War and internal displacement

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World Bank

Forcibly displaced

In 2026:

67.8 million
Internally displaced people

Refugees
42.5 million

In 2015:

- **40.8 M** conflict induced IDPs worldwide
- **8,564,420** new IDPs, half in Middle East

This project

I use geographical data of conflict and internally displaced persons in Iraq to study how conflict displaces people over space and time

Questions

1. Where do people go when they are forcibly displaced by conflict?

Results

1. IDPs are concentrated within 20 miles of conflict
2. Highest concentration within 2 miles of conflict locations, decreasing with distance and time, and disappearing beyond 70 miles.
3. People choose locations in highly populated areas, within 5 miles of a main road.
4. Areas without a clear ethno-religious majority, host more IDPs relative to other areas.

Methodology

1. Non-linear network model with spatial parameter restrictions

Prediction challenges for emergency responses

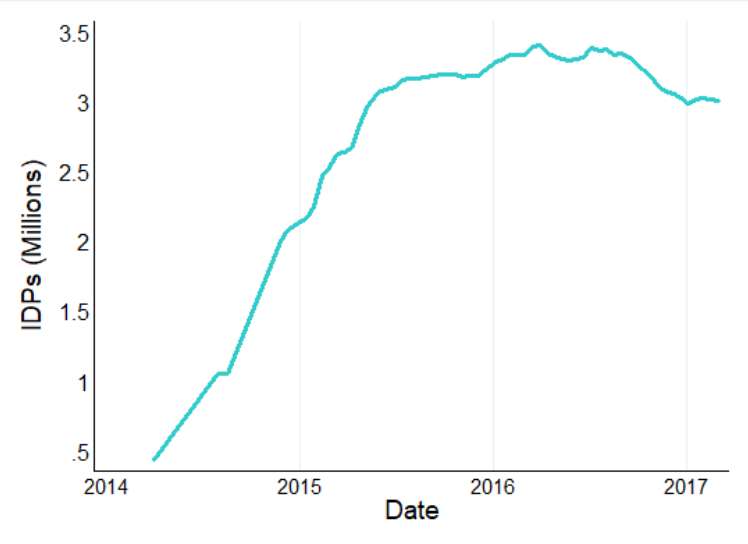
In 2006 and 2007, the scale and timing of forced internal displacement in Iraq were difficult to forecast accurately. As a result, the mismatch between IDP waves and the delivery of emergency assistance led to a humanitarian crisis (Chatty and Mansour, 2011).

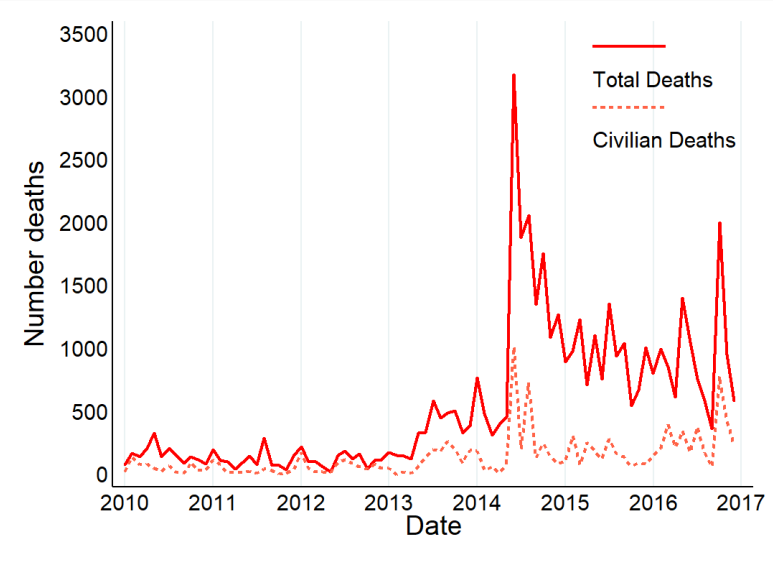
Yazidi girl from Sinjar displaced in Faysh Khabur. August 2014 by Youssef Boudlal

Background

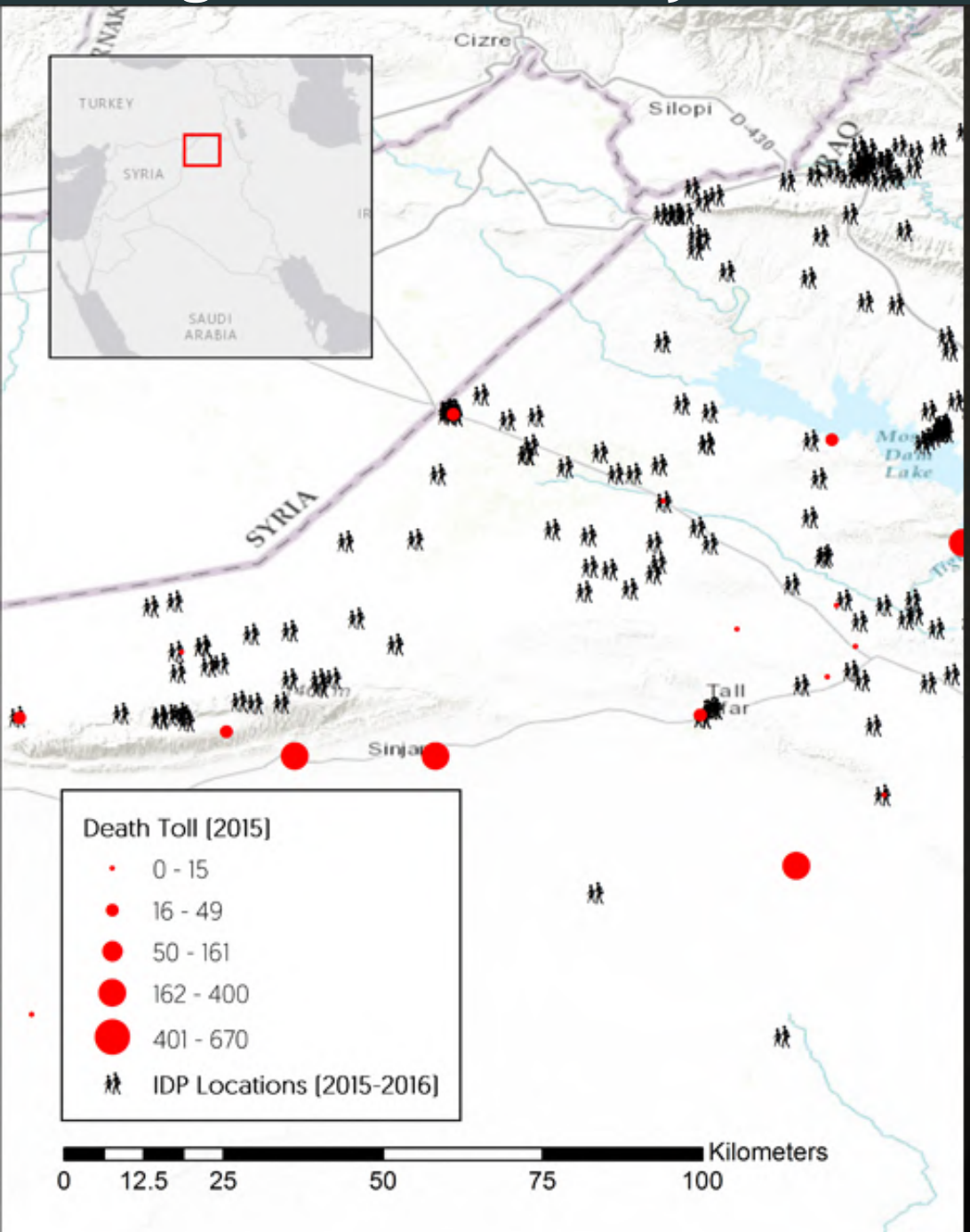
Background: Iraq Politics (2006-2014)

- Shia Prime Minister of Iraq (2006-2014)
- Arab Spring arrives to Iraq in April 2011
- Pacific protests violently repressed from April 2013
- Increasing levels of conflict lead to a civil war in 2014





Background: Case Study - Nadia Murad



Background

1) Conflict and IDPs are spread geographically and over time
   - Over 3 million IDPs, 58.2% underage
   - 58% Sunni and 29% Shia
2) ISIS is involved in 98.4% of conflict events
   - 75.6% - ISIS fighting the Government of Iraq and allies
   - 22.8% - ISIS murdering civilians
3) Generalized violence is the main cause of displacement
   - Not lack of economic opportunities or ethnic/religious reasons
4) IDPs are waiting to go back home as soon as it is safe
   - Not locally integrate, resettle, or become refugees
   - Only 3% of IDPs are in camps

Data

Data: Sources

- **Conflict**
  - Uppsala Conflict Data Program (UCDP) - Geocoded Event Dataset

    Gleditsch et al. (2002); Melander, Pettersson and Themnér (2016)

- **Internally Displaced Persons (IDPs)**
  - IOM DTM Master Lists
  - IOM DTM Group Assessments - Surveys

- **Geographic data**
  - World Pop, Open Street Map, Landscan, ESRI Database, ESOC

Data: Conflict layer

UCDP GED - 3,379 observations from 2010 to 2016

- Period of **2,550** days
- **3,379** conflict events at **1,468** different dates
- **307** different locations

► Features: *start and end dates, type of conflict, factions, combatant deaths and civilian deaths*

Conflict event definition:

"An incident where armed force was used by an organised actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date".

Data: IDP layer

IOM DTM - 217,375 observations

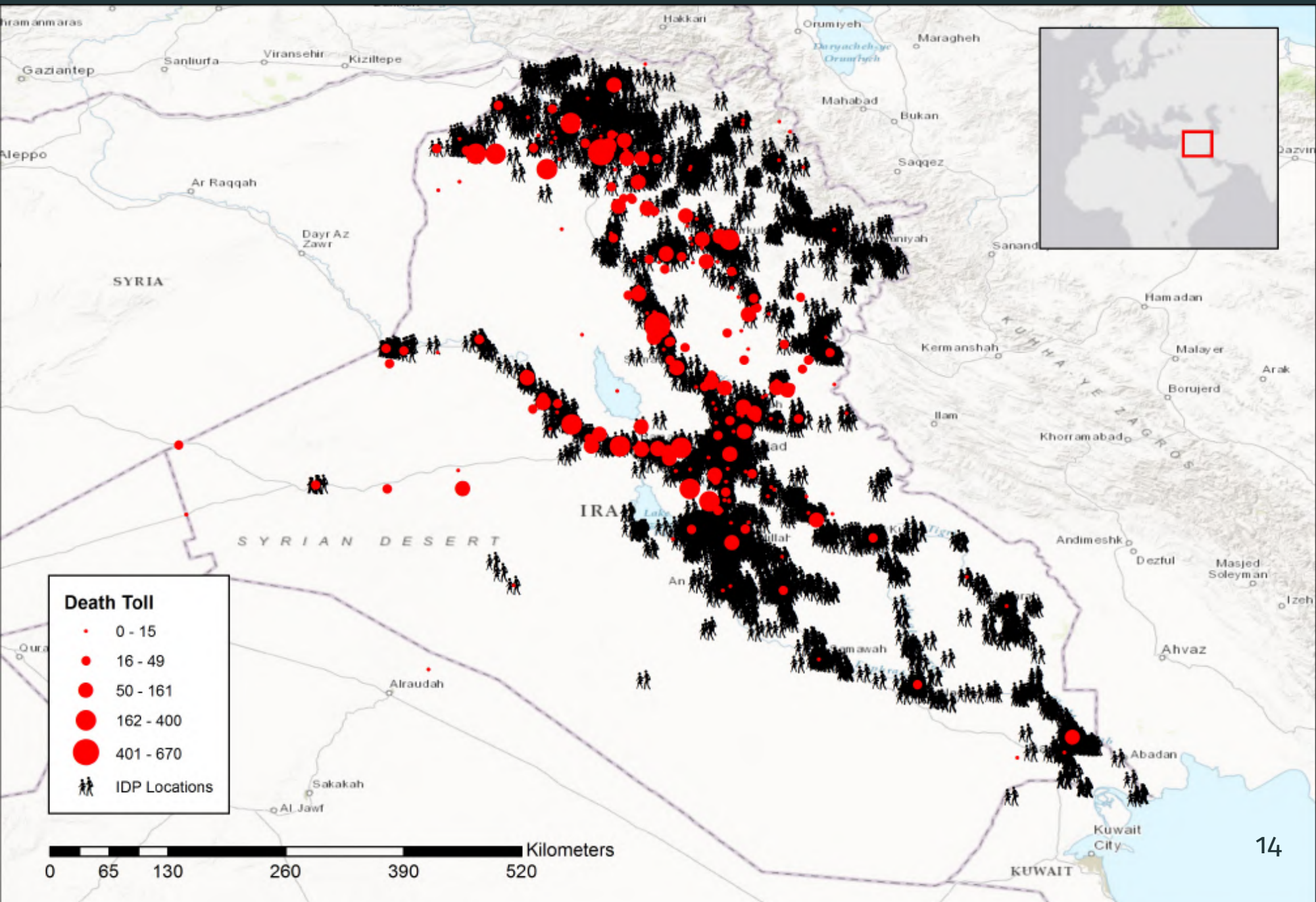
- From **815** to **4,634** locations - Unit of observation
- **68** time periods - From April 2014 to March 2017
- Features: *number of families, number of individuals*

- DTM defines the recorded IDPs to be ISIS-induced
- 4,000 key informants and 140 field staff track IDP locations

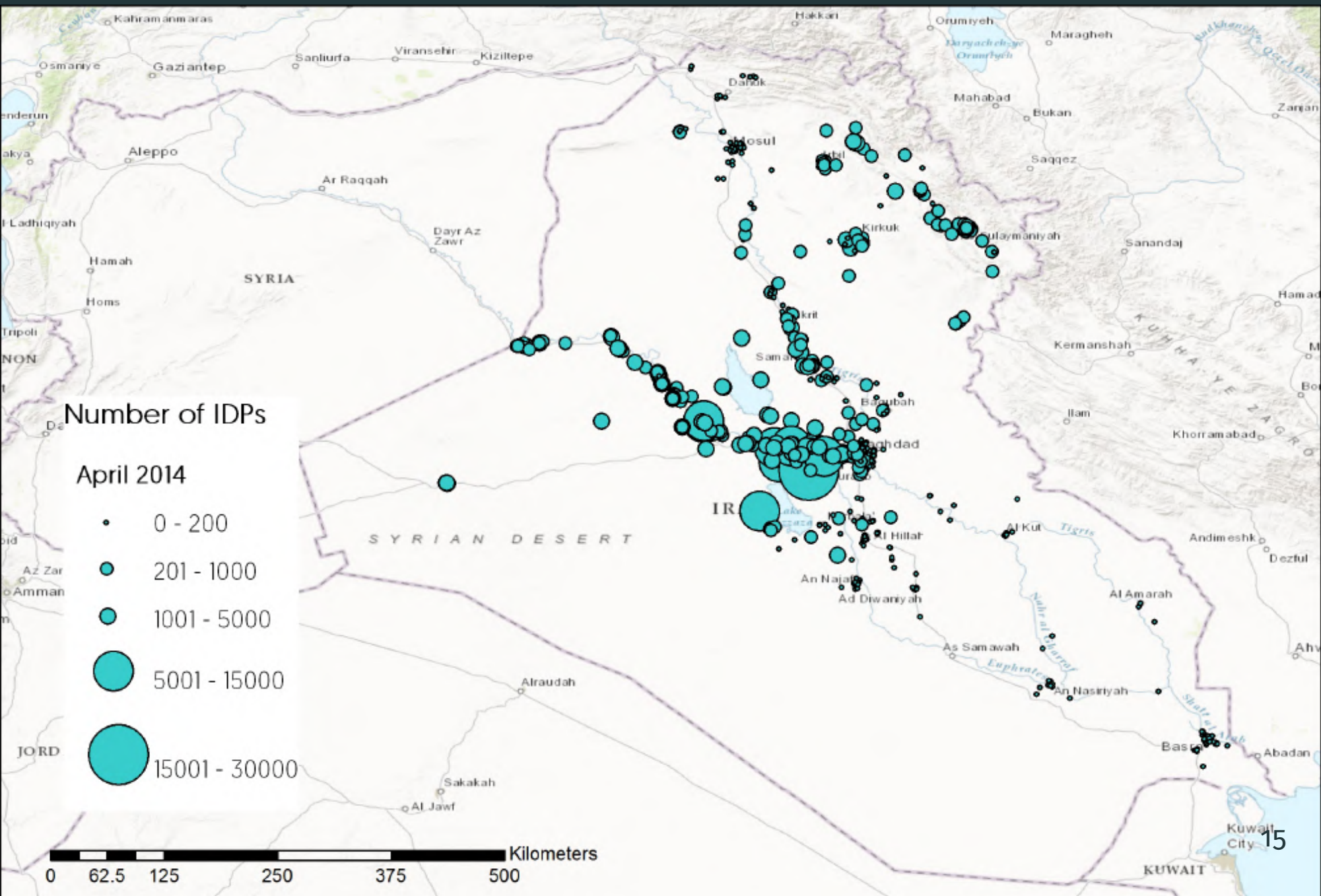
*DTM is funded by the US State Department's Bureau of Population, Refugees, and Migration (PRM); the Swedish International Development Cooperation Agency (SIDA), and the United Nations (Iraq Humanitarian Pooled Fund - IHPF).

Descriptive Analysis

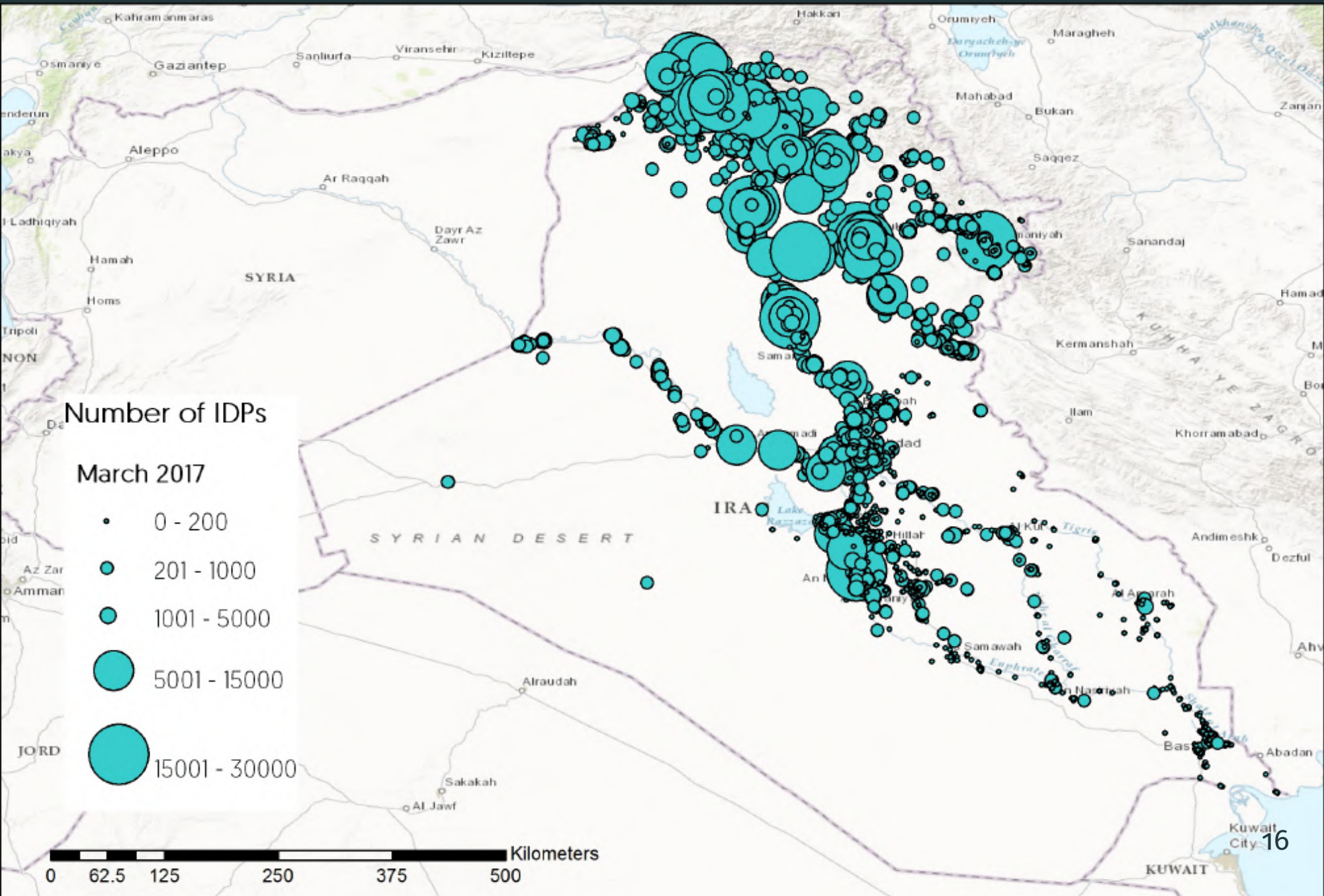
Descriptive Analysis: Conflicts and IDPs (2010-2015)



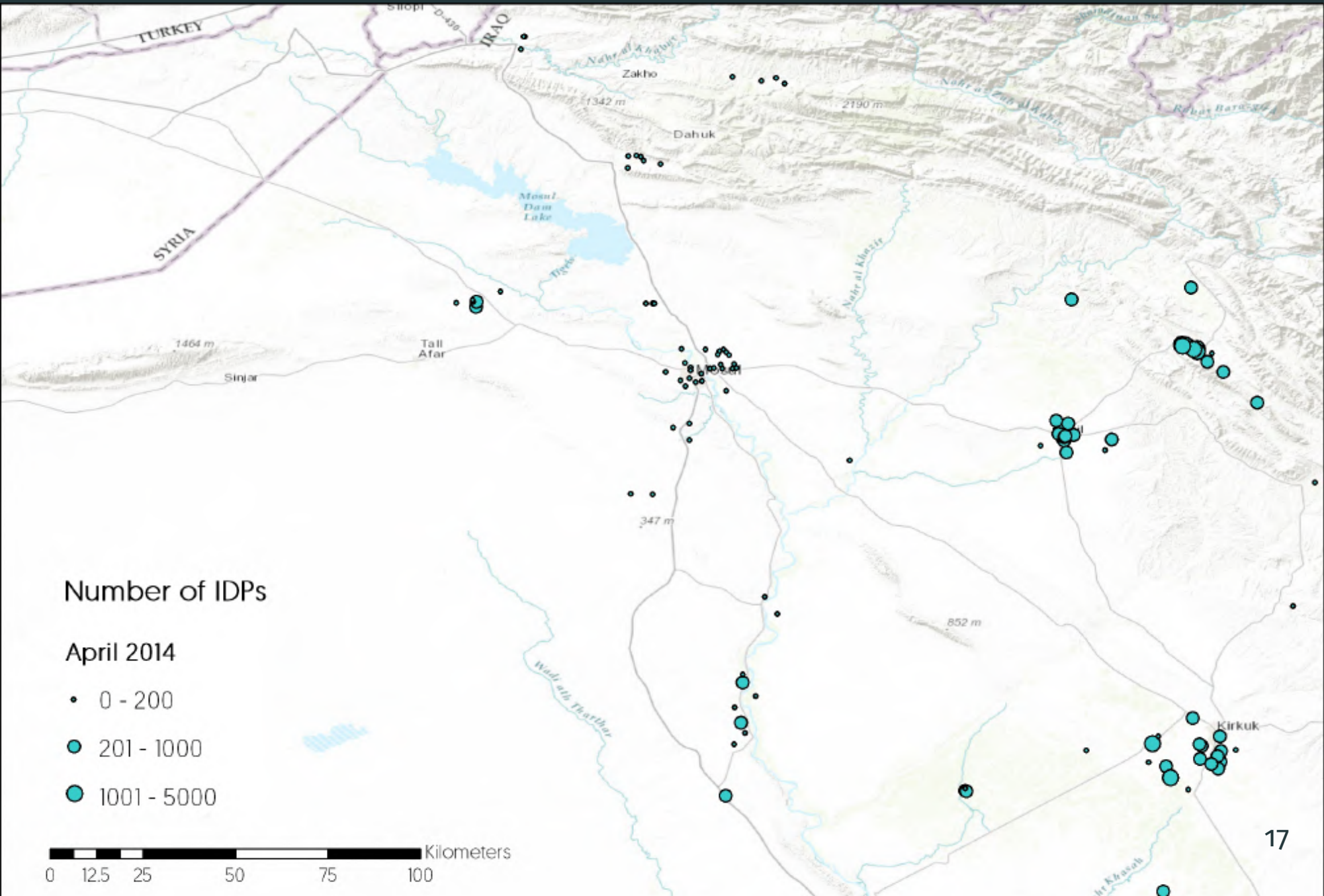
Characteristic 1: Space-time variation



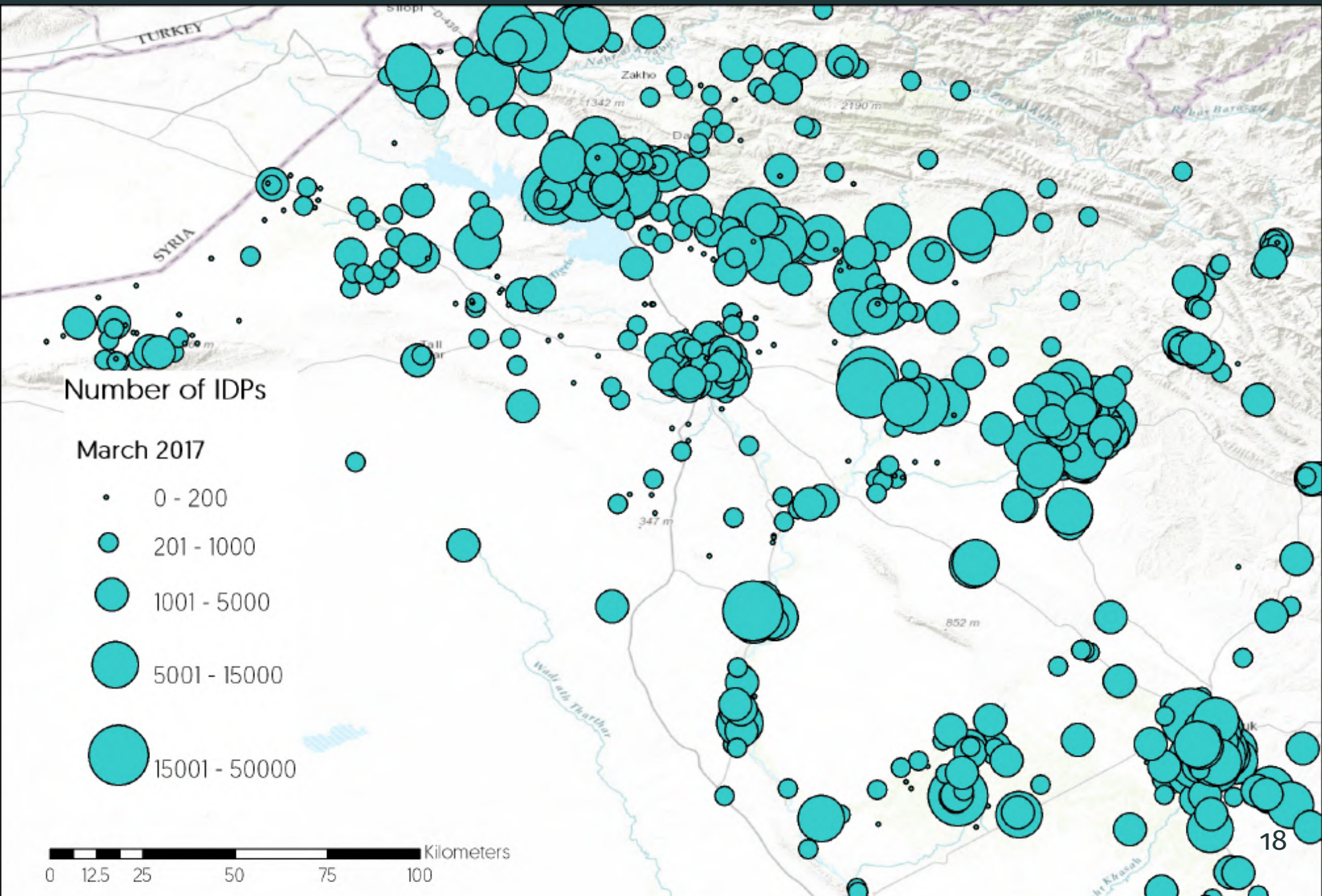
Characteristic 1: Space-time variation



Characteristic 1: Space-time variation

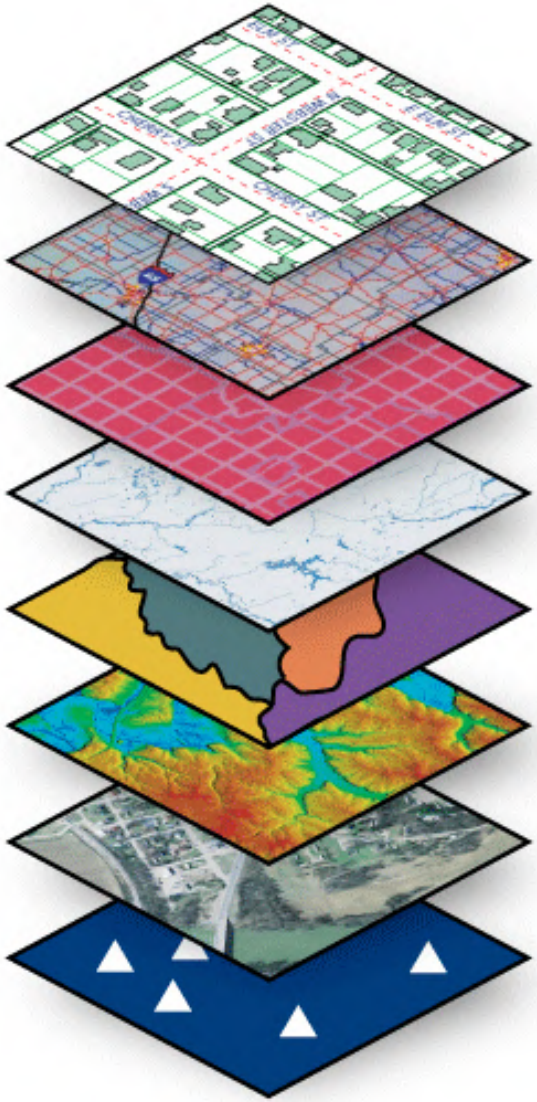


Characteristic 1: Space-time variation



Empirical Perspective

Empirics: GIS data layers



IDP Locations

Returnees

Conflicts

Governorates

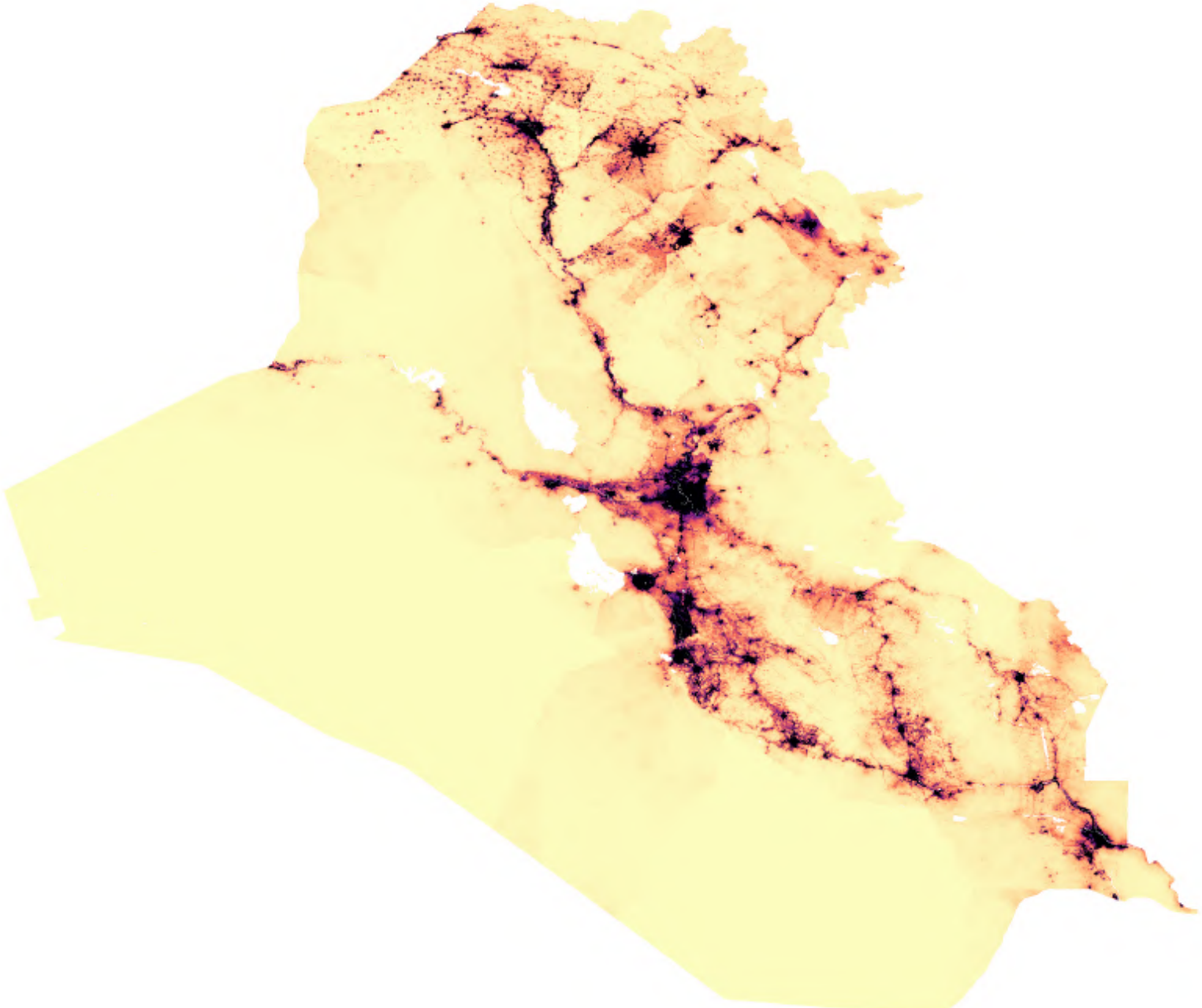
Ethnicity/Religions

Population Density

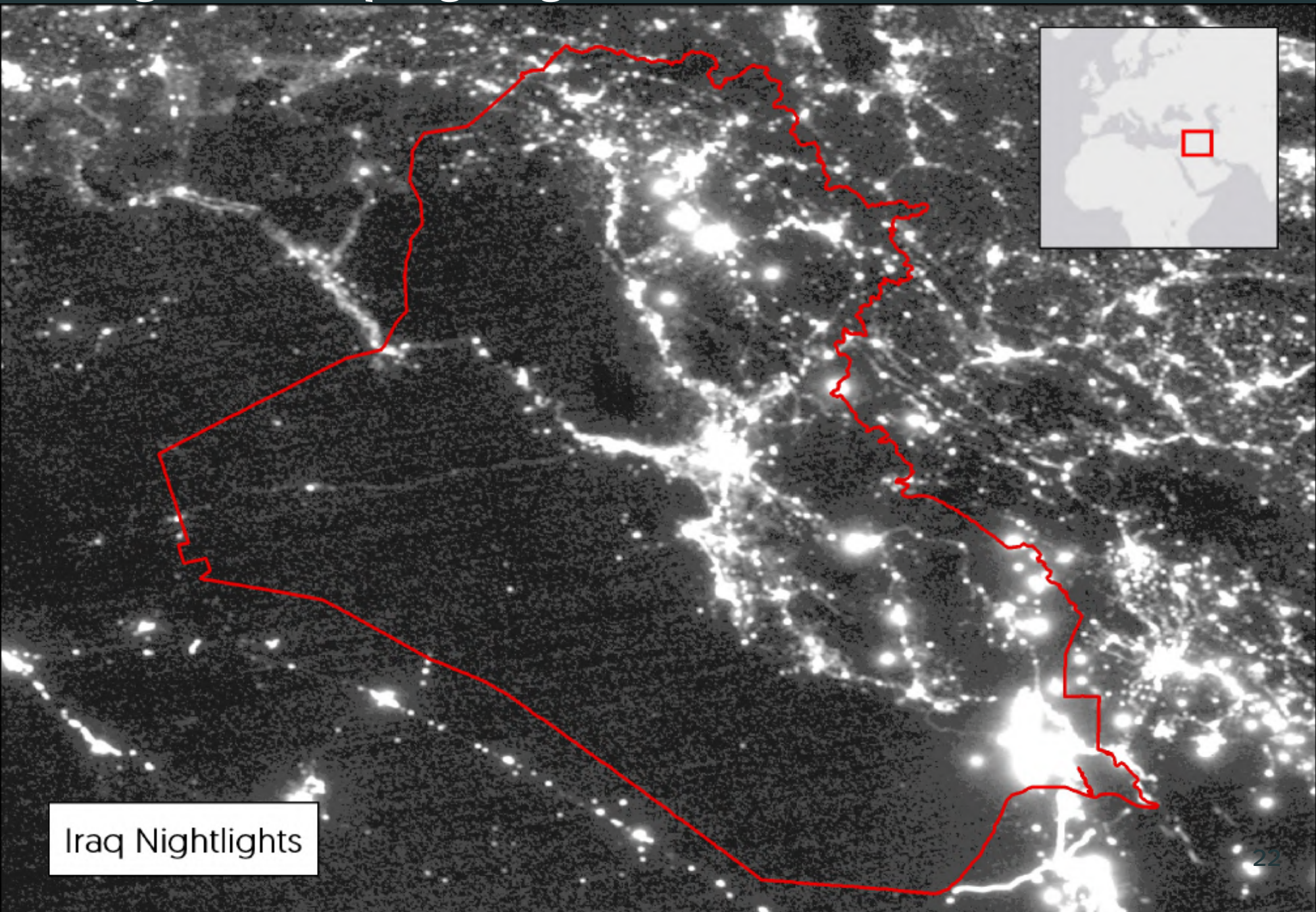
Roads

Landscape

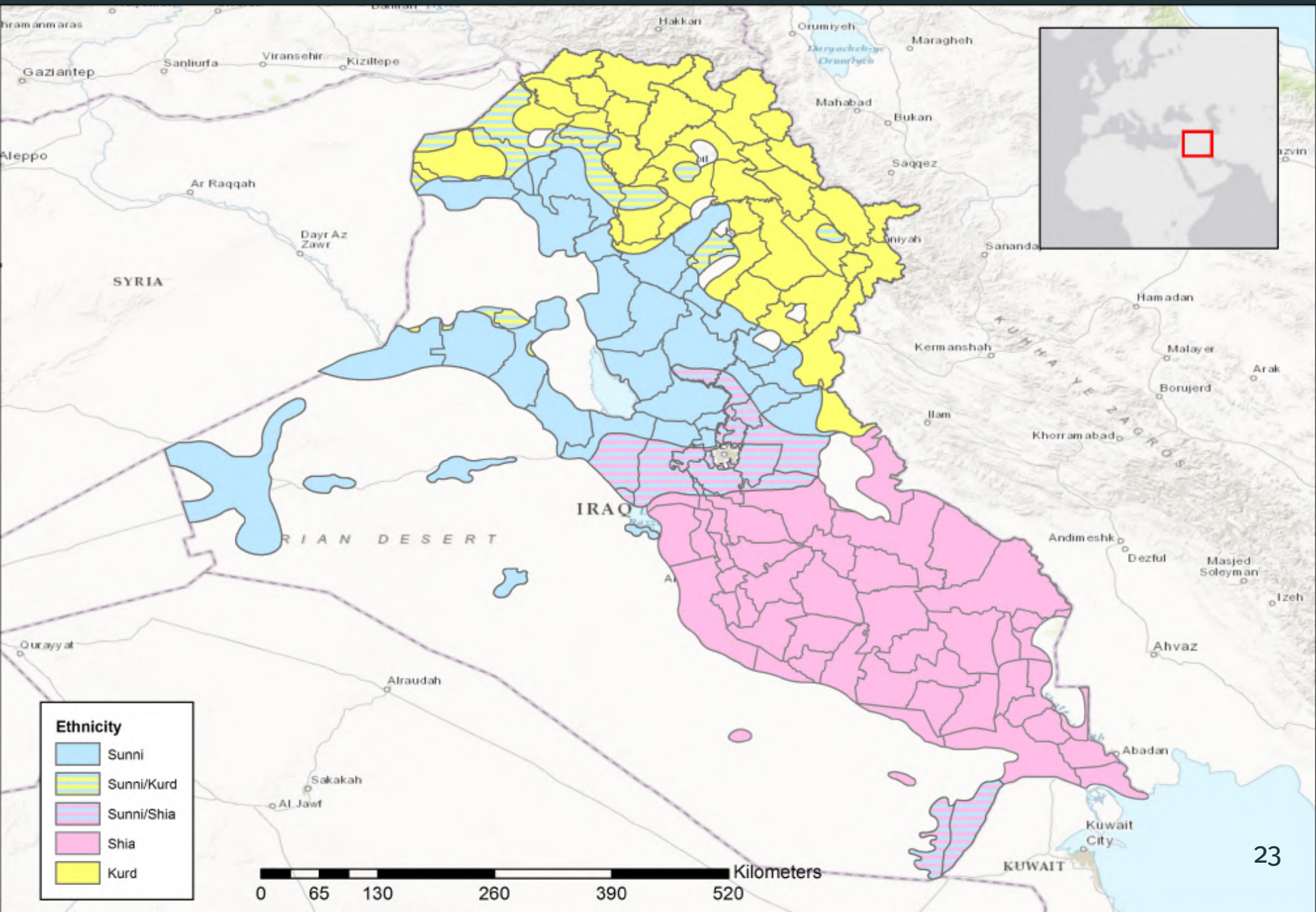
Population Density



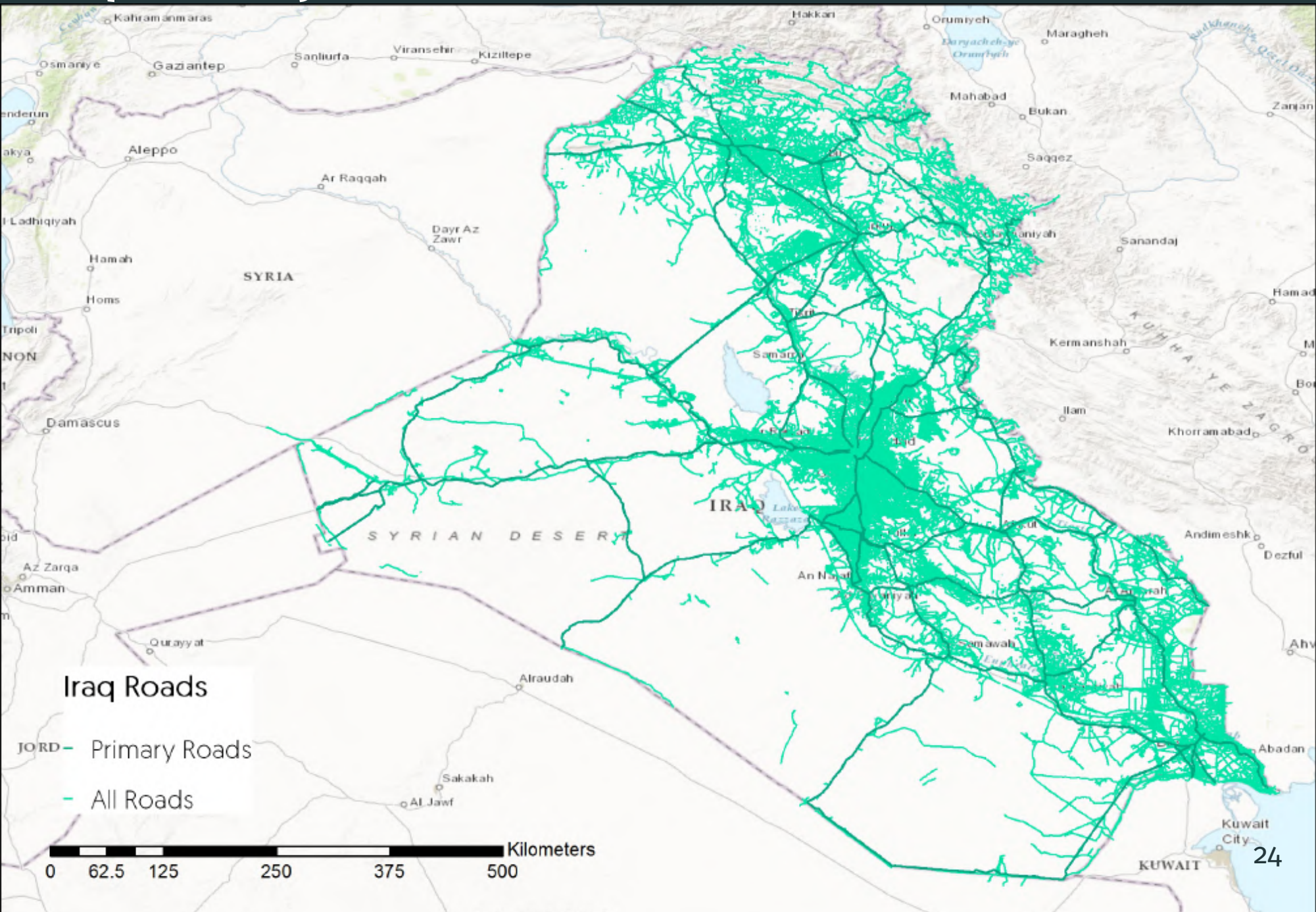
Background: Iraqi Night lights



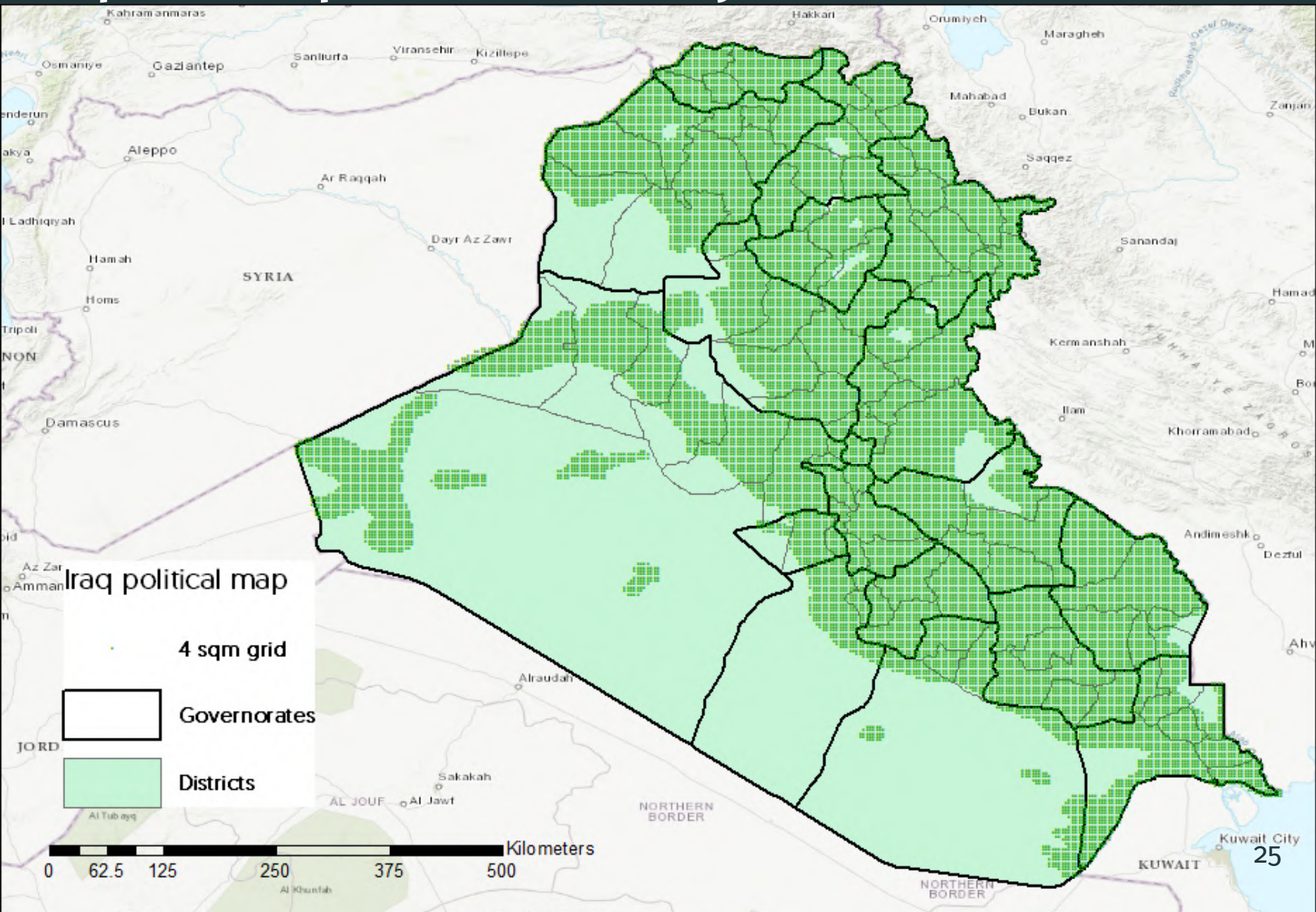
Sunni (30-40%) - Shia (65-55%) divide



Iraqi roads layers

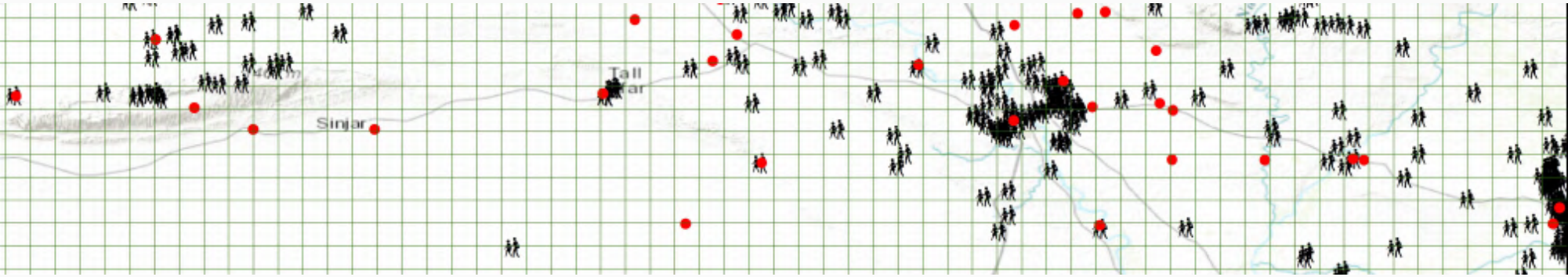


Empirical Perspective: Unit of Analysis



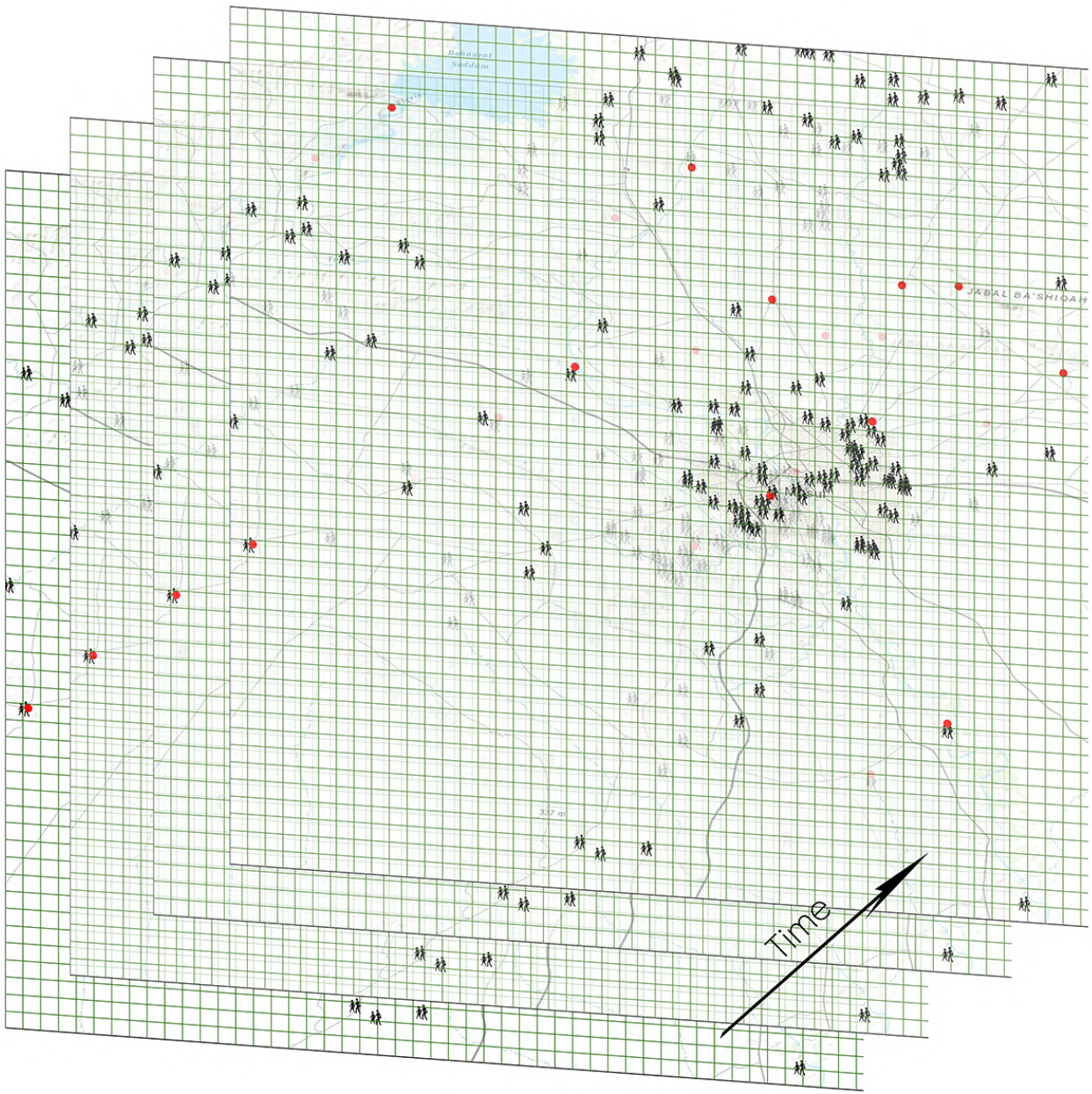
Empirical Perspective

- **Panel from grid:**
  - Iraq's populated area is divided into a grid of equally sized 4 mi^2 cells.
  - A panel is constructed using each grid cell as a cross-sectional unit.
  - The panel includes a cross-section for every 1^{st} and 15^{th} day of the month from April 1^{st} 2014 to January 1^{st} 2017.



- **Geographical merge:**
  - Observations are assigned to the nearest panel unit
- **Temporal merge:**
  - Observations are assigned to the nearest future panel period

Panel Illustration



Empirical Analysis

First Step: Spatial Network Model

$$\mathbf{Y} = \mathbb{N}\mathbf{X} + \epsilon$$

- **Y**: Number of IDPs - nx1
- **X**: Location characteristic (**only 1**) - nx1
- $\mathbb{N}$: Network matrix - nxn
- Parameters of interest: $\mathbb{N} \in \mathbb{R}^{nxn}$

1. OLS would be a model where we impose that $\mathbb{N} = \mathbb{I}\beta$
2. A random effects model would be a model where we impose that $\mathbb{N}$ is a diagonal matrix
3. In Spatial Econometrics, an SLX model would be a model in which we impose that $\mathbb{N} = \mathbb{D}\beta$. Where $\mathbb{D}$ is a weight matrix imposed by the researcher.

Spatial Parameter Restrictions

$\mathbb{N}$ has too many parameters to be estimated and is too large to load on memory.

Indifference Areas:

- Any two elements $\mathbb{N}_{ij}$ and $\mathbb{N}_{ik}$ are the same if the distance* between i and j is equal to the distance between i and k.
- I discretize the set of distances between any two units i and j.

- This way we can reduce the number of parameters to estimate in $\mathbb{N}$ from n^2 to the number of indifference areas of interest.
- We can summarize $\mathbb{N}$ which has as many elements as different indifference areas considered.

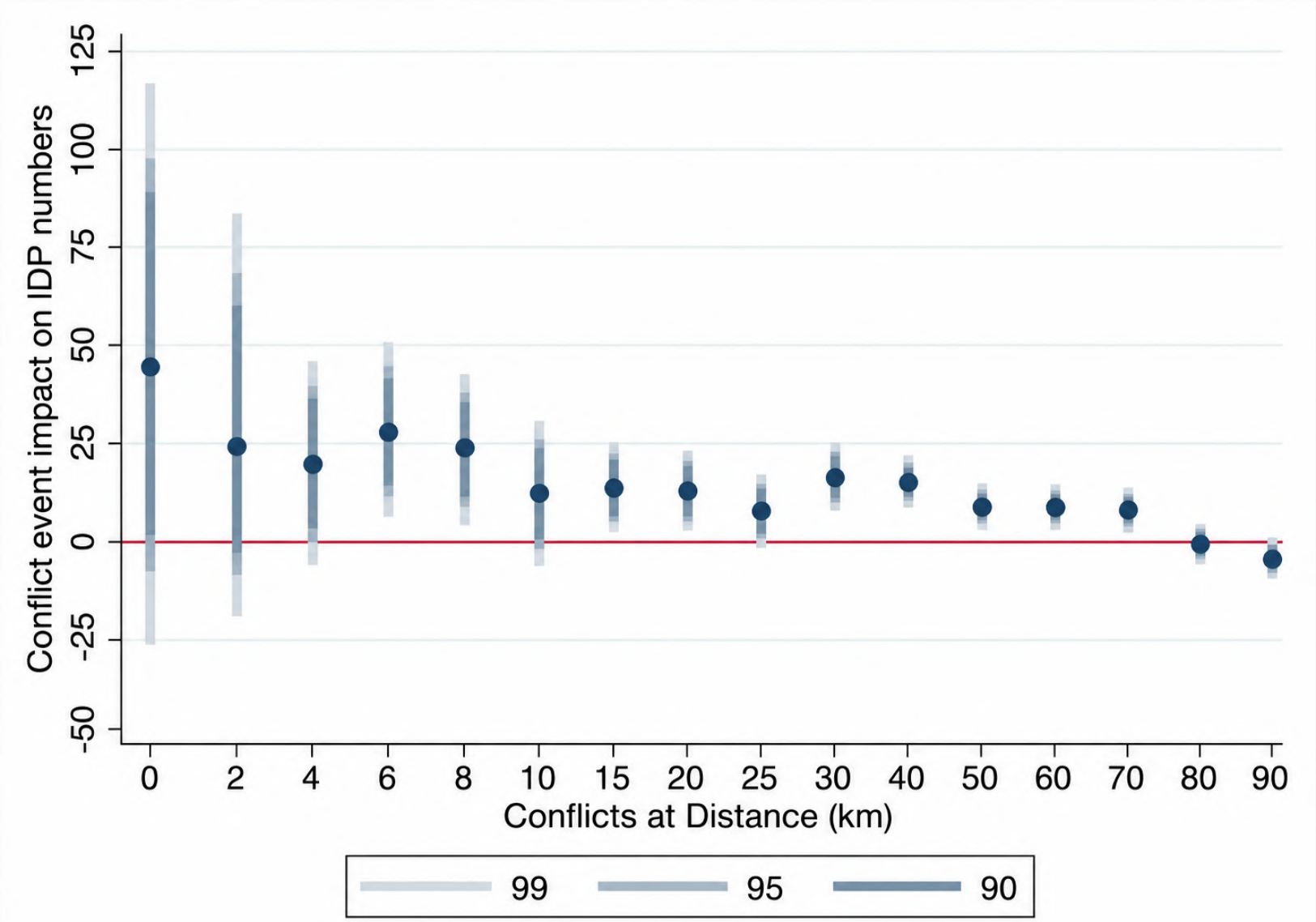
Spatial Network Model

$$\mathbf{Y}_t = f\left(\eta + \sum_k^m \mathbb{N}_k^\tau \mathbf{X}_{k,t}^H\right) + \epsilon_t \qquad \forall t \in \{1, T\}$$

- $\mathbf{Y}_t$: Number of IDPs - nx1
- $\mathbf{X}_{k,t}$: Location k characteristic - nx1
- $\mathbf{X}_{k,t}^H$: History of $\mathbf{X}_{k,t}$ - nx1
- where $\mathbf{X}_{k,t}^H = \mathbf{X}_{k,t} + \mathbf{X}_{k,t-1} + \mathbf{X}_{k,t-2} + \ldots + \mathbf{X}_{k,0}$
- $\mathbb{N}_{k,t}$: Network matrices - nxn
- η: Location fixed effects, f: Rectifier function or Tobit
- Indifference Areas: [0, 2:2:10, 15:5:30, 40:10:100, 150:50:300, 400:100:700].
- With parameter restrictions we reduce the number of parameters from $1.8e14$ to $1.9e3$ (excluding fixed effects)

Results

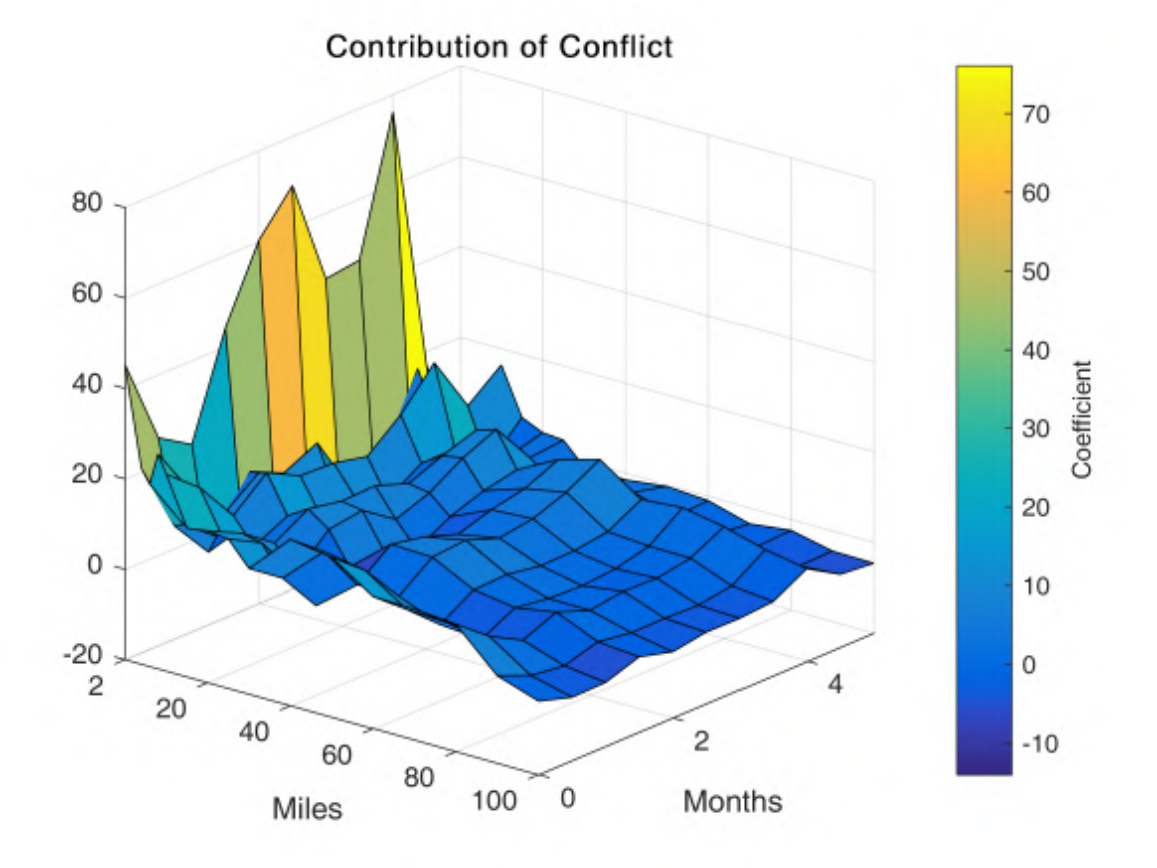
Figure 1: Baseline Model Estimation Results



Spatial Network Results

$$\mathbf{Y}_t = f\left(\eta + \sum_{k}^{m} \mathbb{N}_k^{\tau} \mathbf{X}_{k,t}^{H}\right) + \epsilon_t, \forall t \in \{1, T\} \tag{1}$$

This figure displays a subset of 160 parameters coming from $\mathbb{N}_k^{\tau}$ for $\tau \in [0, 10]$. Where k denotes a regressor for conflict intensity and the subset are the indifference areas $d \in [0, 90]$.



Location Physical characteristics and ethno-religious identity

Table 1: IDP host location characteristics correlation with conflict

	Coeff.	Std. Error	t	$P > \|t\|$
Ethno-religious identity:				
Sunni	-616.25	6.92	-89.1	0.000
Shia	-252.45	6.68	-37.77	0.000
Mixed Sunni Shia	-265.69	13.61	-19.52	0.000
Christian	63.20	35.36	1.79	0.074
Turcoman	-517.22	0.03	-23.45	0.000
Physical characteristics:				
Population	28.47	0.24	118.62	0
Road within 2mi	633.14	6.39	99.06	0
Road within 5mi	424.67	6.25	67.92	0
Conflict regressors	✓			
Observations	1,296,579			

Notes: Ethno-religious majority at origin considered when at least 66% of the population voted for a clearly Sunni, Shia, or Kurd party in the 2011 census.

Prediction Errors: Different models

Table 2: Prediction Error Distributions

	Assuming units are independent		Network Models	
	District	Governorate	4sqm-Linear	4sqm-Non-Linear
In-sample:				
Mean	0.00	0.00	0.00	-8.54
Std. Dev	8,232.89	28,152.38	104.99	235.20
95% Perc.	12,440.92	49,108.27	14.94	-1.00
Out-of-sample:				
Mean	686.50	3,823.30	-4.42	-18.47
Std. Dev	8,386.79	26,529.18	220.67	226.45
95% Perc.	17,510	49,497.91	4.88	-1.42
Observations	6,834	1,206	1,296,579	1,296,579
Fixed effects	Yes	Yes	Yes	No

Conclusions

Conclusions

- IDPs choose locations close to conflict
  - The proximity to conflict makes aid to those forcibly displaced even more challenging.
  - While most IDPs did not choose to go to camps, this paper is unable to disentangle whether this is due to camps' location or a preference for other types of shelter/accommodation.

- IDPs choose locations in populated areas close to main roads.
  - The reason behind this choice, together with how close to their location of origin displaced people remain, might be the nature of their preferred shelter, and that people might try to maintain their usual source of income.

- IDPs choose more diverse locations.
  - While the model shows that locations without a clear ethno-religious majority host more IDPs, surveys show that the main reason of displacement is conflict, and not prosecution based on ethnicity or political views.

Thank you

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QR code link to my website

Annex

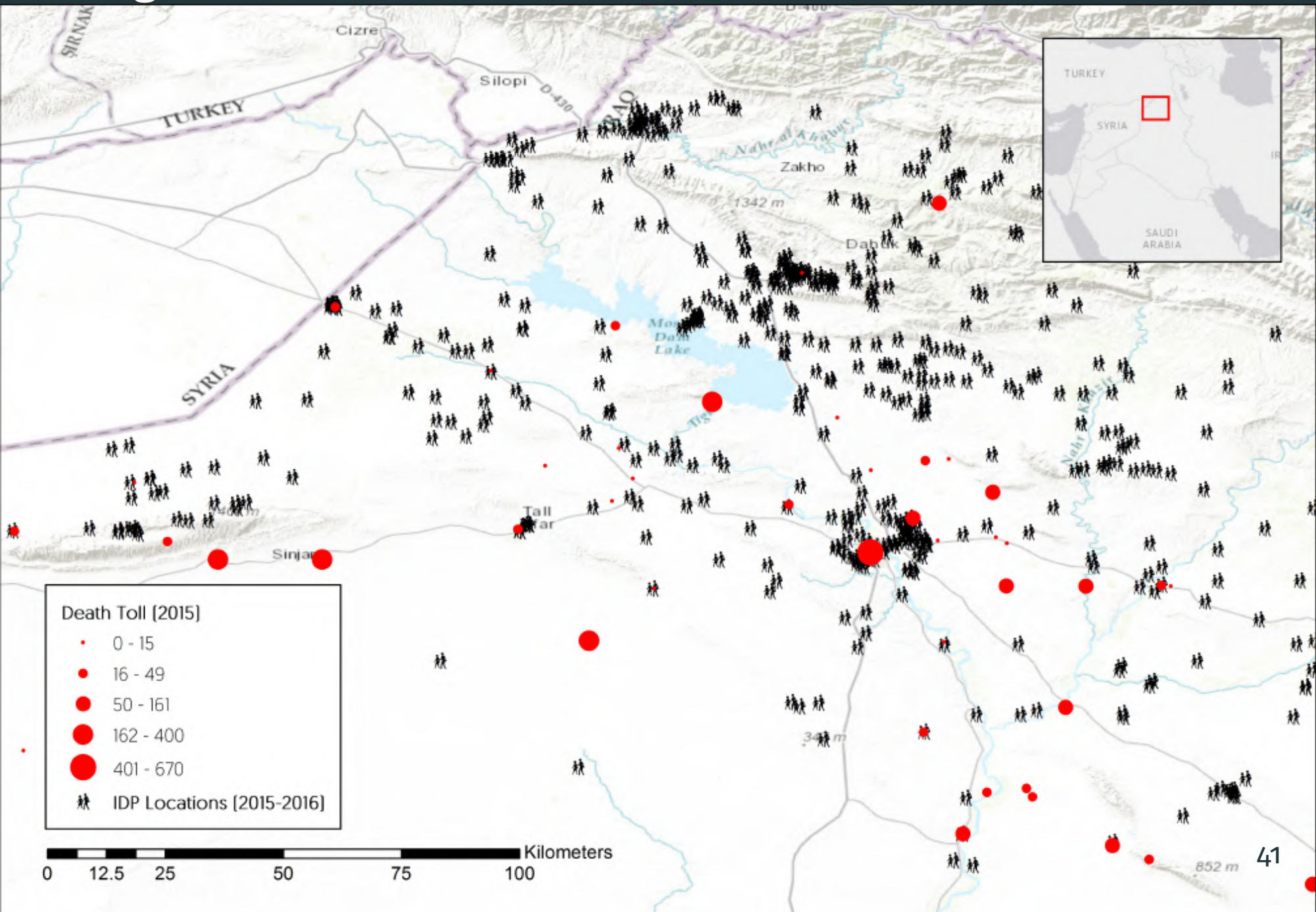
References

Chatty, Dawn, and Nisrine Mansour. 2011. “Unlocking protracted displacement: An Iraqi case study.” *Refugee Survey Quarterly*, hdr012.

Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand. 2002. “Armed conflict 1946-2001: A new dataset.” *Journal of peace research*, 39(5): 615–637.

Melander, Erik, Therése Pettersson, and Lotta Themnér. 2016. “Organized violence, 1989–2015.” *Journal of Peace Research*, 53(5): 727–742.

Background: Conflicts and IDPs - Mosul area (2015-2016)



Descriptive Analysis: Factions involved

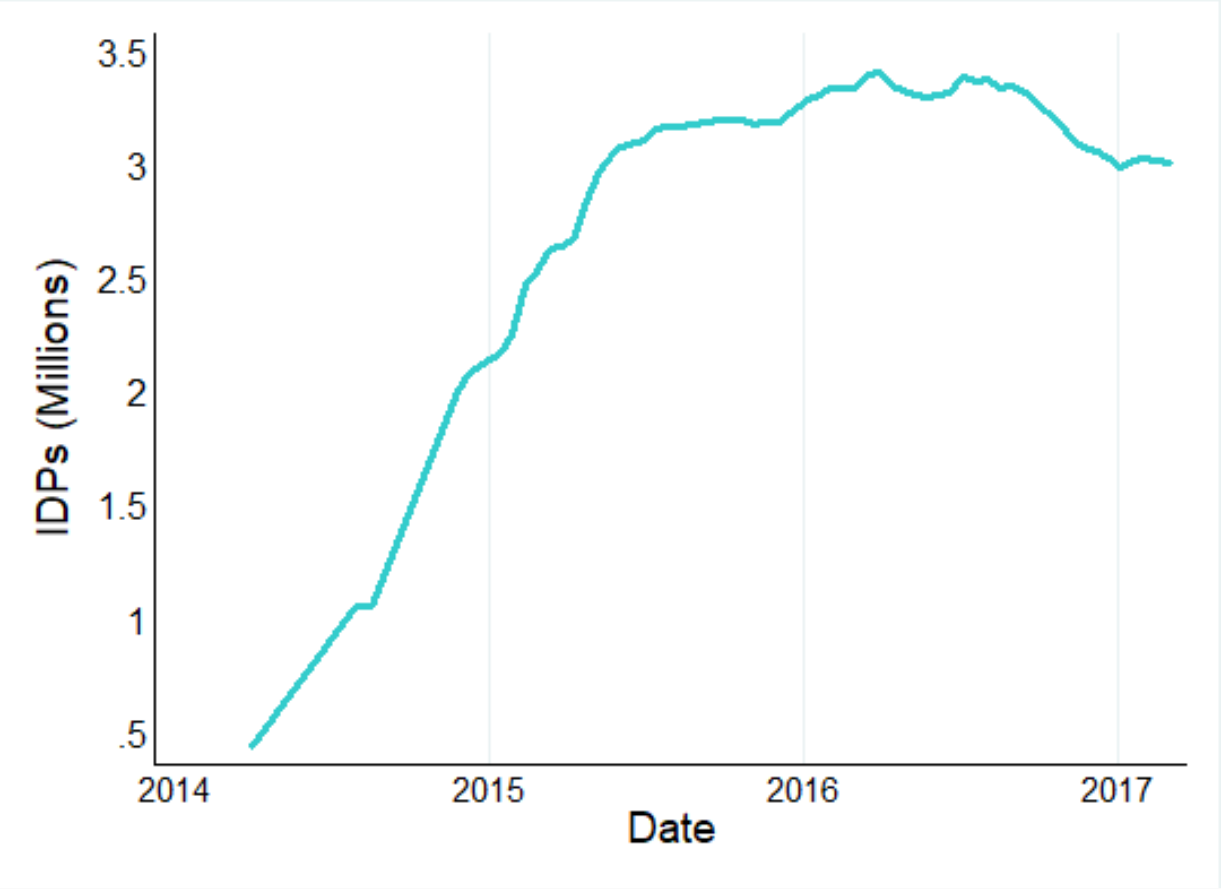
Table 3: Conflict events in Iraq (2010-2016)

Factions involved	Freq.	Percent
Government of Iraq - IS	2,554	75.58
IS - Civilians	771	22.82
Government of Turkey - PKK	25	0.74
Government of Iraq - Civilians	9	0.27
Government of Iran - PJAK	8	0.24
IS - JRTN	6	0.18
Jaysh al-Mukhtar - MEK	4	0.12
Government of Iraq - Ansar al-Islam	2	0.06
Total	3,379	100

Back

Descriptive Analysis: Total IDPs in Iraq (2014-2017)

Figure 2: Number of IDPs over time



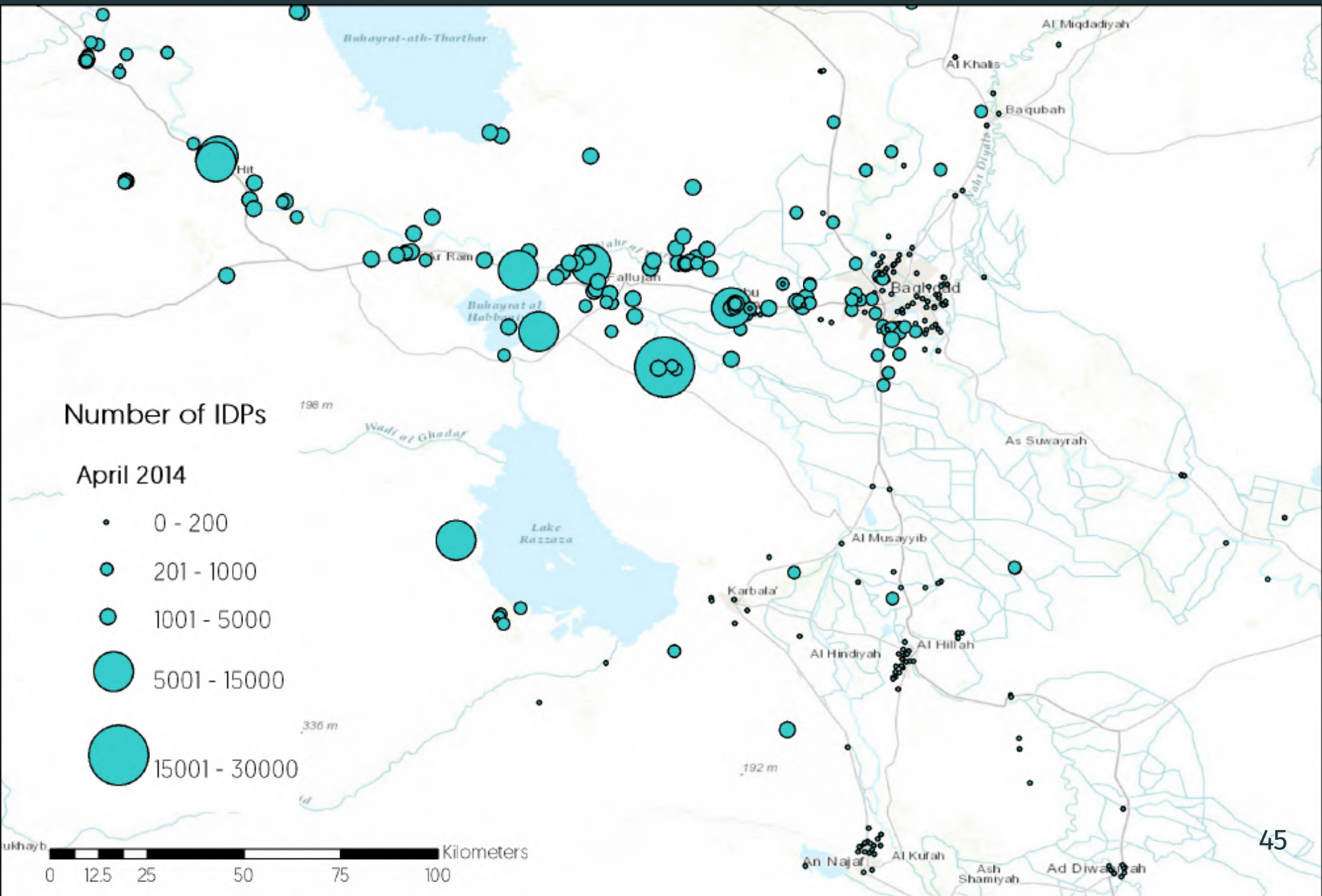
*February 2018: 2.4M IDPs & 3.3M Returnees

Descriptive Analysis: Demographics

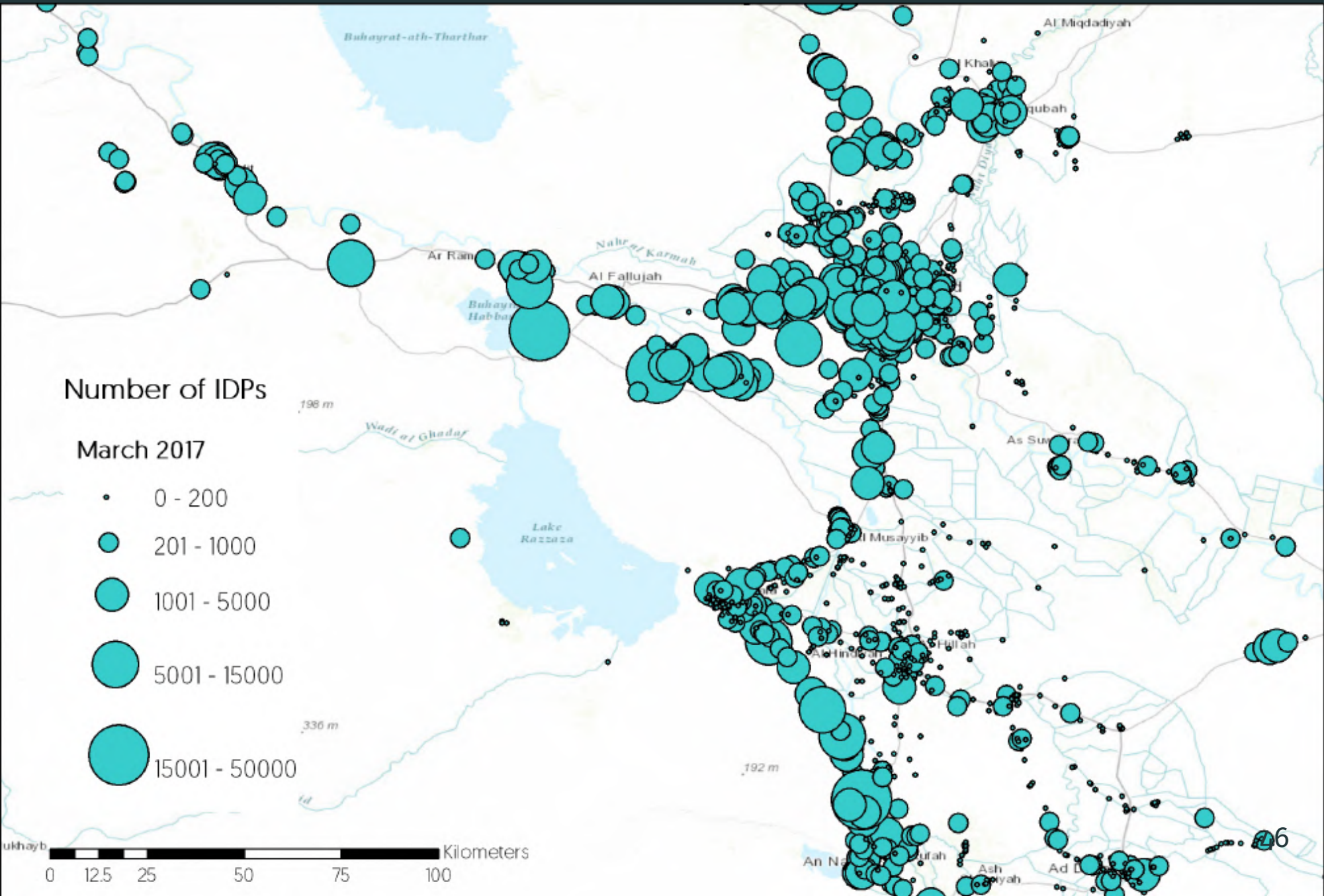
Table 4: Demographics (March 2016 Group Assessment)

Demographic Information	Freq.	Percent
Female	1,400,266	50.04
Male	1,398,032	49.96
Female 0-5	243,382	8.70
Female 6-11	315,911	11.29
Female 12-18	304,132	10.87
Female 19-49	370,882	13.25
Female 50 plus	165,959	5.93
Male 0-5	194,453	6.95
Male 6-11	253,615	9.06
Male 12-18	316,890	11.32
Male 19-49	388,392	13.88
Male 50 plus	244,682	8.74

April 2014 IDPs in the Fallujah/Bagdad area

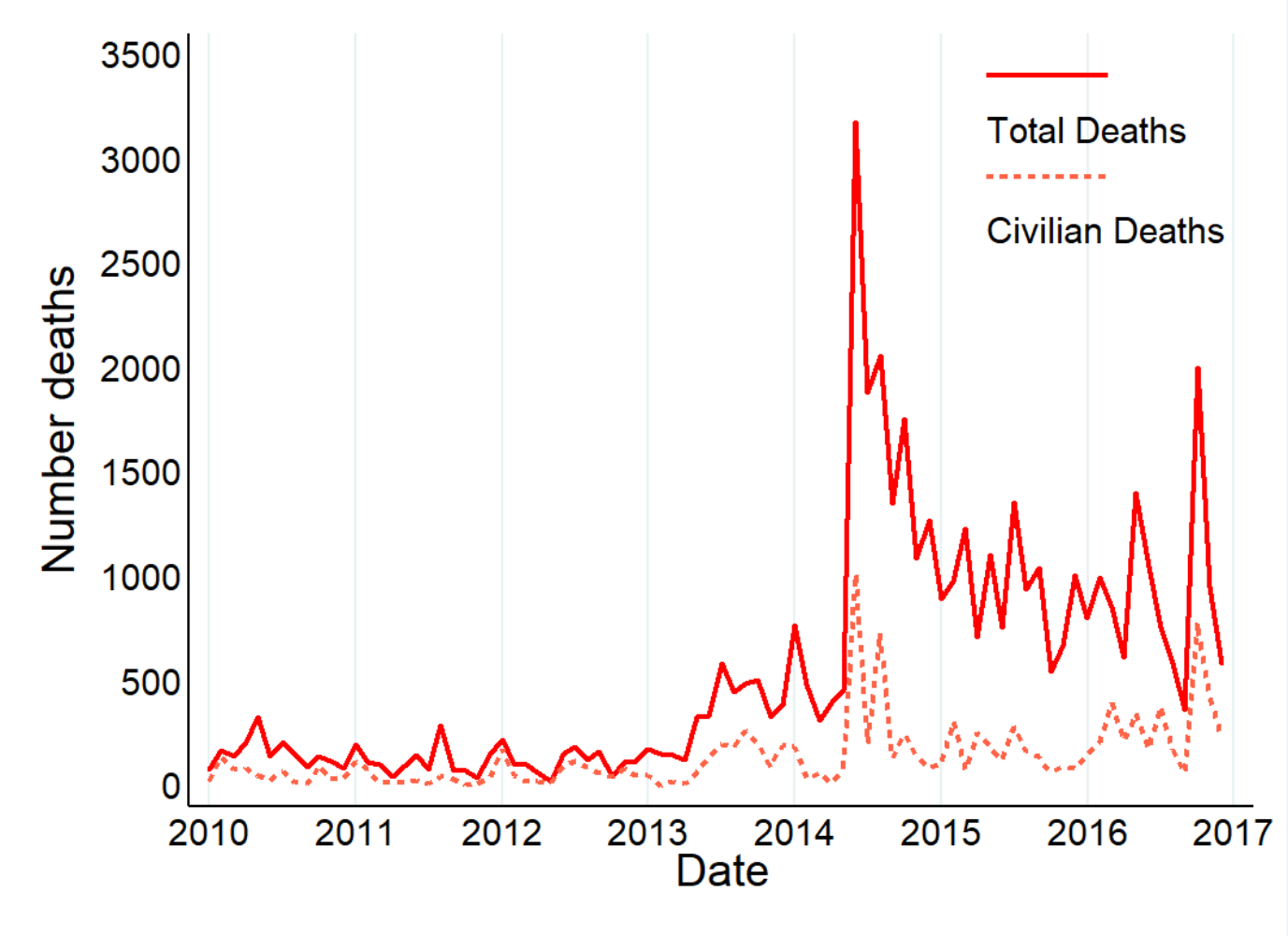


March 2017 IDPs in the Fallujah/Bagdad area



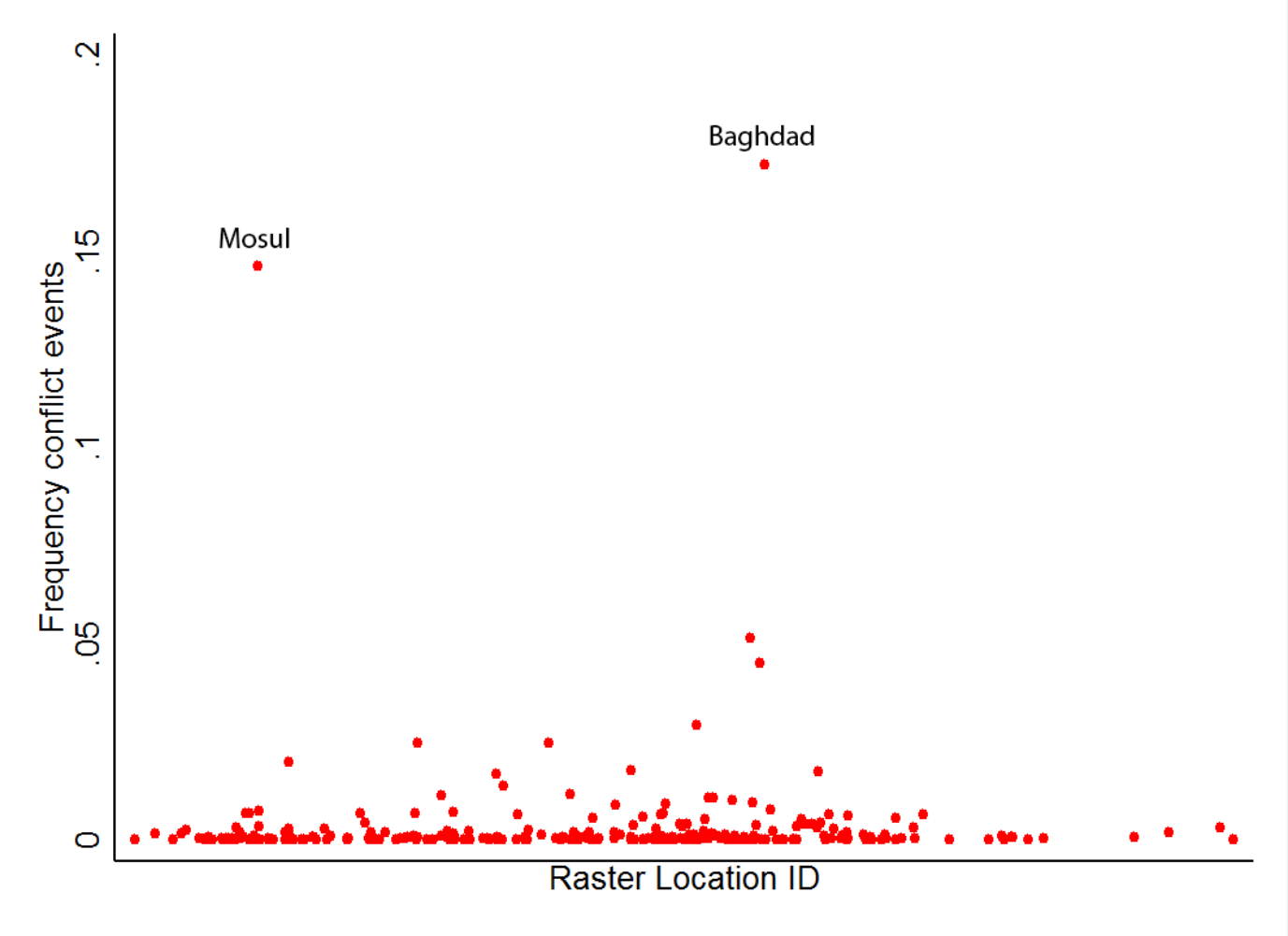
Descriptive Analysis: Conflict induced deaths (2010-2016)

Figure 3: Conflict-induced deaths in Iraq (2010-2016)



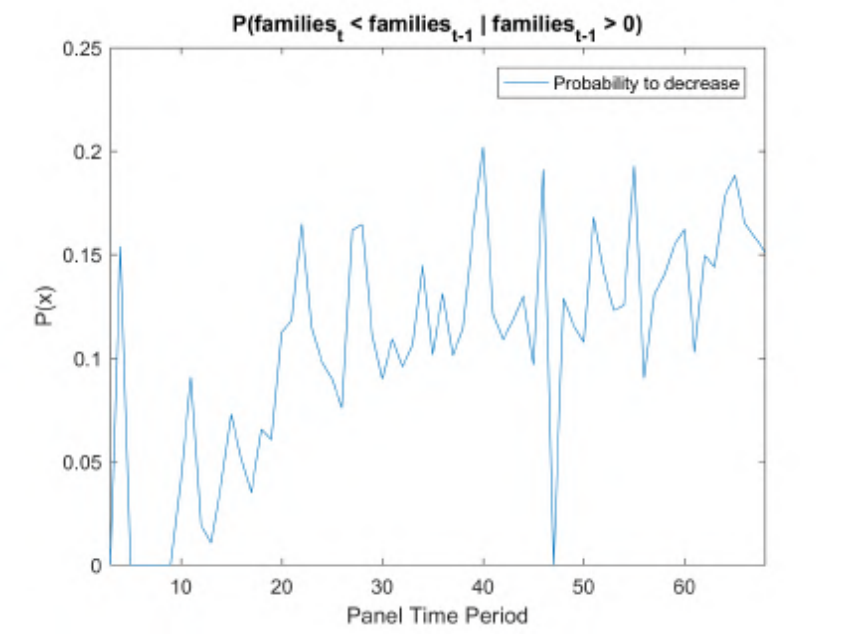
Descriptive Analysis: Conflict by Location (2010-2016)

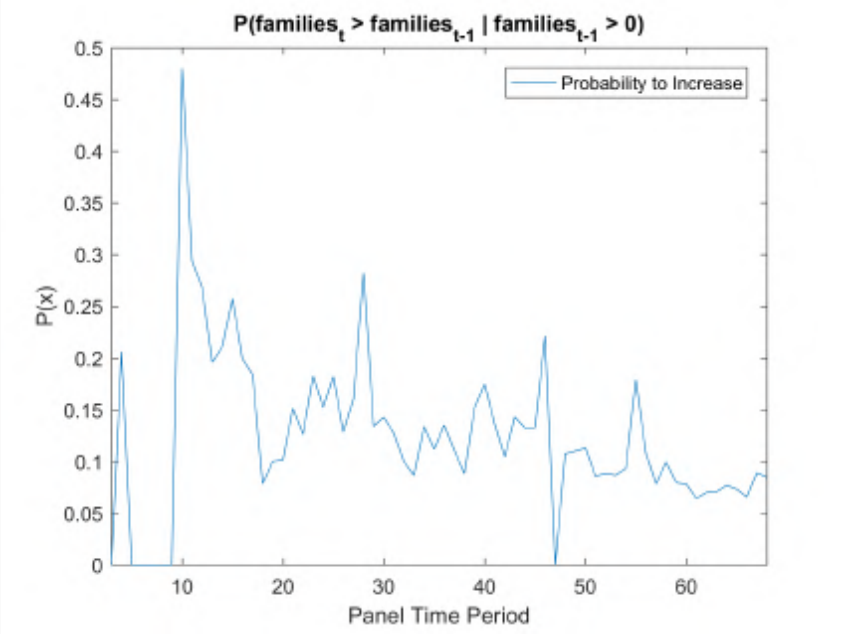
Figure 4: Conflict Relative Frequency by Location (2010-2016)



Descriptive Analysis: Transition Probabilities

Only a few locations host more IDPs, and many locations host fewer IDPs.





Note: The periods where $P(x) = 0$ are periods of missing data which were filled with the data from the previous period and thus $families_t = families_{t-1}$

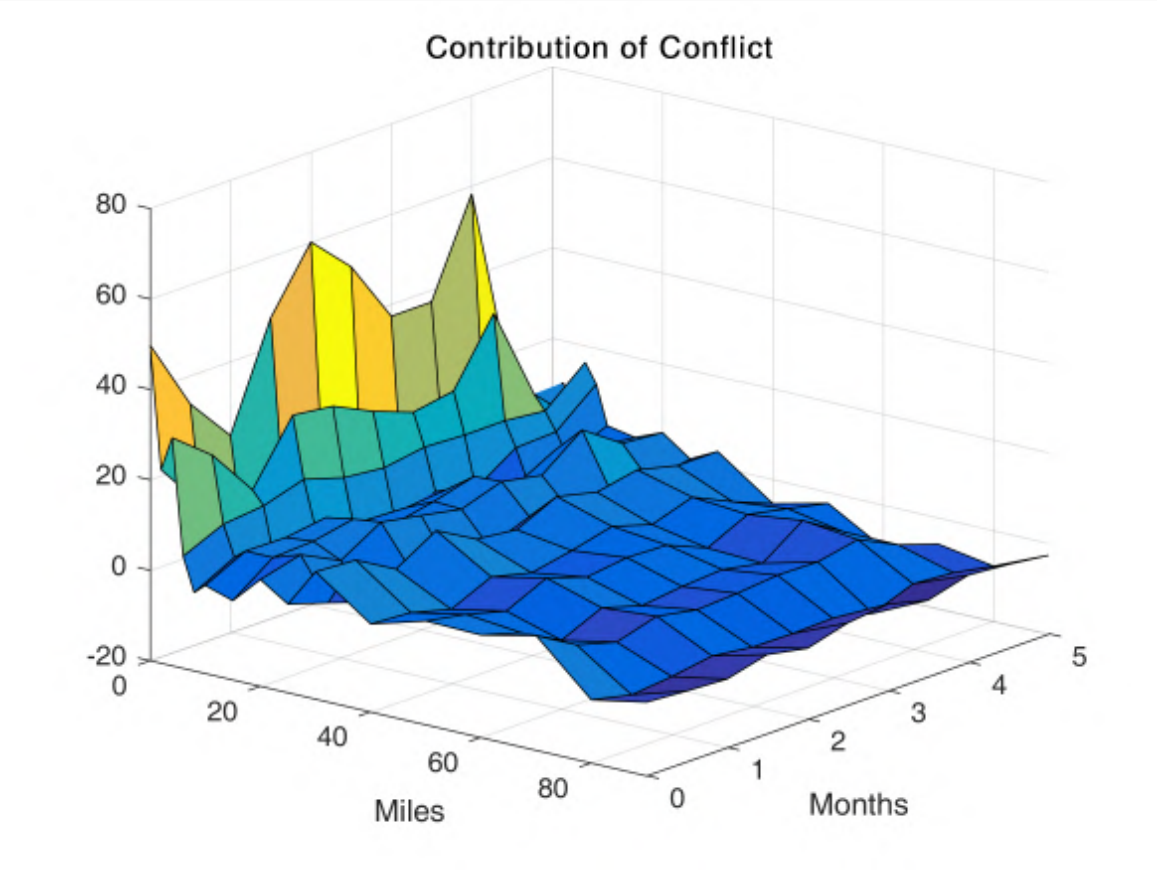
Descriptive Analysis: Location Choice

Table 5: Location choice reason (July-September 2016 Survey)

IDPs' reason to chose location	**Freq.**	**Percent**
Security and peace	1,364	40.46
Presence of extended family/friends	884	26.22
Availability of housing	463	13.73
No other choices	277	8.22
Proximity to location of origin	114	3.38
Availability of services (for example, education and health)	104	3.09
Same religious or linguistic or ethnic composition	101	3
Availability of jobs	64	1.9
Total	3,371	100

Spatial Network Results (II)

Non-linear model results using only grid cells with IDPs at some point in time.



Descriptive Analysis: Violence as the main factor in surveys

In the case of IDPs in Iraq, violence might be the single most important factor.

Table 6: Reported cause of displacement (March 2016 Survey)

Cause of Displacement	Freq.	Percent
Generalized violence and armed conflict	434,758	93.22
Family member killed in general violence	12,953	2.78
Family members killed or threatened for ethnic/religious reasons	7,550	1.62
Direct threats to family	6,776	1.45
Evacuated / displaced by the government (to safer sites)	2,450	0.53
Family members killed or threatened for political affiliation	770	0.17
Evicted from property	716	0.15
House damaged / destroyed	164	0.04
Unknown Reason	104	0.02
Dam manipulation / flooding	80	0.02
Evicted by private owners (They wanted their property back)	36	0.01
Lack of access to sustainable income	16	0.00
Lack of access to basic services	5	0.00
Evacuated / displaced by government	5	0.00
Total Families	466,383	100

Descriptive Analysis: Displacement Nature

“They all wanted to go home, though many- Raghad estimated 40 percent- had their houses and farms destroyed by the regime shelling"

The Home That Was Our Country, Alia Malek (Syria).

Table 7: Intentions (March 2016 Survey)

Intentions	**Freq.**	**Percent**
Return to place of origin	437,463	93.80
Waiting on one or several factors	12,982	2.78
Locally integrate in current location	11,441	2.45
Resettle in a third location	2,294	0.49
Unknown intention	1,186	0.25
Return to Area of Past Displacement	1,009	0.22
Moving outside of Iraq	8	0.00
Total Families	466,383	100

Descriptive Analysis: Displacement Nature

People are waiting for conflict levels at home to go down to return.

Table 8: Main obstacle to return (July-September 2016 Survey)

IDPs' main obstacle to return home	Freq.	Percent
The area of return is unsafe due to on-going conflict	2,633	78.11
Unable to return because property is inhabited	294	8.72
Absence of services back home	168	4.98
House in place of origin is destroyed	110	3.26
Lack of money	110	3.26
Fear due to the changed ethnoreligious composition at home	52	1.54
Other	4	0.12
Total	3,371	100

Descriptive Analysis: Displacement Nature

Table 9: Shelter type (March 2016 Survey)

Shelter Type	Freq.	Percent
Rented housing	200,004	42.88
Host Families	139,206	29.85
Unfinished/Abandoned building	50,731	10.88
Religious Building	26,308	5.64
Informal settlements or collective shelters	21,487	4.61
Camp	14,398	3.09
School Building	6,144	1.32
Hotel/Motel	5,796	1.24
Other	1,241	0.27
Unknown	1,068	0.23
Total Families	466,383	100

Descriptive Analysis: IDPs' income

Table 10: Main source of income (July-September 2016 Survey)

IDPs' source of income at location (choose 3)	Freq.	Percent
Paid job (public)	1,036	30.73
Informal commerce or inconsistent daily labor	780	23.14
Paid job (private)	735	21.8
Agriculture / farming / herd animal raising	206	6.11
Savings	198	5.87
Pension	109	3.23
Money from family and/or friends in Iraq	85	2.52
Loans	65	1.93
Aid from national institutions	59	1.75
Aid from international institutions	37	1.1
Business	28	0.83
No source of revenue	24	0.71
Income from rent of house or land	4	0.12
Money from family and/or friends abroad	4	0.12
Other	1	0.03
Total	3,371	100

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