

Land management in time of crisis

Land cover change induced by civil conflict and forced displacement

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المؤتمر العربي
الثاني للأراضي

Second Arab Land
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Impact of conflict and violence on productive land can be especially destructive, especially in countries dependent on agriculture

Two channels

- **Direct destruction** of farmland, orchards, irrigation infrastructure
- **Lower productivity** due to forced displacement & labor shortages

Impact is felt in **neighboring countries**, not only in conflict countries

Objective of the research: Measure the impact of the Syrian civil war along the **Syria/Turkey border**



Research questions

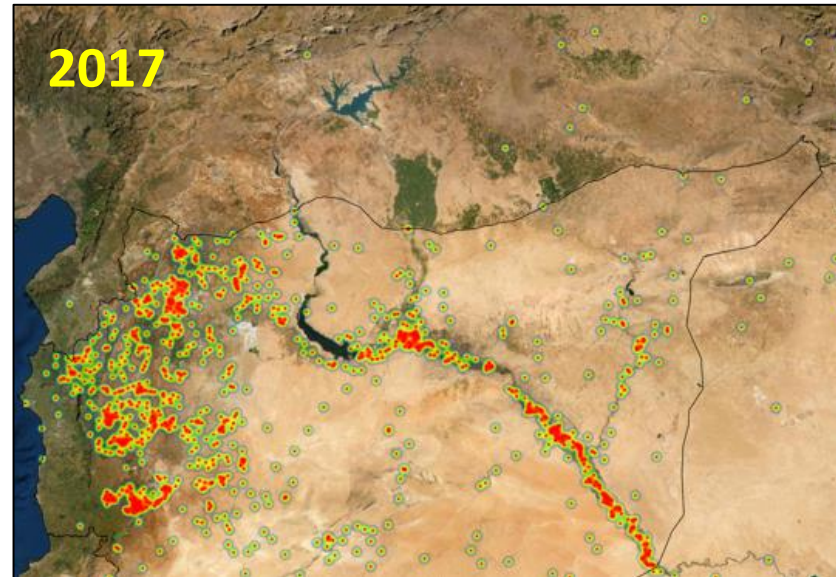
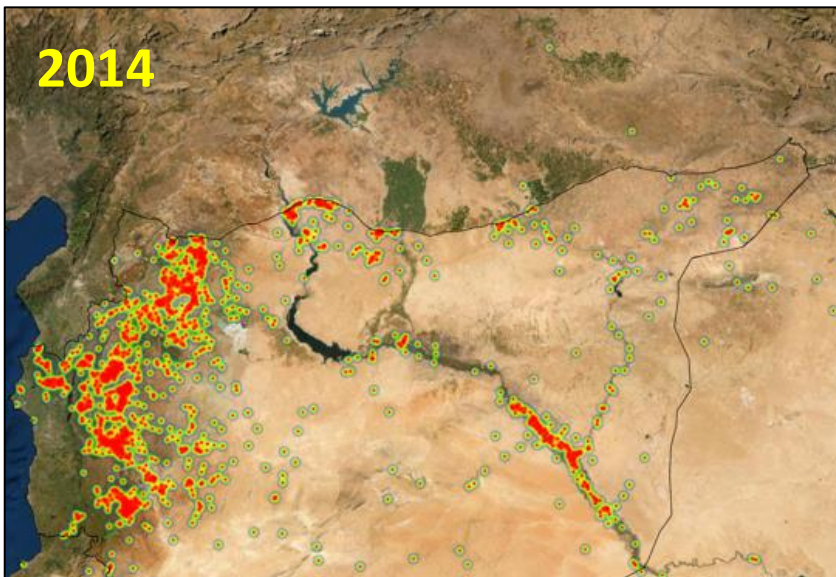
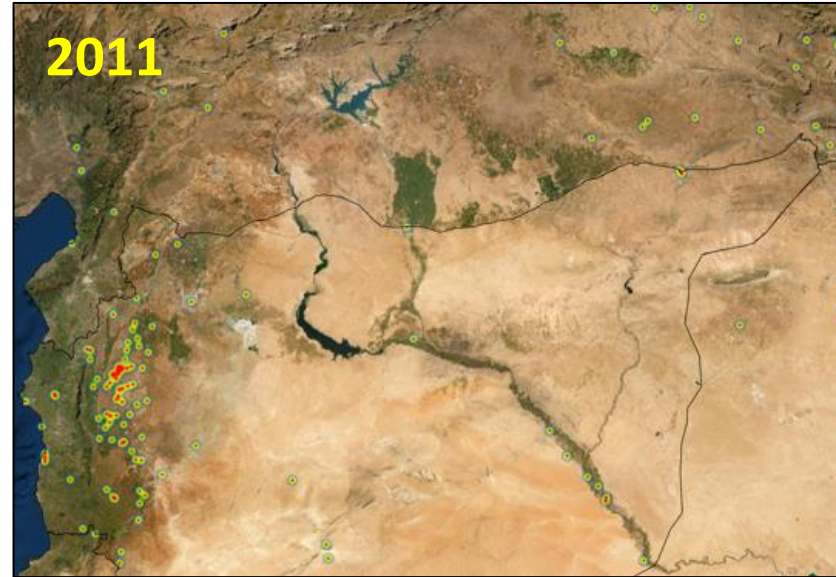
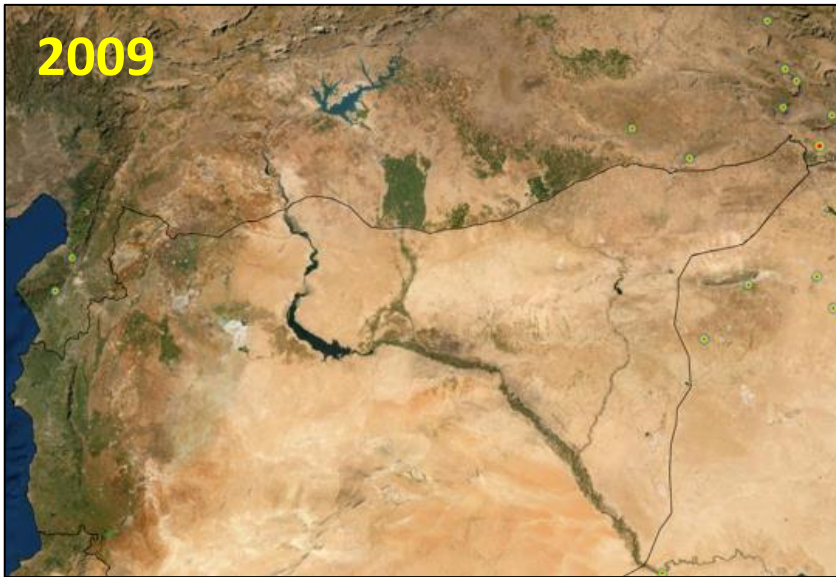
- What is the **extent of the phenomenon** (cropland gains and losses)
- What are the **mechanisms** (linked to violence and migration)?
- Are these **transitory or permanent** changes?
- What is the **overall economic impact**?

Methodology

- Mobilize **satellite imagery data** (and other data on violence and population displacement) over time to study changes in cropland
- Apply “Spatial Regression Discontinuity” to identify the **causal impact of conflict on cropland**

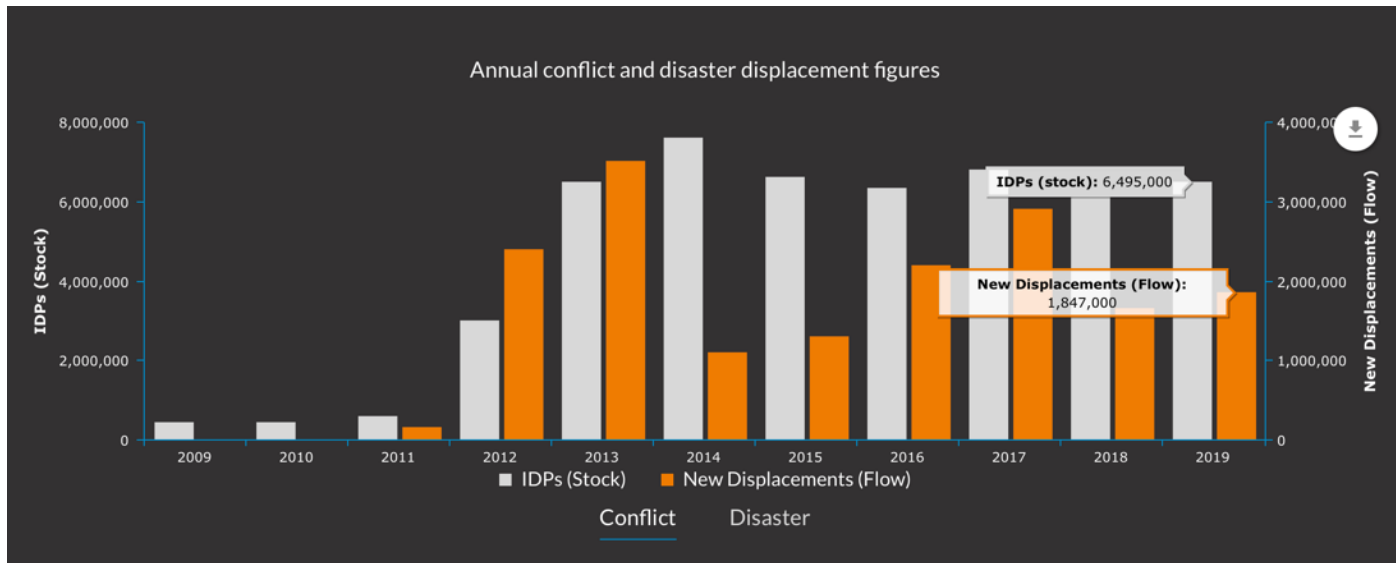


THE SYRIAN CONFLICT (1/2)



**Organized
violent events**
(Source: Uppsala
Conflict Data
Program)



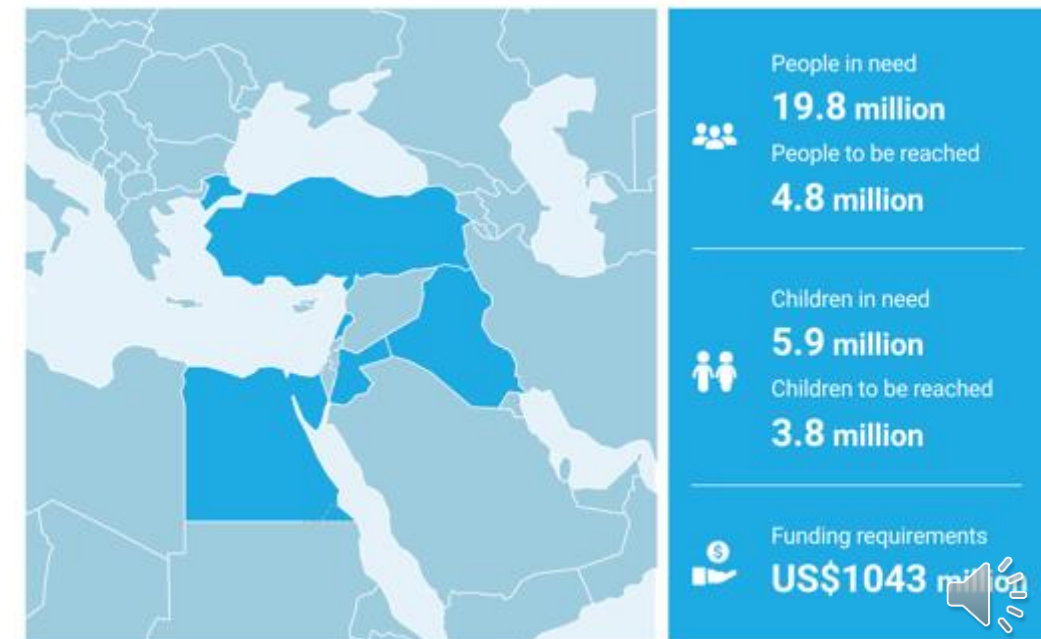


6.5 million internally displaced people
(Source: IDMC)

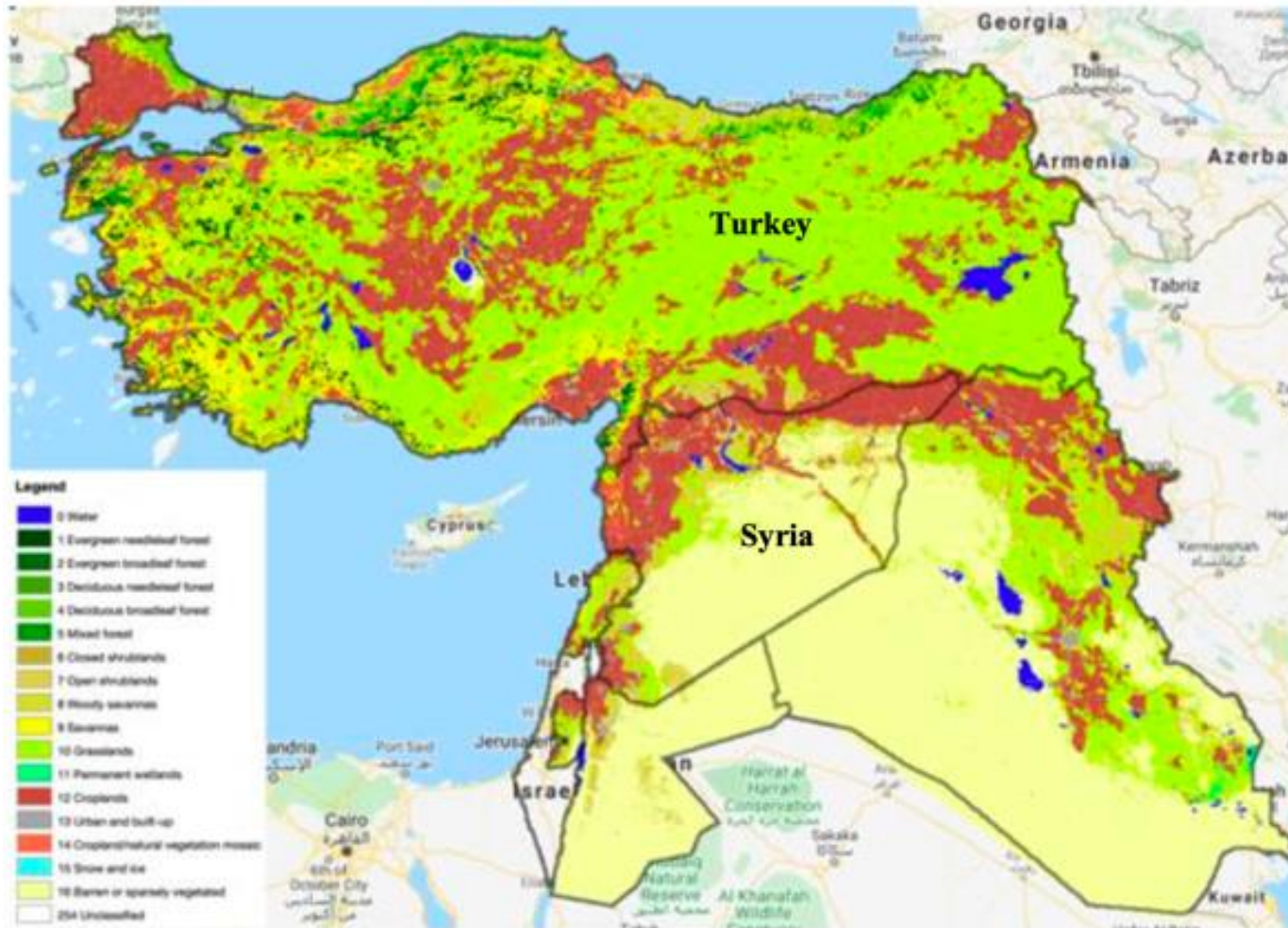
5.6 million registered refugees, mostly in neighboring countries

- 3.6 million Syrian registered refugees in Turkey
- 8% in refugee camps

(Source: UNHCR)



LAND USE (MEASURED FROM SATELLITE IMAGERY, 1/4)



Cropland (in dark red)

- Much cropland is located in the North of Syria and the South of Turkey



Cropland loss (in dark red) in Syria Vs. **Cropland gain (in black)** in Turkey



Land cover type change (2009-2017)

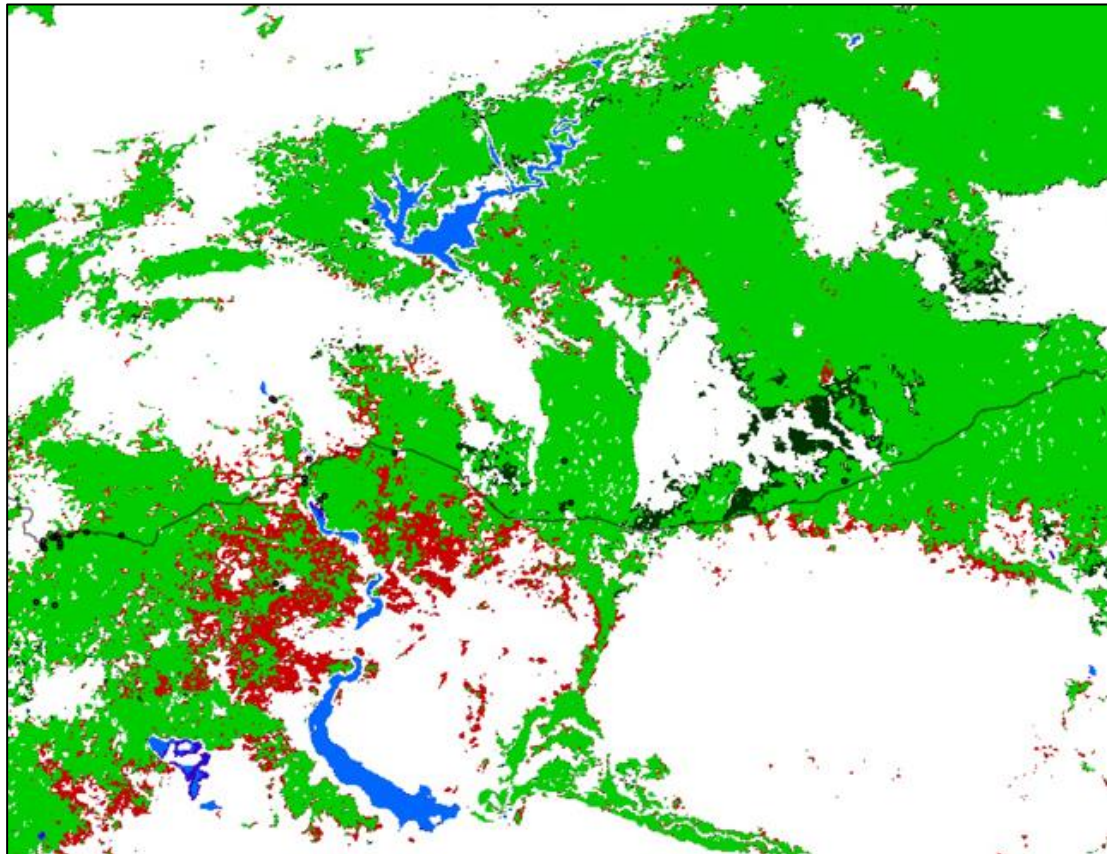
Cropland 2009 --> 2017 Classification

- Water --> Water
- Other --> Other
- Other --> Cropland
- Cropland --> Other
- Cropland --> Cropland

- Refugee camps



Zooming in on the Syria/Turkey border



- Abandoned cropland around the Euphrates river.
- Newly developed cropland in Turkey in Sanliurfa and Mardin provinces

Cropland 2009 --> 2017 Classification

Blue	Water --> Water
White	Other --> Other
Dark Green	Other --> Cropland
Red	Cropland --> Other
Light Green	Cropland --> Cropland



LAND USE (MEASURED FROM SATELLITE IMAGERY, 4/4)

Ar Raqqah - Sanliurfa border
There are no natural barriers (rivers, mountains) separating the two countries

2009



2016



Source: Google Earth



We divide the border into **vertical segments**

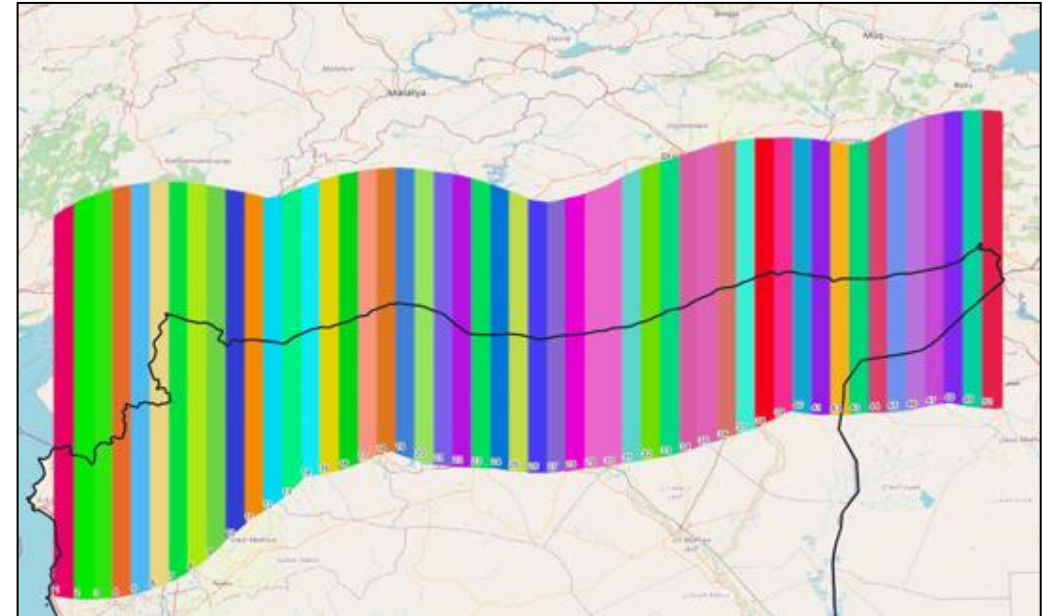
- 50 segments of around 10km width
- Each of the 340,000 pixels in the sample is attached to a single segment

Empirical analysis

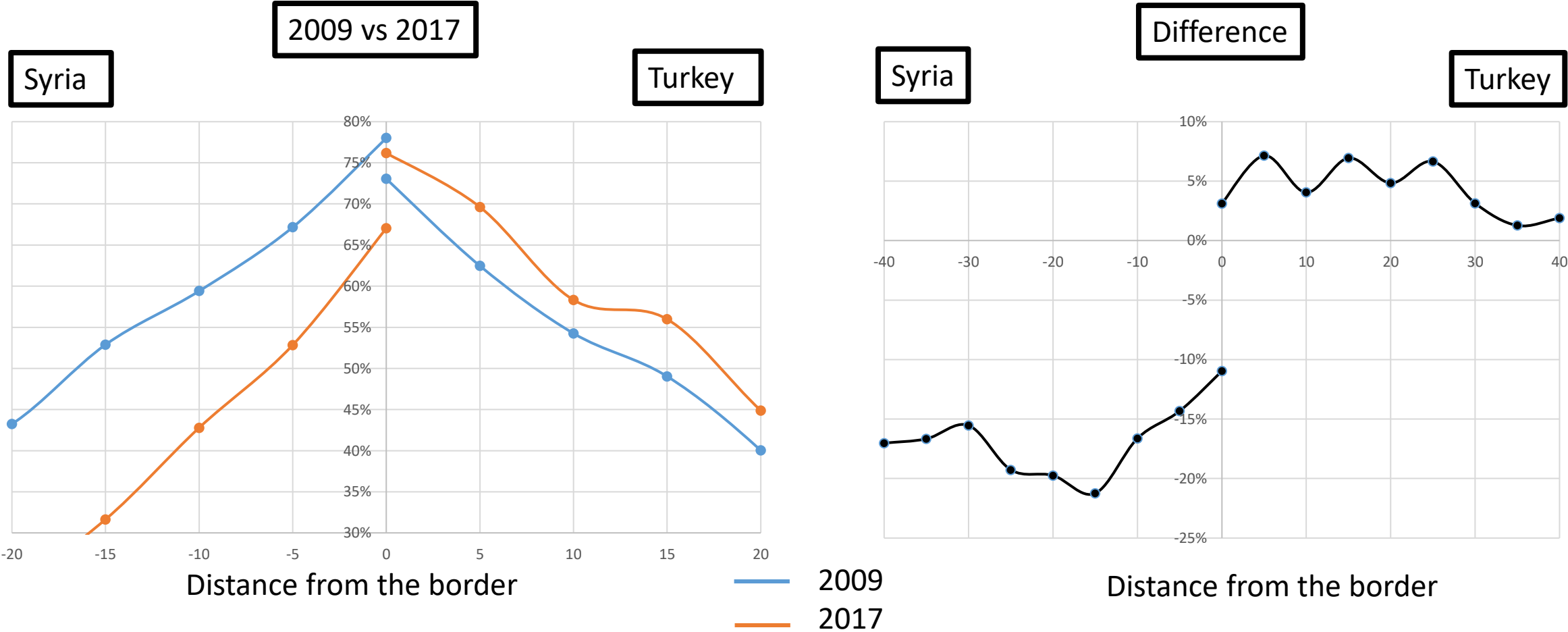
- We run a separate regression for each segment

$$y_i = \alpha + \tau T_i + \beta \cdot D_{ib} + \gamma T_i \times D_{ib} + \epsilon_i,$$

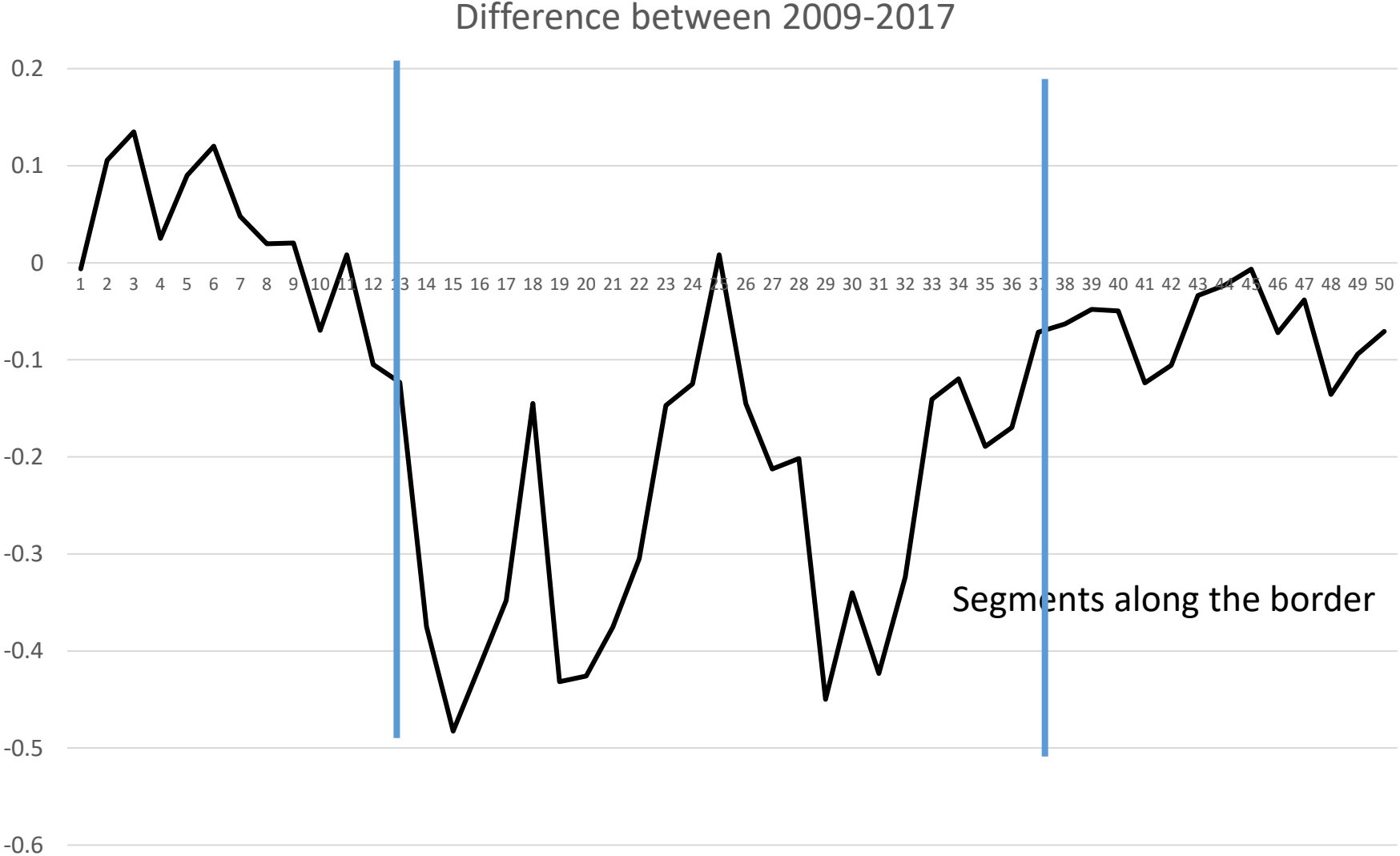
- We estimate τ , the impact of the conflict (how cropland changes for pixels in Syria during the conflict compared to comparable pixels in Turkey)



Cropland percentage along the border (center region)



SPATIAL REGRESSION DISCONTINUITY (3/3)



Results

- There is significant **decline on cropland use on the Syrian side** and **expansion on the Turkish side**
- The **difference is around 28%** - around 20% due to decline in Syria and 8% due to increase in Turkey

Next steps

- **Contributions of violence and migration** (out of Syria/into Turkey)
- **Persistence over time**
- Assessment of **economic cost**

THANK YOU FOR THE ATTENTION!