97
Main Roads	3,9	0,5	2,5	15,35
Gardens	11,0	1,5	-0,8	-1,03
Pockets	23,1	3,1	1,7	1,06
Water	25,0	3,3	0,0	0,00
Green Area	199,1	26,4	-27,9	-1,85
Desert	132,7	17,6	-13,7	-1,40
Airport	11,4	1,5	0,0	0,00
Utilities and Main Activities	48,6	6,5	0,0	0,00
Total	753	100	0,0	0,00
Informal Built-up (sub-total)				
Core Villages	2,7		0,0	0,00
Informal without core villages	127,0			
Informal total	129,70		25,7	3,20

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1.3 IS as the regular popular home

The IS are clearly the place that shelter the wide majority of the Cairenes. IS are the norm of living in the GCR, and formal areas or even shantytowns are becoming more and more exceptions to the rule.

Table 4: ISIS population and areas of Greater Cairo in 1991-1998

	1991	%	1998	%	Annual growth rate
POPULATION					
Informal	5 422 236	52	6 844 082	57	3,38
Formal	5 002 150	48	5 140 554	43	0,39
Total	10 435 701	100	11 933 496	100	1,93
	Area (sq/km)	**%**	**Area (sq/km)**	**%**	**Annual Growth Rate**
Informal residential built-up	104,03	40,01	129,70	43,50	3,20
Formal residential built-up	155,99	59,99	168,43	56,50	1,10
Total residential built-up	260,02	100,00	298,12	100,00	1,97

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The report prepared by Makary Consulting for the Ministry of Planning & PUMP[5] about various estimates of the extent of IS has pointed out that there exist large differences between sources and reports. The table below shows the results of recent studies made by different public or international organizations. Our approach is convergent with the ILD-ECES result for the population and for the area concerned even though the ILD base map scale was 1/50000. The others studies were generally based on poor methodology, maps and data and gave clear underestimations. They answer to political interests and give assessments for public intervention and classification of specific areas which reflect more where local authorities want to take action than reality. In brief, they are not exhaustive.

Table 5 : different studies results concerning informal settlements

	CAPMAS		ILD-ECES		IDSC		NPUIS	
	Informal population 96	Area in sq/km	Informal population 96	Area in sq/km	Informal population 96	Area in sq/km	Informal population 96	Area in sq/km
Cairo	2 098 469	_	_	_	2 193 587	_	_	_
Qalyubiya	589 343	_	_	_	686 350	_	_	_
Giza	706 953	_	_	_	1 398 000	_	_	_
Greater Cairo	**3 394 765**	**_**	**7 070 075**	**129**	**4 277 937**	**86**	**4 543 644**	**91**

Sources : CAPMAS (1996) , ILD-ECES-CEDEJ, “Formalization of Egyptian’s Urban Informal Sector” (2000), IDSC, “Report on Informal Area in Ten Selected Governorates by Cabinet of Ministries” (1996), National project for Upgrading Informal Settlements by Ministry of Planning GTZ-CEDEJ (1996).

[5] MAKARY CONSULTING., GTZ-Participatory Urban Management Programme (PUMP), (2001), Facts and Figures on Informal Areas in Egypt, 34 p.

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According to our study, over the period 1991-98 the population living in informal settlements increased 10 times faster than the population residing in formal districts. During these seven years the formal city sheltered about 138 000 more inhabitants whereas the IS housed more than 1.4 million. The formal city relative share declined from 48 % to 43% of the total population and that of IS became clearly dominant, growing from 52% to 57%.

To a large extent, IS sheltered young couples coming from the center and formal sector where housing is too expensive. Less than 2% of inhabitants of GCR are born outside of the GCR and they represent 20% of the time-life residential migrants in the GCR.

In the IS, the annual demographic growth rate 1991-98 reached 3.4% whereas the formal city is almost stagnant with a rate of less than 0.4%! Globally, the demographic growth rate of the GCR is 1.97% exactly the same as the increase of the total built-up area; showing how much those processes are interlinked. Normally, in most the metropolitan areas, even in the dense context of Asia's big cities, the built up growth rate is always higher than the demographic one. The GCR is an exception, but a certain reversal is in process with the selling of all public desert land accessible around GCR to private contractors. Since ten years, the urbanized area has almost doubled. The trend is producing the framework for a dual city opposing an extremely dense popular core metropolitan area and an extensive and costly fringe city. In any case new cities are representing alternative to IS growth.

IS built up annual growth is 3.2%, compared with 3.4% population growth, showing clearly the densification. The increase in IS built up area is not a classical sprawling, it maintains its density; showing the intensity of the demand and its capacity to attract it immediately. IS construction fits with popular demand, which is absolutely the opposite with the other segments of the housing market.

2 THE "CRAM-IN" OR "STUFFING" PROCESS, BLOCKING LAND AND PUBLIC INTERVENTION OPPORTUNITIES

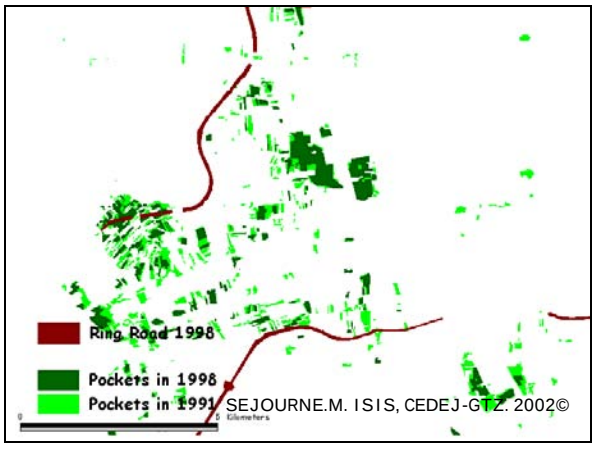
2.1 The Disappearance of Green Pockets

The relative invisibility of popular metropolitan encroachment on green land is explained by the "cramming in" on small enclaved parcels which makes the phenomena difficult to detect. The fringe process, taking the physical form of village expansion and extension along access roads is much more easy to detect; but because of the dominant stuffing dynamic, which avoids the enforcement of construction laws and gives access to services, expansion rarely takes on the appearance of a wide and open sprawling dynamic. The price of agricultural land re-enforce the densification process.

In Table 1, we see that more than 11 sq/km of existing green pockets in 1991 have been transformed into dense IS. The popular outskirts housing dynamic has absorbed more than half of those pockets in 7 years!

We can assume that, if the rate of disappearance between 1991 and 1998 (11% per year) is continuing today, green pockets of 1991 are almost totally built on and will, for sure, be completely built-up within 3 years.

Map 3 : Disappearance of Pockets between 1991 and 1998 in Giza Area



In 1994, the *Giza, Comprehensive Urban Planning Policy* (IAURIF-GOPP) noticed, based on a detailed survey, that Giza's IS still contained 30% of unbuilt areas inside the Ring Road. They considered it as an opportunity to limit densities and "improve inhabitants living conditions" and they proposed, in the short term, to "identify and freeze unbuilt landed properties" and "produce a comprehensive land use scheme for informal areas". Most of this vacant space has disappeared today, as have the opportunities of public intervention. Only state owned properties inside IS

give some chance of public services development, such as the Imbaba's airport or the agricultural fields of the Ministry of Agriculture and University.

2.2 Ring road and the control of IS extension

Ring Road is considered as a main tool to reduce the inner-city transit circulation and also to limit the extension of IS on the valley's green land. As executed, connections of the popular outskirt settlements to the Ring Road are almost non-existent; and even where they exist, they don't answer to local access but only to inner-city accessibility. In Giza and Qalyubiya, the Ring Road is elevated as a wall constraining the local interconnection and accessibility. It doesn't only reduce access to the highway but, built as a wall, it limits severely the possibly to develop tangential connections to IS inside and outside the Ring Road.

It appears that 7 sq/km of the 15,5 sq/km green land built on between 1991 and 1998 has been outside of the Ring Road (45%).. There is no basis to assume that the process has slowed. More over, as stuffing inside the Ring Road becomes completed, extensions outside should accelerate. Between 1991 and 1998, green pockets construction was dominantly an inner Ring Road phenomena, with only 72 hectares or 6,5% of the total taking place outside the Ring Road.

2.3 Producing Degradation of Agricultural Land

Ring Road completion is responsible for almost 4 sq/km of direct green lands lost in the valley. This loss was clearly inevitable considering the lack of east-west connections and was allowed for the public interest. At this time, in the Master Plan conception, accessibility was considered as a priority over the defense on agricultural lands.

But the Ring Road enclosure has had a veiled effect (other than the voluntary choice to constrain local accessibility) that is almost contrary to the initial preservation objective. It has induced the transformation of 13 sq/km of green land in agricultural pockets. With the Ring Road wall, these cultivated fields are becoming enclosed and progressively barren. This could explain why the estimations of agricultural land lost to urbanization produced by the Ministry of Agriculture are underestimated; certainly, a large part accuse a transitional phase of declassification. For the 1976-1992 period, the Ministry of Agriculture noticed only 6.5 sq/km of agricultural land made barren.

When they are included inside the Ring Road, the fields are more difficult to be irrigated. Many irrigation canals have been degraded or even cut by the Ring Road construction. Many canals and drains have been blocked with construction refuse coming from public works and private activities. Of course, solid wastes are also commonly dumped into these channels without any

alternative. With the accelerated extension and densification of IS inside the Ring Road without sewage facilities, the irrigation water is becoming terribly polluted. Today, the crops collected on those fields are excessively dangerous for health and should be prohibited from human consumption.

Around the Cairo metropolis it appears that hazardous reuse of untreated municipal and industrial wastewater mixed with irrigation canal has generated soil and food contamination accentuated by accumulation of air pollution in water and soil (el-Fouly, 1996). This study demonstrates that the degree of contamination differs tremendously between Cairo and rural areas. Depending on the produce, the contamination is between 10 and 40 times higher in Greater Cairo; watercress, parsley, melon, and lettuce, among others, are extremely exposed. For example, Izbat al-Nakhl agricultural land in the northeast fringe of the agglomeration is depending totally on sewage water for irrigation!

Table 6 : Concentration of heavy metals in the soils of Shubra al-Kayma district compared to a remote area in Sharqiya province (around 1980)

Location	Lead	Cadmium	Zinc
Near to metallurgical complex	547	18,0	271
Close to glass and metallurgical work	384	5,6	230
Near to urban industrial activities	276	5,1	197
Bigam villages (informal neighborhood)	160	3,9	160
Remote rural area in Sharqiya province	15	0,2	32

In ppm. Source: el-Fouly, 1992.

Table 7 : Mean lead concentration in edible portions of vegetables grown in Shubra al-Kayma compared to a remote rural area in Sharqiya province (around 1980)

Area Crop	Cairo Shubra	Rural area Sharqiya
Lettuce	26	0.9
Melon	29	0.8
Watercress	38	1.0
Parsley	32	0.7
Tomatoes	4	0.4
Pepper	5	0.3
Carrots	8	0.5
Turnips	7	0.4

In ppm. Source: el-Fouly, 1992.

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The soil and food contamination invites a different view of the rural-urban fringe interlink. Today, building on agricultural land is strictly forbidden but not enforced, and degradation of soil leads to a passive unsustainable urban integration of rural borders, even though these lands are very valuable and still feed the city. The future of the enclosed or walled agricultural lands, which represent a clear opportunity to organize the fringe urbanization have to be determined.

In 1998-2000, a new express road was completed from Mohandisin to the Alexandria and Six of October city roads. It produces a new phenomena of enclosure, accelerates pollution of water and land and facilitates continued IS illegal extension. And again, there is absolutely no plan to organize the inevitable urbanization of this wide green open space.

3 IS GROWTH LOCATIONS AND TRENDS: SPATIAL ANALYSIS

3.1 Physical

3.1.1 Location and distribution of the IS extension

In general, the residential urban fabric of Greater Cairo increased about 38 sq/km between 1991 and 1998: 2/3 as informal settlements and 1/3 as formal settlements.

The main urban developments occurred in the western part of the city (Giza governorate), and the northern part of Greater Cairo (Qalyubiya governorate) and somewhat less in the southwest. (In this case it is mostly due to the bad quality of the 1991's satellite images where this area is covered by the clouds and prevent the comparison.)

Nevertheless, it is only a slight exaggeration to say that informality is the defining characteristic of those two first governorates (Giza and Qalyubiya) and that it may further increase, while the proportion of informal areas in Cairo governorate seems to be relatively stable.

The main urban extension in Cairo governorate is "formal" (16.3 sq/km out of 22 sq/km) and corresponds roughly to the development of Madinet Nasr and some others sites in the eastern desert. About the IS, its areas represented 23 % of the total area of the governorate included in the area study in 1991 and 23.4% in 1998. In the other hand, the IS surface area of Giza and Qalyubiya represented respectively 70% and 66% of the total area of those governorates in 1991 and mostly 77% for both of them in 1998. Their increasing surfaces represent 15 sq/km for Giza and 5 sq/km for Qalyubiya. (Qalyubiya would be much more if the satellite image sources had not missed the extremely dynamic northeast part of the GCR.

Nevertheless, in Cairo governorate itself, especially in the south, a large amount of green land has been transformed due to IS extension. These extensions have produced many green pockets that are in a very bad condition, highly polluted and with irrigation difficulties.

In the western part (Giza) the rural to urban land conversion area appears in particular in the qisms (districts) of al Haram, the urban fringes of the markaz Imbaba and especially in all the villages that are now included in the urban fabric of the agglomeration (Manshiyyat al Bakari, Saft al Laban, Bashtil…). Most of the urban extension is due to the growth of informal settlements excluding of course the wide private exclusive projects around the new cities that cover 100 sq/km of land sold by the state.

Urban extension in the eastern desert part of the city mostly escapes from the "informal" growth. In fact, most of this area has been built up "formally" all along the eastern part of the ring road,

except some old “informal” settlements as Manshiyyat Nasser located on the eastern part of the cemeteries and more recent ones like Ezbet al Haggana. Anyhow, in general, those expansions, whether formal or not, didn’t follow the recommendations of the 1982 master plan (updated in 1991 and 1997), which excluded any urbanization on this area.

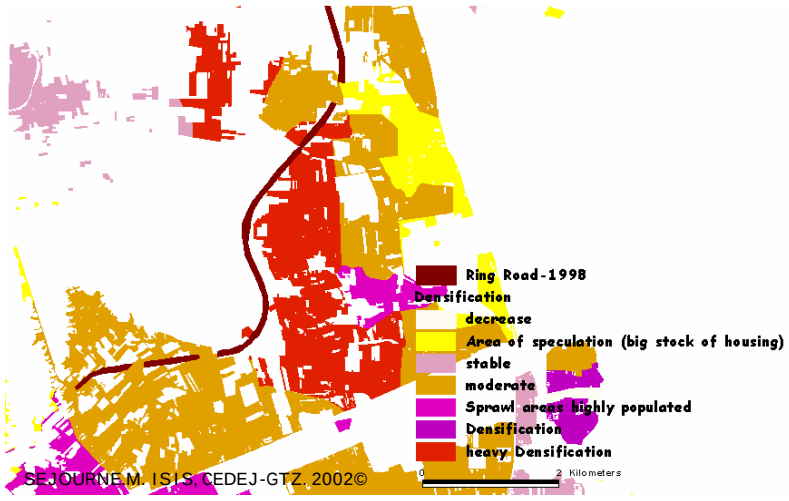
On the one hand, the feature of a non-encroachment in these desert zones is due to the fact, as we mentioned before, that most of the Cairo’s desert was once public land (and therefore prohibited to be developed) subsequently sold by the government. It is now privately owned and devoted to “new cities” and “gated communities” -especially on the west: 6th of October- and the project of New Cairo on the eastern part of the city. On the other hand, it appears far more convenient for any IS to develop on agrarian areas than on desert lands:

- Firstly, because in general a large number of urban families (approximately half of urban households) seek a private agricultural plot to build upon as an investment (most commonly as a result of savings generated from work in the neighboring oil-rich countries);
- Secondly, we can argue that agricultural lands are more suitable as it’s more convenient to connect “illegally” the settlements to any public networks. In particular to water network insofar as it already exist and just need to be extended;
- Thirdly, in terms of accessibility (which also applies to a few districts established on desert land like Manshiet Nasser for example), it’s quite more suitable for the majority of the people living in informal areas to set up a place to live nearby to the city center or activities and industrial places, as they are depending on low cost (duration and financial) mode of transportation such like microbuses or the metro. In this case, districts like Bolak al Dakrour, Imbaba and most of the northern informal zones are more convenient than any “new cities” located in the desert (east and west). For an example, Imbaba, Boulak al Dakrour and also Ard al Liwa are very close to Mohandessin (maximum 2 kilometers distance) and well connected, in terms of transportation especially “informal”, to the city center (about 20 minutes ride). Manshiet Nasser (situated in governmental desert land belonging to the governorate of Cairo) as well, appears to be a “central” place as it is in the border of “old Cairo” were most of the workshops are found.

Proximity of services, cost of connection, distance to the center and accessibility are the major factors that are stimulate the choice to stay or to go to IS.

3.1.2 Decrease VS over-densification

Map 4: Sample of densification and speculation zone
Pyramids Area (Giza)



The spatial decline of the global relation between built up extension and population growth rate suggest a classification and a location of sub dynamics. We observe quite clearly that the strongest densification of informal settlements appears on agricultural land, and in particular on the western part of the city (*markaz* Imbaba, qism Boulak al Dakrour…), inside the ring road, and also in the northeast (*qism-s* al Khanka, al Marg). In the other hand the southern part (*qisms* Badrashin, Tura…) and the center (*qisms* of Sahil, Sharabiyya…) seems to be stable or even decreasing in population. The mature informal settlements like al Haram, some part of Bulaq, etc., seems to be moderate in terms of densification.

It also comes into view that in some parts of these districts the growth of the built up area increased more than population growth rates. It means that there is a large stock of empty buildings or at least vacant dwellings. This is mostly the case near the archeological sites of the Pyramids and Bassatin –close to Ma'adi-, Bulaq al Dakrour –in close proximity of the formal district of Mohandessin-, and Hilwan. We assume that to a certain extent they are regions of speculation. Yet again, it is due to the fact that those areas are close to formal districts connected to all the public networks (sewage, water, electricity…), which make them appealing in terms of investments as a result of their accessibility to public utilities, services and even potential working places. Here, we can notice a second generation of building development with higher standards, which mean more capital invested and the involvement of some contractors. It could link to a certain de-densification but also to higher housing prices in the oldest and nearest IS and a centrifugal dynamic leading to the development of new poor areas outside.

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- **Demographic**

  In the global context of the GCR population growth tending towards IS, at the level of governorate, some differences appeared clearly.

3.2 Distribution of the IS built up and population by governorates

Table 8: Distribution of Informal Settlements area and population by governorate in 1991 and 1998

Governorate	IS pop 91	% of the IS population 1991	IS Area 1991	Total Area	% area IS in the governorate	IS population 98	% of the IS pop in 1998	IS Area 1998	Area Total	% area IS in the governorate	Growth rate of IS population
Cairo	2356028	43	37,8	163,9	23,0	2721397	40	43,5	185,9	23,4	2.47
Qaliubiya	755991	14	14,8	22,4	66,1	1140974	17	19,7	25,7	76,7	5.25
Giza	2310217	43	51,5	73,7	69,8	2981710	44	66,4	86,5	76,7	3.61
Greater Cairo	**5422236**	**100**	**104**	**260**	**40**	**6844082**	**100**	**129,6**	**298,1**	**43,5**	**3.38**

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The annual growth rate of the population living in IS in Cairo governorate (2.47%) is closed to the global growth rate of informal population at the Greater Cairo scale, but it still sheltered a large part of new households: about 360 000 inhabitants between 1991-1998. This annual growth rate is mostly comparable to the one of the whole city (including formal and informal), which reached 1.9. Nevertheless, this rate hides a lot of disparities that emerge inside the governorate. To give an obvious example, the *shyakha* of Tura al Asmant (*qism* of Tura) has a annual growth rate of 22.3, al Mahagar (*qism* of Manshiet Nasser) 34.93 while some *shyakhas* of the central *qism* al Khalifa have a negative growth rate. The old IS are also affected by the "de-densification" process that touches all central districts of Cairo. Even so they still have a very high density, between 800 and 1500 inhabitants per Ha.

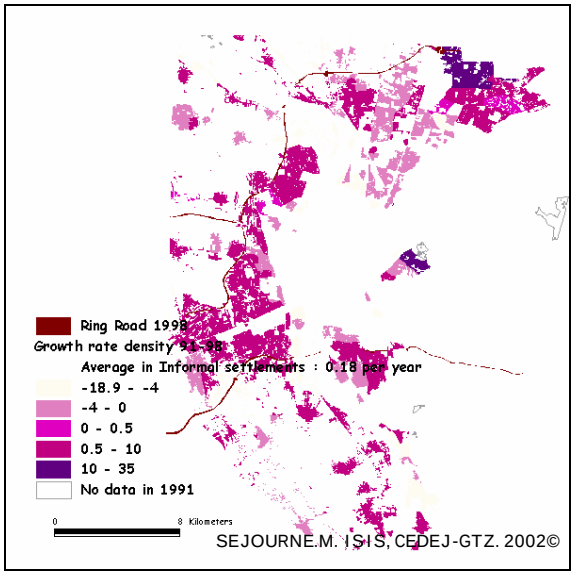
Qalyubiya's IS annual growth rate (even if our study area doesn't cover the whole governorate) is the highest (5.25%). Qalyubiya IS have sheltered more than 380 000 new inhabitants between the two dates covering our study.

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The informal settlements of Giza governorate housed the largest share (47%) of the "new" population, estimated at more than 670 000 inhabitants with an annual growth rate of 3.61%. This appears to be quite logical if we take into account that it is where the morphological growth was the strongest during the period 1991-1998. So, we strongly presume that this governorate is where the pressure and the densification will persist and even increase, as a rapid look to the annual growth rate of densities shows. Effectively, most of the IS of Giza governorate have a growth rate of densities between 1 and 10 while the average of the Greater Cairo IS is 0.18 per year.

And even some mature IS like Munira, Madinat al Ummal or Madinat al Tahrir (*qism* Imbaba) seem to follow this over densification trend (with a density growth rate of more than 0.7) even if they already reached a maximum density: more than 1600 inhabitants/Ha.

Map 5 : Growth Rate of Densities in Informal Settlements 1991-1998



Those informal settlements largely explain why Cairo is one of the densest cities in the world, after Indian cities like Bombay.

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- **Housing stock and vacancies**

  As we have seen previously, there are quite a lot of "speculation" areas in Cairo, whether they are located in formal and informal settlements. The number of empty units at the scale of Greater Cairo reached more 1.27 million in 1998. This can easily be demonstrated by an analysis of the vacant units located all over the metropolis.

  In the whole of the Greater Cairo Region we note that 27% of the units are considered vacant or unfinished. It also appears to be roughly the same range at the level of the 3 governorates composing Greater Cairo: Giza has a share a little bit higher: 30%, Cairo governorate : 27%, and Qaliubiyya 23%.

  We assume that a large share of this phenomenon is the direct consequence of the speculation in the construction sector especially the one occurring in the new cities like 6th of October, New Cairo, which take the form of "gated communities" (estimated to represent roughly 60 000 units), but also in some mature districts such as Madinet Nasr, which had more than 110 000 empty units in 1998.

  But even informal areas witnessed the same trends, as we estimate that 46% of the vacant dwellings in Greater Cairo (in 1998) are found in informal settlements. this represent about 582 000 units. In spite of the decrease of activities of the construction sector, this phenomena seems to increase as the share of empty units in IS was 36% in 1991. The majority of the "vacancy" takes place in Giza governorate (22%) and especially on the agricultural fringes, alongside the ring road. In those areas we can even perceive a "new trend" in terms of speculation. Till the early 90's the purchase of land and the construction of a building (mostly reserved for a personal use or to the people of a whole family) was a way to invest the money accumulated from the period of work in the oil-rich countries. In the best case, those buildings never exceed 4 or 5 floors. Now, we remark the growing fact of high building neighborhoods counting sometimes more than 15 stories. This is happening particularly in those "recent" IS like Kafr al Tohormos (Giza).

  In Cairo Governorate, the share of empty units slightly decreased as its respective percentages were 16% in 1991 and 15% seven years after. In Qalyubiya the rates rosee a bit from 3% to 8%. In the case of Cairo governorate it seems due to the fact that there is now no more vacant lands to support the extension of IS or investments in IS, even in terms of squatting, as the entire desert around the metropolis has been privatized and reserved for the "compounding process". Unlike many developing countries, in Egypt there is virtually no squatting of or invasion on private land.

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One of the only exceptions in terms of speculation on desert land that we noticed is the case of Manshiet Nasser district that is squatting governmental terrain. The strongest urban expansion occurs on the area called Wadi Pharaon, behind the Moqatam hills. It consists generally of small "huts" absolutely unconnected to any public network or services.

We presume that this is the result of the implication of international development and upgrading projects that take place in this area (like the GTZ project), as well as the implementation of public sewage networks, which, in a certain way make this area quite more secure and less subject to eviction. These arguments can also be applied to other areas all around the city. Anyway, to a general extent, there is little arbitrary eviction and demolition of residential property in Egypt, even if the tenure is "illegal". If the property is occupied, demolition is impossible unless alternative housing is offered by the concerned authorities (governorate, ministries…). Even the alternative public housing will be considered by those who are assigned it as part of resettlement as an asset to be sold as soon after occupancy. And then they will be back in their IS or in an alternative one.

To conclude, as we mentioned before, according to the number of vacant units (or about to be completed) we assume that there is no need to built any more dwellings for the next 14 years to "absorb" the coming new households settling in IS (estimated to be 42 000 per year). In the same manner, the established empty units in formal districts, estimated to be more than 690 000 in 1998, can shelter the coming population for the next 130 years without any new construction!

Table 9: Proportion of empty units by governorate, divided by types, 1991-1998

	% of empty units total 91	% of empty units total 98	% of empty units informal 91	% of empty units formal 91	% of empty units informal 98	% of empty units formal 98
Cairo	59	52	16	43	15	37
Qaliubiya	8	12	3	5	8	4
Giza	33	36	17	15	22	13
Greater Cairo	**100**	**100**	**36**	**64**	**46**	**54**

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Table 10: Proportion of occupied and vacant units by governorate in 1998

	total units 98	occupied units 98	% occupied units 98	vacant units 98	% vacant 98
Cairo	2474927	1811241	73	663686	27
Qaliubiyya	680437	525781	77	154656	23
Giza	1542901	1087650	70	455251	30
Greater Cairo	**4698265**	**3424672**	**73**	**1273593**	**27**

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Table 11: Surplus units by governorate, divided by types 1991-1998

Governorate	surplus units total 91	surplus units informal 91	surplus units formal 91	surplus units total 98	surplus units formal 98	surplus units informal 98
Cairo	390437	107494	282944	663686	468874	194812
Qaliubiyya	52900	19126	33774	154656	50545	104111
Giza	213736	112931	100805	455251	171536	283715
Greater Cairo	**657074**	**239551**	**417522**	**1273593**	**690955**	**582638**

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Table 12: Units and households by governorate, divided by types, 19911998

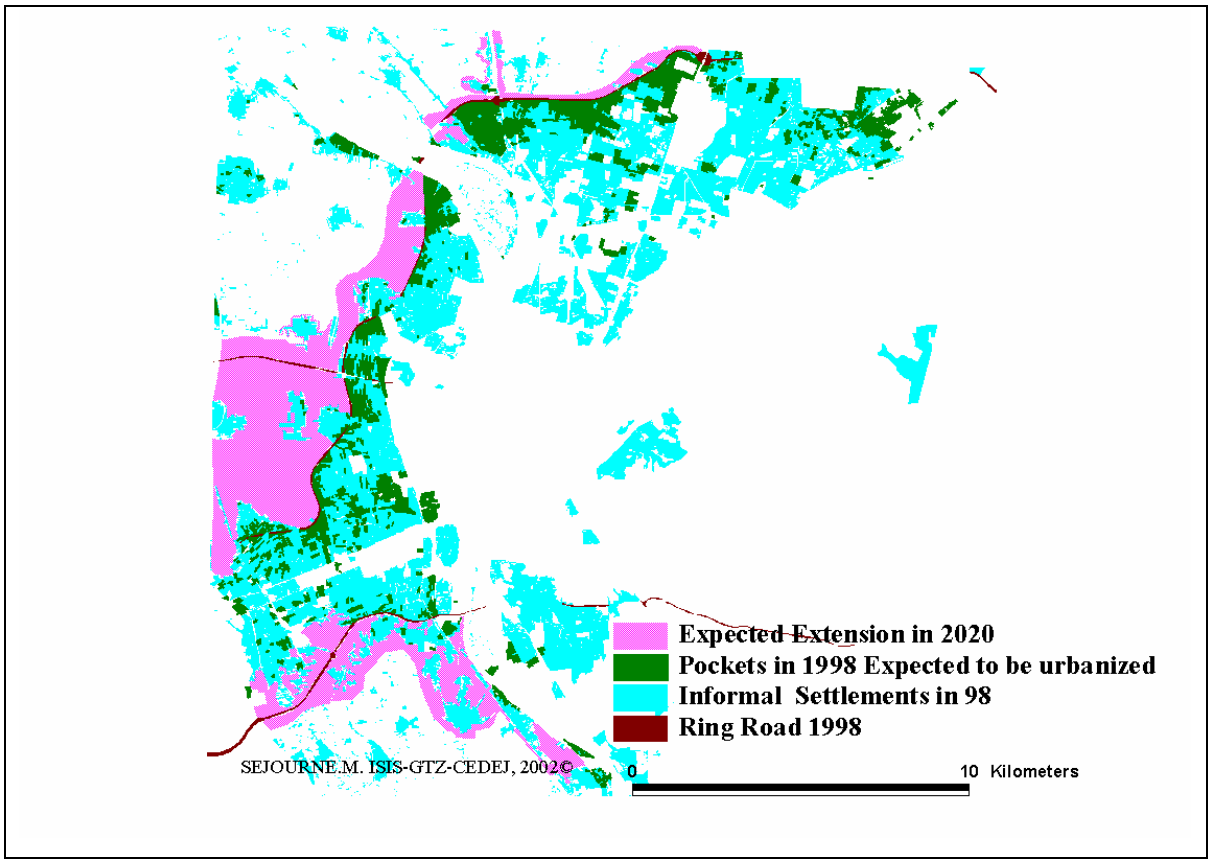
Governorate	Hhs 1991	Hhs in IS 1991	Hhs 1998	Hhs in IS 1998	Units 1991	Units in IS 1991	Units 1998	Units in IS 1998
Cairo	1 496 970	377 549	1 811 241	551 770	1 887 408	485 042	2 474 927	746 582
Qaliubyya	389 393	249 687	525 781	367 568	442 293	268 814	680 437	471 679
Giza	820 217	577 059	1 087 650	802 526	1 033 953	689 991	1 542 901	1 086 241
Greater Cairo	**2 706 580**	**1 204 296**	**3 424 672**	**1 721 865**	**3 363 653**	**1 443 847**	**4 698 265**	**2 304 503**

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4 IS CONTINUING EXTENSION SCENARIO

If the trend of IS expansion continues without any deceleration, the IS will represent 66% of the population of the GCR population in 2020 (10.2 millions inhabitants) and more than half of it's residential build up area (202 sq/km). IS will shelter 3,8 millions inhabitants more (or 3.9 millions if we use the constant population growth rate by governorate) and 72 sq/km of green land will be transformed in some densely popular outskirts. Since our analysis doesn't cover all the built up area of GCR and specially the extremely dynamic northeast part (Qalyubiya governorate), this assumed IS built up extension is probably underestimated.

Map 6: IS Extension Expected in 2020



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Table 13: GCR population in 2020 with a constant growth rate

	Constant Growth Rate 1986-1996	Population distribution 2020	Demographic growth 1996-2020	Built up distribution 2020 (in sq/km)	Built up extension 1996-2020
Informal	3.38	10 198 353	+ 3 794 835	202	+ 72
Formal	0.30	5 259 967	+ 216 026	196	+ 28
Total	1.90	15 458 320	+ 4 010 861	398	+ 100

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We strongly think the main urban extension will occur all along the Ring Road (inside and outside) on agro lands and particularly on the western and northern part.

Table 14: Expected IS Extension Zones Horizon 2020

Extension Areas (2020)	*Area in sq/km*
Extension on pockets and green areas transformed on pockets	22
Giza (area between the Ring Road and 26th July Corridor)	20,5
Area between the Ring Road and Pyramids street	3,6
Giza : outside the ring Road	22
Qalyubiya : outside the ring road	3,8
Total	**72**

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First of all, we can consider as "on the way of urbanization" the green pockets of 1998 as they were already largely subjected to pressure and might be urbanized in an intensive mode considering current trends (as we mentioned before in the study). This means that an area of roughly 22 sq/km (included the green areas which were transformed to pockets due to the construction of the Ring Road) of green pockets will turn into built up areas at the horizon year 2020.

We also assume that one of the first zones that going to be under pressure of extension and densification will be the one located between the 26th of July Corridor and the Ring Road (in Giza governorate). This zone is already subjected to high pressure and is completely enclosed. Therefore, in a certain way, as we mentioned above, these areas are no more "suitable" for agriculture, and, on the other hand, are more "accessible" and "exposed" to urbanization processes. We estimate that this area will reach approximately 20.5 sq/km (and this represents only the area covered by the satellite imagery of 1998).

In addition, and according to field work, we expect that the strongest expansion will take place all along the ring road, in Giza governorate, as well as the northern part of the city in the governorate of Qalyubiya (mostly outside the coverage of images) as they have higher growth rates (respectively 3.61 and 5.25 according to a constant growth rate of population of each governorate between 1986 and 1996). Both together may shelter more than 2.9 millions inhabitants more within 14 years.

Table 15: IS population in 2020 with a constant growth rate of IS by governorate

Governorates	Growth rate 86-96	IS population in 2020	Demographic growth 1996-2020	IS pop % in 2020
Cairo	**2,47**	3583024	+ 1 036 808	35
Qalyubiya	**5,25**	2185187	+ 1 117 659	21
Giza	**3,61**	4583448	+ 1 793 675	44
Greater Cairo		10 351 659	+ 3 948 141	100

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This extension might happen on the zone located between the Pyramids street and the Ring Road, which mean an area of roughly 3.6 sq/km. This will be the result of an extension of the built up till the desert (on the west) and for the major part an active “stuffing” process on green pockets and agro land inside the ring Road.

Outside the Ring Road (district of Munib, of Gezirat al Dahab, of Abu al Numrus…) and on the southern part of the west bank of the Nile (Giza *Markaz*) we estimate that the extension will reach 21 sq/km in Giza governorate. In the part sited on Qalyubiya governorate the expansion is expected to be 3.8 sq/km.

In Cairo governorate the main problem lies in the fact that there is no more land to expect the future growth. Nevertheless, if the population growth rate is constant (2.47), this governorate is supposed to shelter about 1.05 millions more inhabitants in 2020. The only potential “available” space to receive the growth is the northern part of the governorate (district of al Marg) which already registered very high densities (about 800 inhabitants/Ha and sometimes more than 1500), and is located on agricultural land. As we have seen before, there are no opportunities on desert land since it is completely privatized and reserved for private urban developments.

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The result expected in Cairo Governorate mainly, but also on the others governorates, is an increase of the already extreme densities and a “cram-in” process inside the already existing built up, thus a rapid disappearance of potential open spaces to implement public infrastructures and services.

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Results, proposals and future activities needed

Contrary to what a lot of studies or public discourses showed or said till now, there is no better mastering of the metropolis, as well as no decrease of the informal settlements growth, either in terms of physical extension nor population. Nothing demonstrates that the “informal process” will disappear or even decrease in spite of the increasingly unrealistic strict legal and regulatory framework, which in a certain way participated to generate the “informal phenomena”. In a certain way, the urban and planning regulation structure implemented since the late 60’s did not offer any chance for the majority of Egyptians to built a house in a “legal” way. One of the first laws regulating the urban informal sector appeared in 1966 and was enforced by the Prime Minister Decree of 1996. Those laws strictly forbid any construction on desert and agro land. At the same time nothing was implemented to promote a place to live (either private or public), at least for the poorest. In this context, informality was the only solution affordable for most. Formal regulation is a main reason for IS development, the second one being the wasteful management of land use and the extensive public land asset.

However, a main problem is the massive lack of public services (water network, sewage, paved streets but also schools, hospitals, youth centers…). In general, the majority of the IS also suffer from a huge problem of accessibility. This is getting more and more serious because of the disappearance of vacant land that could be used to public utilities. In some places now there is NO land available to introduce this kind of infrastructures and services. This is generally the case in districts established on agricultural land, as most of the green pockets are in process of urbanization and are anyway privately owned. Any solution –followed by real action -- has to be taken very rapidly for the reason that, as this study showed, the inner green pockets will entirely disappear within 3 years. In this case there is a strong need for the governmental authorities to concentrate their action and to invest on the few public lands still available for utilities and services (like the Imbaba airport or the agricultural fields of the Ministry of Agriculture and University). We assume that the governmental efforts have to be made in this way as, from experiences, the accumulation of laws forbidding the informal constructions have demonstrated that they have little effect in terms of erasing or even reducing the process. For the districts established on desert terrain the problem is also serious. Even if the land belongs to the State there are not a lot of possibilities, as we have seen that most of the desert surrounding Cairo is

now private, as well as in terms of “vacant” land inside those districts. Most of them are also under the process of “squaterization” and “cramming”.

Anyway, no matter the tenure status of those districts, we believe that the dichotomy “formal” versus “informal” doesn’t have to be the point of any political actions. The government anyhow can’t continue to not take into account the fact that the informal sector was, and still is, the only manner to have shelter for most of the people and participate to the process of urbanization in Cairo (and by extension, in the whole Egyptian territory). Also, the government cannot ignore that the informal sector has kept a certain political tranquility as the informal process replaced the role of the State in the matter of housing the poor.
Even in this time of globalization and reduction of State expenditures (IMF, World Bank), it should be clear that now the government must concentrate efforts to provide at least the minimum required infrastructure and services to those areas which represent more than half of Greater Cairo’s population!

In addition, many things could be done or improved in terms of security of tenure, even though Egyptian informal settlements do not suffer much from an arbitrary demolition or eviction. This “effective” tenure could permit people to invest on their environment (houses, buildings, and even neighboring public spaces), as they will be absolutely assured of their investments’ security. It will also authorize them to participate to the housing market and maybe stop speculation practices, which avoid the access to housing for the large majority. With this kind of security of tenure, and added to it a new ruling framework concerning the renting process, there might also be opportunities of housing to those whom cannot afford to buy a flat. It will place them in a better position to ask for public intervention and also have access to credit opportunities like the mortgage law or micro credits.
But at the same time, the trend behind the legalization has to be monitored to avoid new popular extensions. We have witnessed a second generation of building located in the more accessible IS fringe which are not affordable for the “standard” population of IS. They are becoming middle class inner-city quarters and at the same time the popular families are obliged to find shelter further and further away on agricultural fringes and this is increasing the IS process around villages. So legalization has to be accompanied by a mastering of land use and management of public land in the desert.
We could suggest that the area between the ring road and the 26th July Corridor in Giza could be an excellent test zone to implement a land use regulation exercise. Regarding the present IS

dynamic; this area will be totally urbanized and densely settled within the next 20 years. An alternative is to develop concepts to promote the urban agriculture with a different status from agriculture in general and to quantify and enforce the future uses (density and activities) of any open places for the next 20 years in this area. In general, all the pockets and green areas have to be quantified and have to be monitored as an intermediate category of green open land and not as rural zones. The extension of those areas has to be defining, taking into consideration the unavoidable IS sprawling.

If no study is able to say what is exactly the global consequence of IS improvement and integration for the future popular sheltering and the inevitable seeking of the poor for less expensive places, the creation of alternative popular settlements on desert lands should not be neglected, even though it is quite late in the game. That is to say, desert development has to be clearly evaluated, mapped and opportunities detected and controlled.

On the other hand, the IS dynamic shouldn't be separated from the general analysis of both housing and land markets. In addition, a major reflection should be opened concerning the question of vacant housing in order to locate and to quantify it.

In terms of GIS research, this project must be followed and could be improved by a more detailed study to produce alternative information fitting with the new approaches and detailed approaches of physical changes. We might provide an assessment at a smaller scale accompanied by case studies of some areas in order to show the need of those IS in terms of services and public utilities and to assess the "still" available empty land that could be used for those infrastructures. This could be done by using the satellite imagery of Ikonos 2000 (1 meter resolution) and CAPMAS datas and maps. But above all this project also has to involve all the stakeholders in charge of the urban planning and management like the Ministry of Housing and the general Organization for Physical Planning, Governorates (and all their associated departments and local units), the Ministry of Local Development, etc.

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Annex

Annex 1 : Methodology

The first product is a series of layers that are localized the land use in 1998 and a other one giving the 1991 land use by difference both with a specific focus on informal settlement (IS). Areas defined as IS are the totality of urban settlements built after 1940 and not integrated in a public or private land development plan. All the information are subdivided at the level of shyakha and connected with demographic data coming from census 1986 and 1996.

The basis of the GIS database which is geographically completely fitting with the footprint of building from 1/5000e maps produced by CAPMAS are based on satellite images from Indian Remote Sensing (IRS) for 1998 and Russian Spin 2 for 1991. The first has a precision of 6 meters and the first one 2 meters but it not available for the whole areas considered for the study (750 sq/km centered on Cairo). We used also a mosaic of 8 meters Spin 2 images to complete the information but it gives some geographical distortion. It fits only “on the fly”, area by area. Nevertheless, after many cross checking, with CAPMAS data, and land surveys, we assume that information provided are precise at the 1/5.000e scale with the possibility of 10 meters shift. The 750 sq/km kilometers doesn’t cover the whole Greater Cairo Region. Only 80% to 90% of informal areas and the entire formal city except the recent extension on desert are considered in the study. We lost, a part of northeast Cairo between Shubra al Khayma and al Salam, and the south of Hilwan. Also the trend for some villages in Giza could not be stressed regarding a bad weather and pollution giving some clouds on both images.

To compare population of 1986 and 1996 with the physical information of 1991 and 1998, population has been projected based on growth rate between 1986 and 1996. Residential built up has been divided by shyakha and qarya for rural areas considered and population affected to those areas in order to define precisely the densification trend and rhythms of built up sprawling. Formal and informal population is also divided at this scale. Share of population of informal area by shyakha is proportional to the share of the informal area in 1991 and its growth rate is the same as the whole population of the shyakha between 1986 and 1986. In the case, of the shyakha where the whole population decline between 1986 and 1996 but the share of the informal area continue to growth between 1991 and 1998 we use the informal built up growth rate and we apply it to the population. If the population decrease and the physical share of informal settlement is stable, we consider also the “informal population” as constant. Other data, as building information, are dispatched regarding the same methodology.

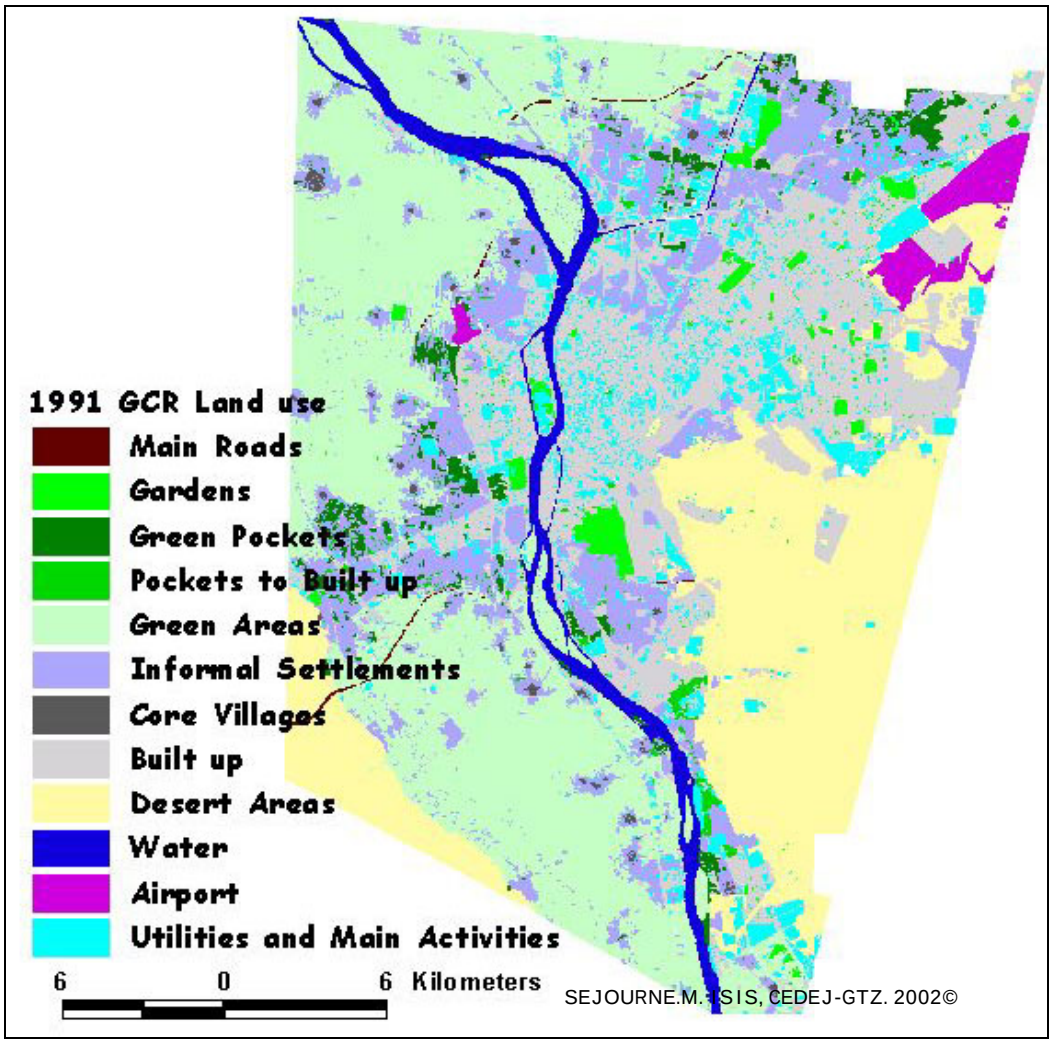
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Public facilities as administrations, water plant or schools have been excluded from the residential built up area as the main activities buildings (industries, shops and offices). Of course mixed building with activities and building are included. It is not the net build up area, which needs also to extract the roads. Data and time was not available for this activity in this project. The sources for extraction are IGNESA 1/5.000e maps from 1977 and actualization with different more recent maps and surveys.

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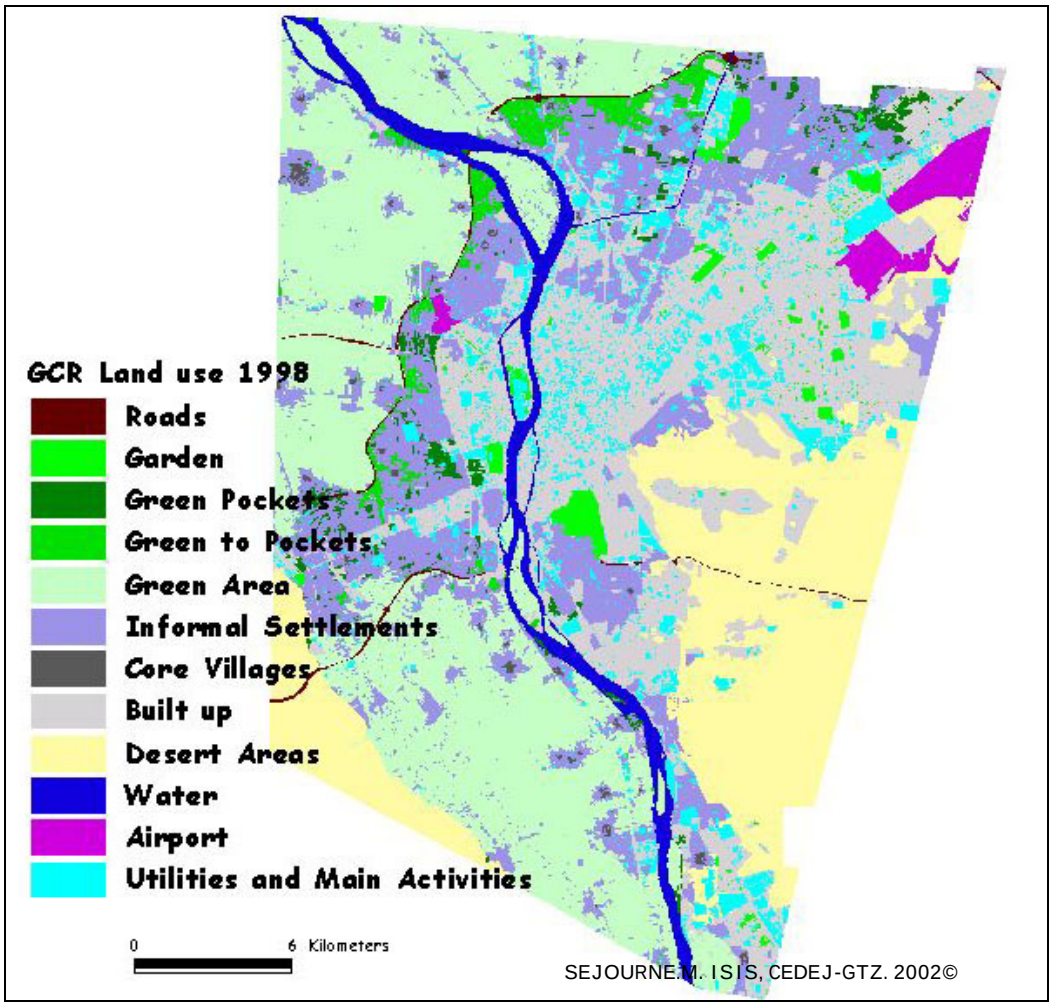
Annex 2 : Maps of Cairo Land use in 1991 and 1998

Map 7: 1991 Greater Cairo Land use



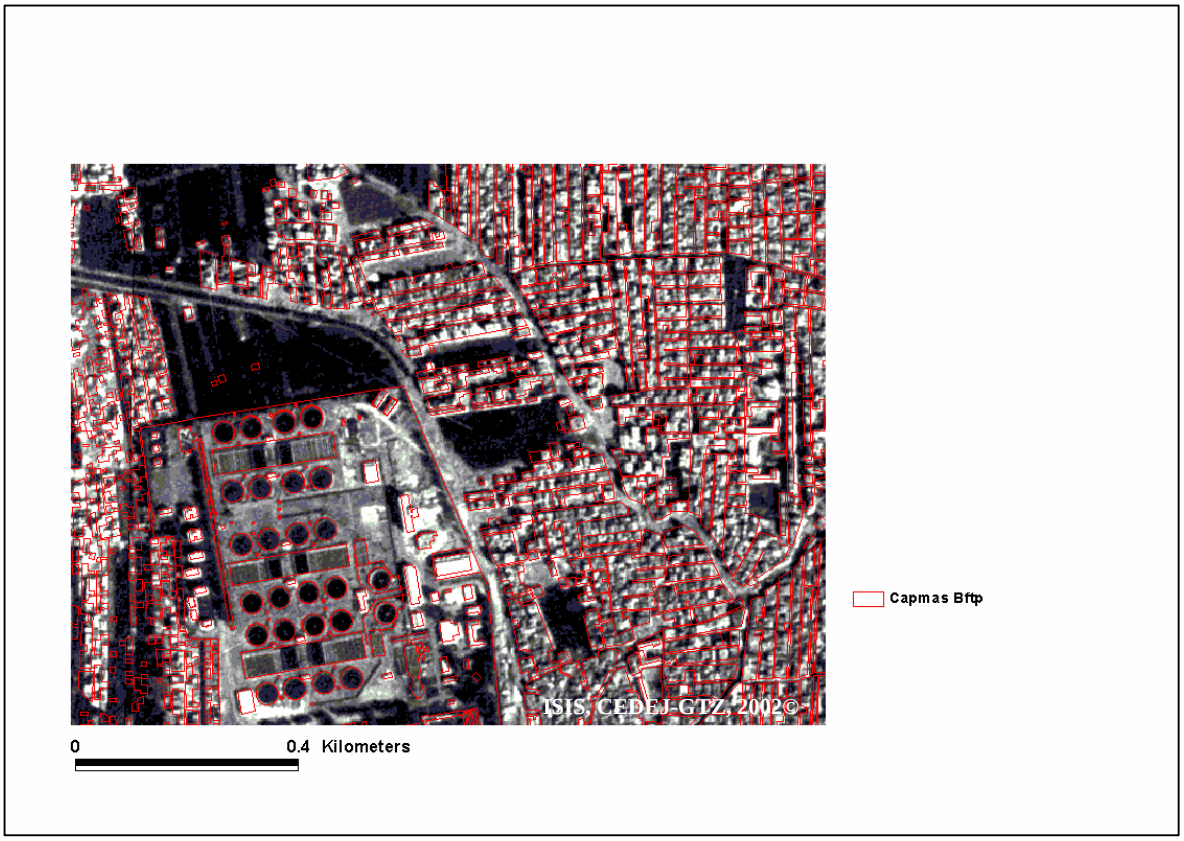
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Map 8: 1998 Greater Cairo Land Use



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Map 9: Overlapping of 1991 satellite imagery (SPIN2, 2 meters resolution) and Building foot print of CAPMAS (1994), Area of Bulaq al Dakrour.



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- **Services and infrastructure in the informal settlements**
- **IS capture and shelter most new families**
- **IS have still a wide potential for growth**
- **General conclusions**

1 GENERAL ANALYSIS: A DENSIFICATION WITHOUT STRUCTURE

1.1 Our approach compared to recent studies of IS phenomena

1.2 Absorption of green land a tremendous process

1.3 IS as the regular popular home

2 THE "CRAM-IN" OR "STUFFING" PROCESS, BLOCKING LAND AND PUBLIC INTERVENTION OPPORTUNITIES

2.1 The Disappearance of Green Pockets

2.2 Ring road and the control of IS extension

2.3 Producing Degradation of Agricultural Land

3 IS GROWTH LOCATIONS AND TRENDS: SPATIAL ANALYSIS

3.1 Physical

3.1.1 Location and distribution of the IS extension

3.1.2 Decrease VS over-densification

- **Demographic**

3.2 Distribution of the IS built up and population by governorates

- **Housing stock and vacancies**

4 IS CONTINUING EXTENSION SCENARIO

Results, proposals and future activities needed

Annex

Annex 1: Methodology

Annex 2: Maps of Cairo Land use in 1991 and 1998

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Table 1: Changes between 1991 and 1998

Table 2: Average Annual Loss of Agricultural Land 1976 – 1992

Table 3: Land use in 1998 and changes 1991-1998

Table 4: ISIS population and areas of Greater Cairo in 1991-1998

Table 5: different studies results concerning informal settlements

Table 6: Concentration of heavy metals in the soils of Shubra al-Kayma district compared to a remote area in Sharqiya province (around 1980)

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Table 8: Distribution of Informal Settlements area and population by governorate in 1991 and 1998

Table 9: Proportion of empty units by governorate, divided by types, 1991-1998

Table 10: Proportion of occupied and vacant units by governorate in 1998

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Map 2: Samples of Changes between 1991 and 1998

Map 3: Disappearance of Pockets between 1991 and 1998 in Giza Area

Map 4: Sample of Densification and Speculation zone – Pyramids Area (Giza)

Map 5: Growth Rate of Densities in Informal Settlements 1991-1998

Map 6: IS Extension Expected in 2020

Map 7: 1991 Greater Cairo Land Use

Map 8: 1998 Greater Cairo Land Use

Map 9: Overlapping of 1991 satellite imagery (SPIN2, 2 meters resolution) and Building foot print of CAPMAS (1994), Area of Bulaq al Dakrour.