Land and Conflict in MENA

Land Use Change induced by Conflict and Displacement along the Syria-Turkey border

Caglar Ozden, Javier Parada, Hogeun Park, Harris Selod, Souleymane Soumahoro

You may access an interactive version of our maps at

https://javierparada.github.io

We appreciate any comments. Please feel free to contact us at

fparadagomezurqu@worldbank.org

Objective:

- Assess the impact of conflict (Syrian Civil War) on land use

- Research questions
  - 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?
- Data
  - Satellite imagery: MODIS land cover type data
    - Compare 2009 and 2017
  - Focus on Syria, Turkey and Iraq

Data: MCD12Q1.006 MODIS Land Cover Type Yearly Global 500m

- Availability: Yearly 2001-2019

Dataset Provider

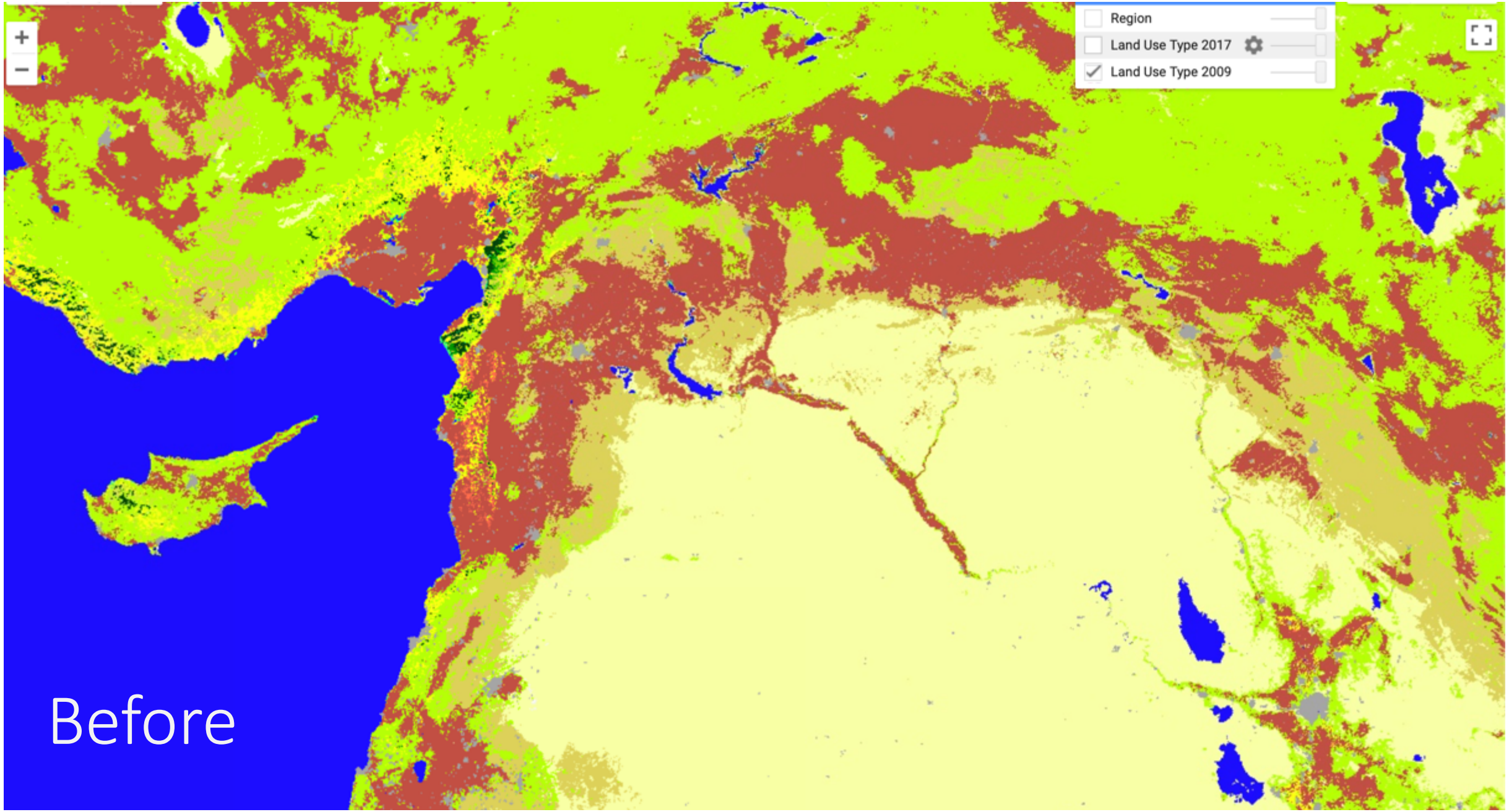
NASA LP DAAC at the USGS EROS Center

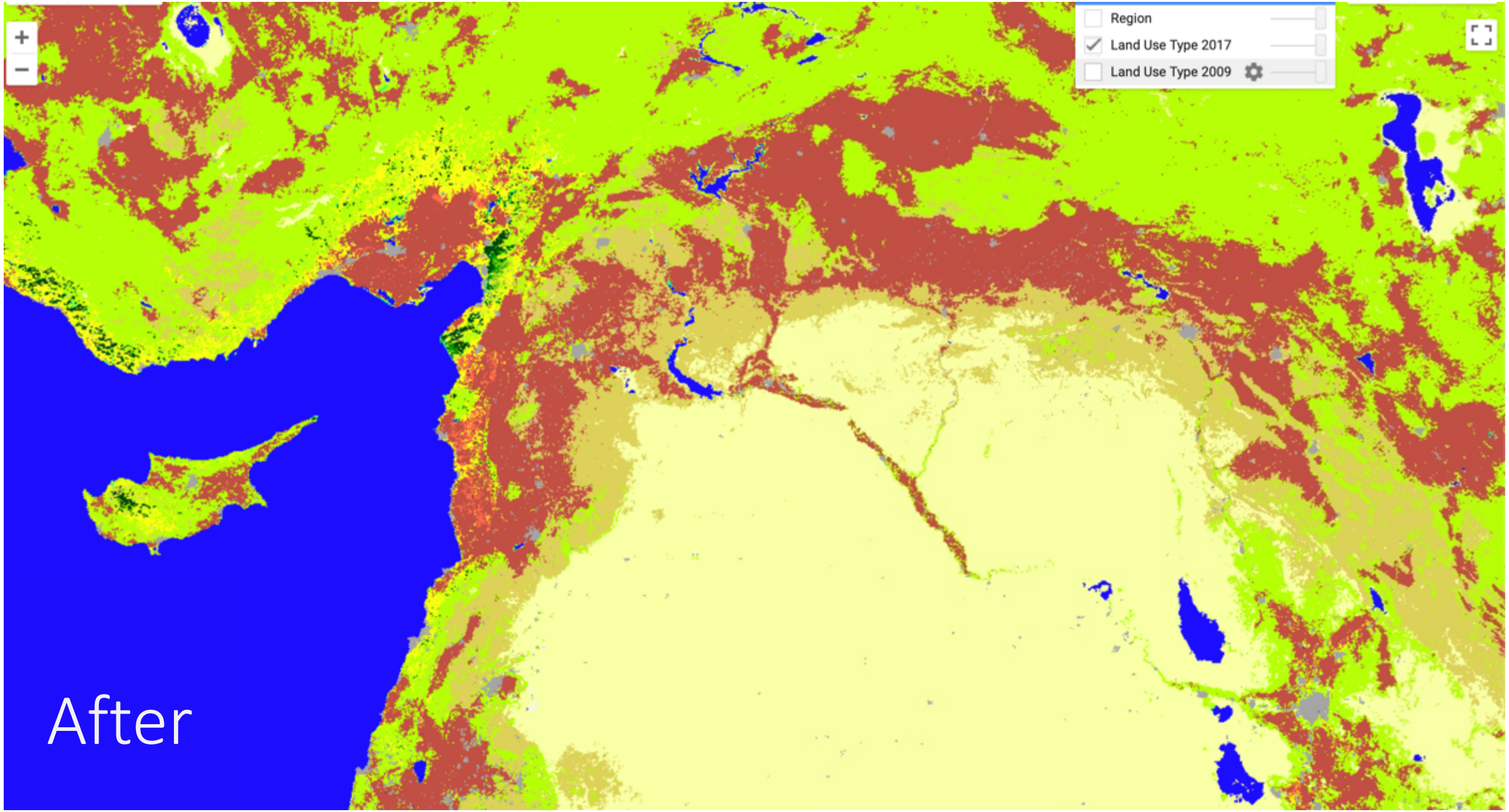
- Collection Snippet

ee.ImageCollection("MODIS/006/MCD12Q1")

Land Cover Type 2: Annual University of Maryland (UMD) classification

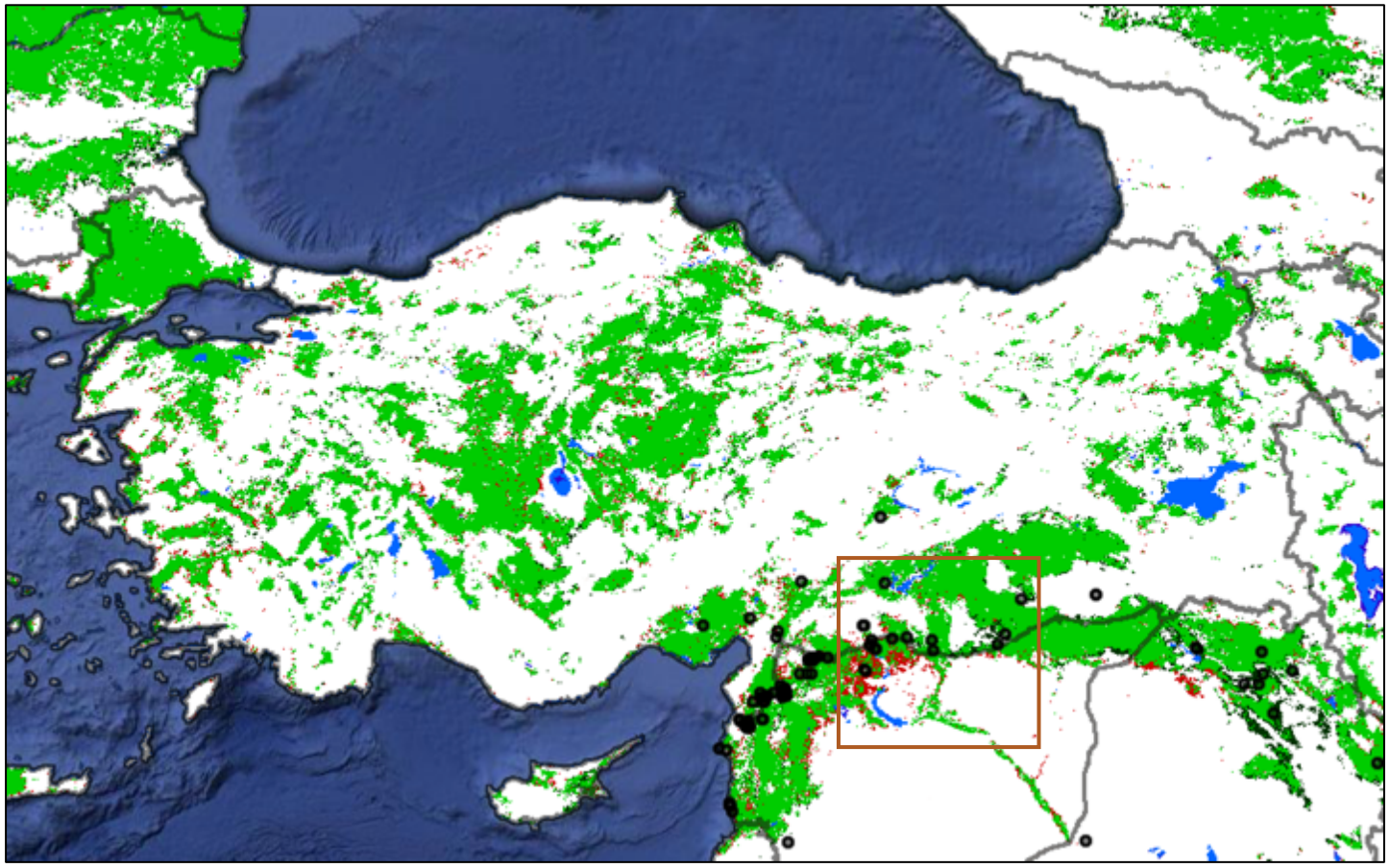
Value	Color	Color Value	Description
0		#1c0dff	Water Bodies: at least 60% of area is covered by permanent water bodies.
1		#05450a	Evergreen Needleleaf Forests: dominated by evergreen conifer trees (canopy >2m). Tree cover >60%.
2		#086a10	Evergreen Broadleaf Forests: dominated by evergreen broadleaf and palmate trees (canopy >2m). Tree cover >60%.
3		#54a708	Deciduous Needleleaf Forests: dominated by deciduous needleleaf (larch) trees (canopy >2m). Tree cover >60%.
4		#78d203	Deciduous Broadleaf Forests: dominated by deciduous broadleaf trees (canopy >2m). Tree cover >60%.
5		#009900	Mixed Forests: dominated by neither deciduous nor evergreen (40-60% of each) tree type (canopy >2m). Tree cover >60%.
6		#c6b044	Closed Shrublands: dominated by woody perennials (1-2m height) >60% cover.
7		#dcd159	Open Shrublands: dominated by woody perennials (1-2m height) 10-60% cover.
8		#dade48	Woody Savannas: tree cover 30-60% (canopy >2m).
9		#fbff13	Savannas: tree cover 10-30% (canopy >2m).
10		#b6ff05	Grasslands: dominated by herbaceous annuals (<2m).
11		#27ff87	Permanent Wetlands: permanently inundated lands with 30-60% water cover and >10% vegetated cover.
12		#c24f44	Croplands: at least 60% of area is cultivated cropland.
13		#a5a5a5	Urban and Built-up Lands: at least 30% impervious surface area including building materials, asphalt and vehicles.
14		#ff6d4c	Cropland/Natural Vegetation Mosaics: mosaics of small-scale cultivation 40-60% with natural tree, shrub, or herbaceous vegetation.
15		#f9ffa4	Non-Vegetated Lands: at least 60% of area is non-vegetated barren (sand, rock, soil) or permanent snow and ice with less than 10% vegetation.


Region
Land Use Type 2017
Land Use Type 2009
Before


Region
Land Use Type 2017
Land Use Type 2009
After

Cropland expansion in Turkey

Map 1: Land cover type change (Turkey and Syria, 2009-2017)



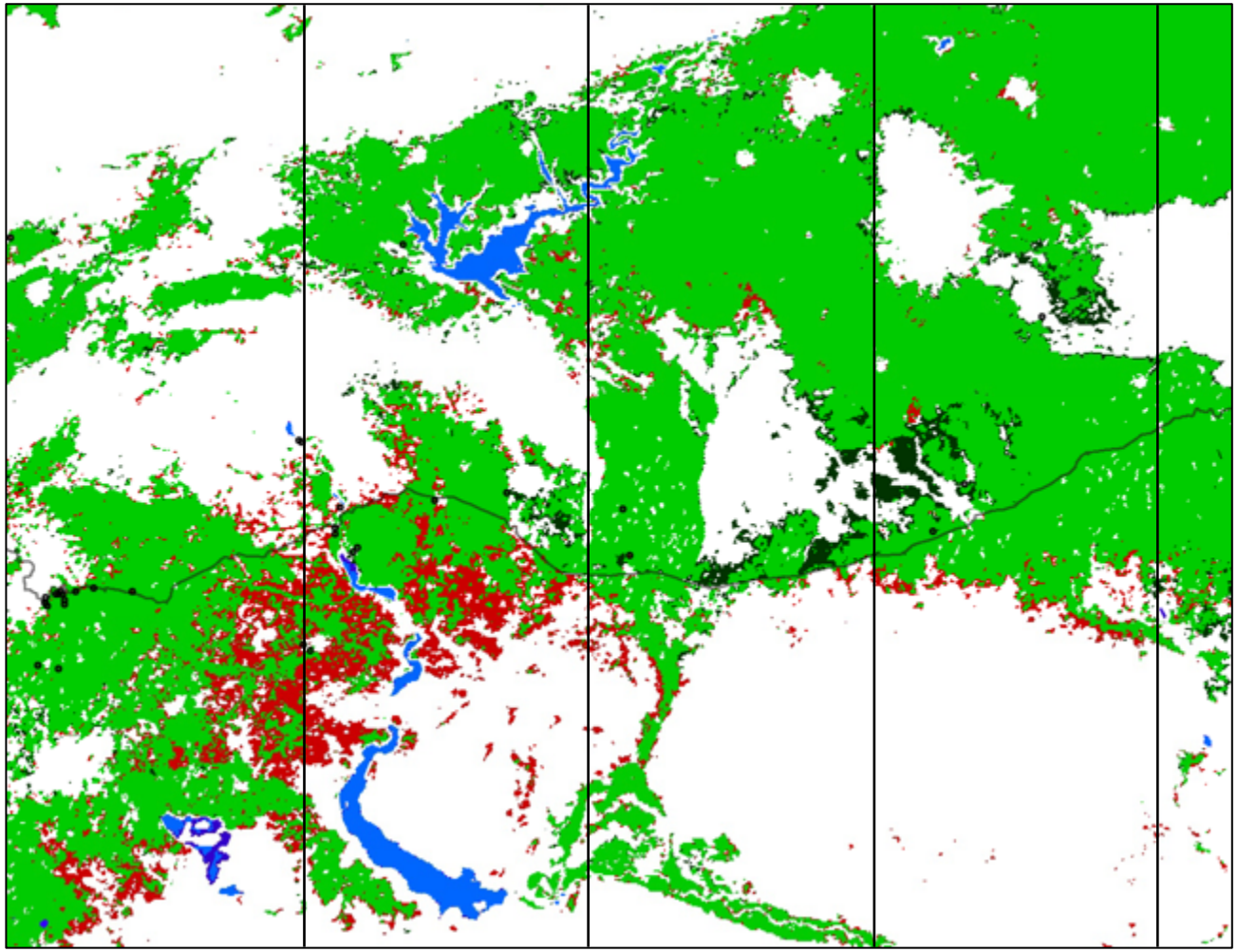
Source: MCD12Q1.006 MODIS Land Cover Type Yearly Global 500m

- Migrants (working in agriculture) initially located near the border
- Cropland expanded at the margin of existing cropland (likely irrigated, commercial agriculture)

- Refugee camps

Zooming in to the Syria-Turkey border

Map 2: Land cover type change (Syria-Turkey border, 2009-2017)



- Most of the abandoned cropland is located around the Euphrates river on the Syrian side of the Syria-Turkey border in Aleppo and Ar-Raqqah governorates.
- Most of the newly developed cropland in Turkey is in Sanliurfa and Mardin provinces.
    - Refugee camps

Source: MCD12Q1.006 MODIS Land Cover Type Yearly Global 500m

Further zooming in to the Syria-Turkey border

Map 3: The Ar Raqqah - Sanliurfa border

- There are no natural barriers (rivers, mountains) separating the two countries

2009

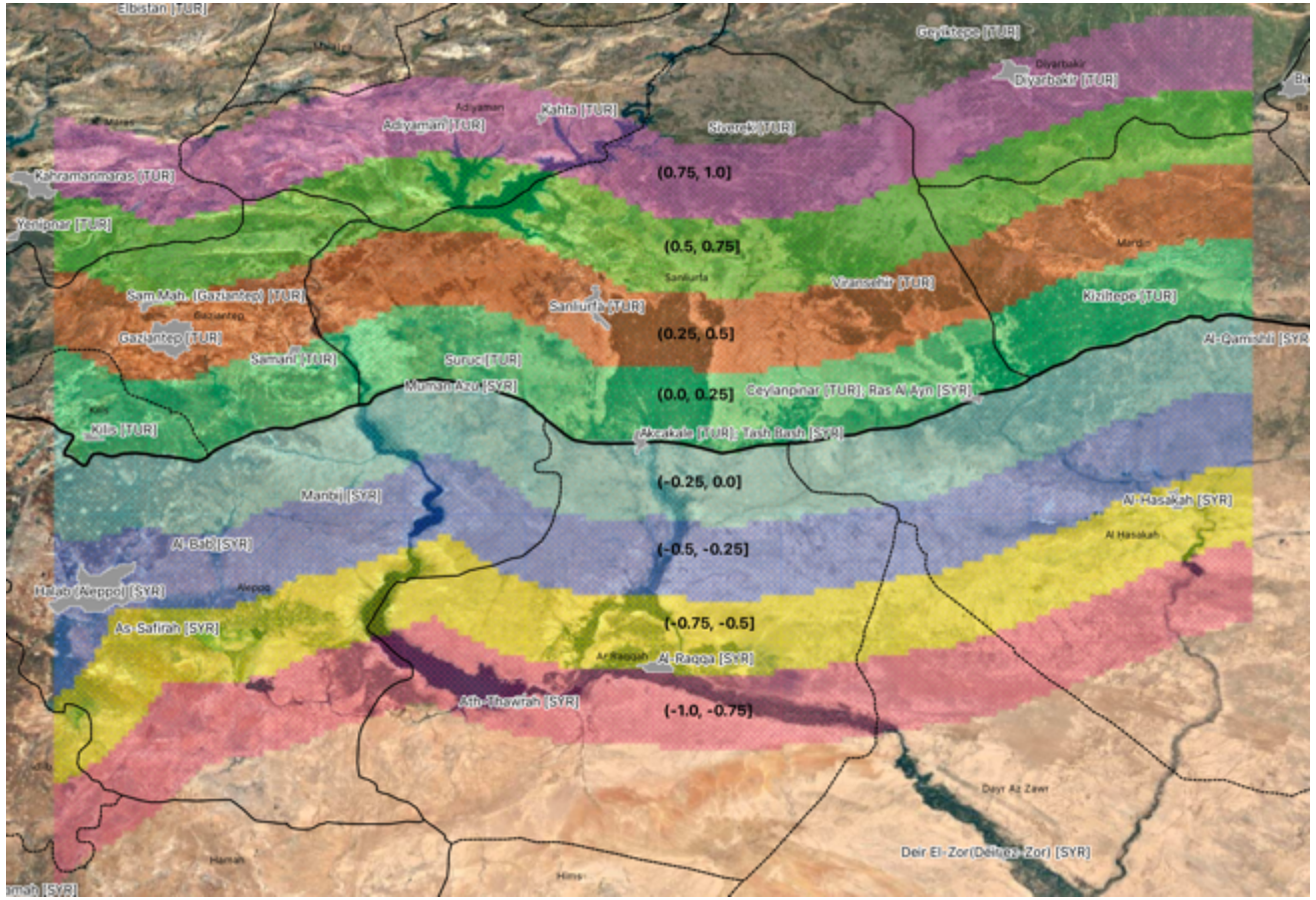
2016

Source: Google Earth

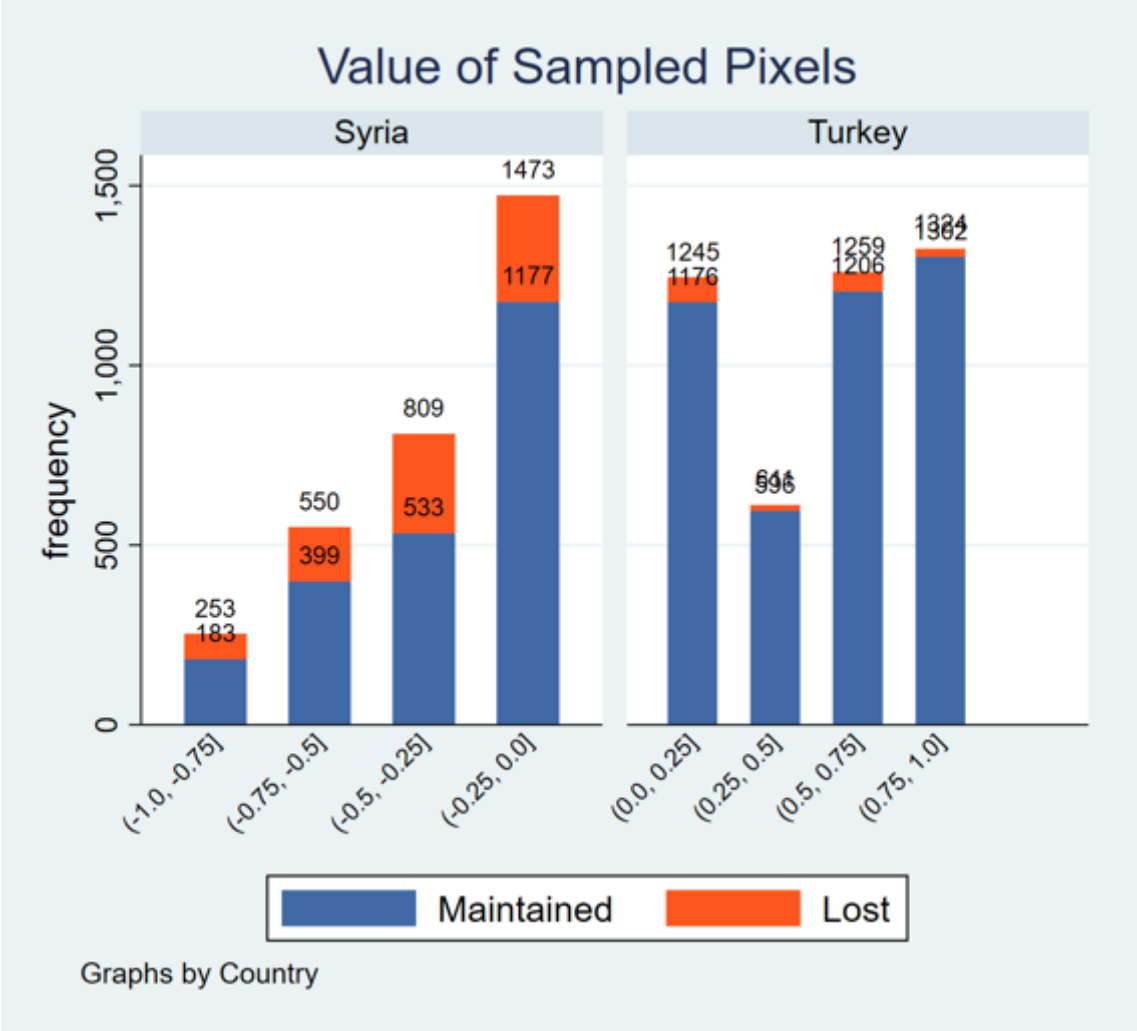
Buffer zone analysis

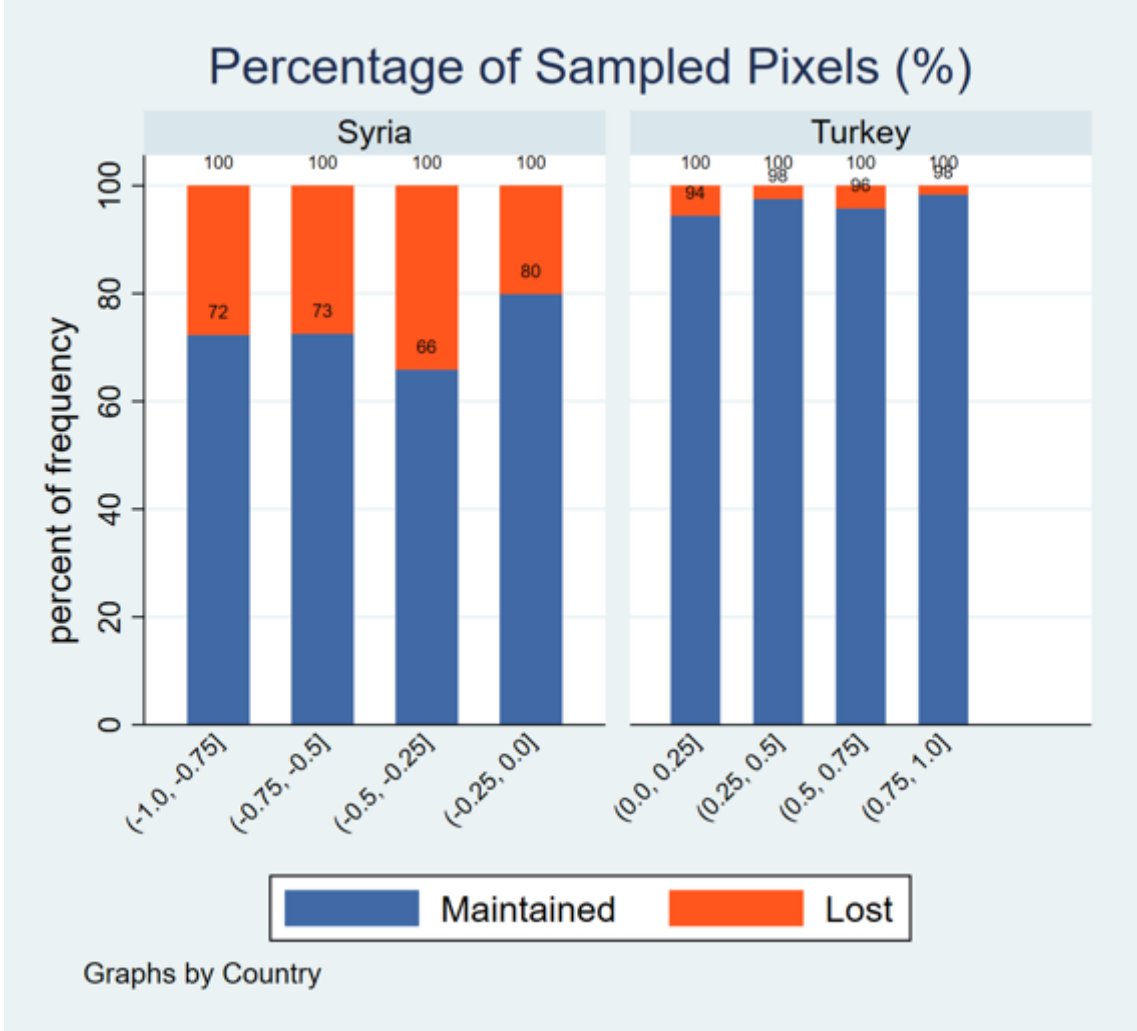
- We study **transitions into and out of cropland** on each side of the border (1-degree band / 110 km in each direction)
  - **Losses**: Whether 2009 croplands were maintained or lost in 2017
  - **Gains**: Whether 2017 croplands already existed in 2009 or were newly developed
- We divide each band into 4 **buffers**. The areas of the two middle buffers are similar in:
  - total area
  - cropland area
  - weather

Map 4: Buffer zones along the Syria-Turkey border

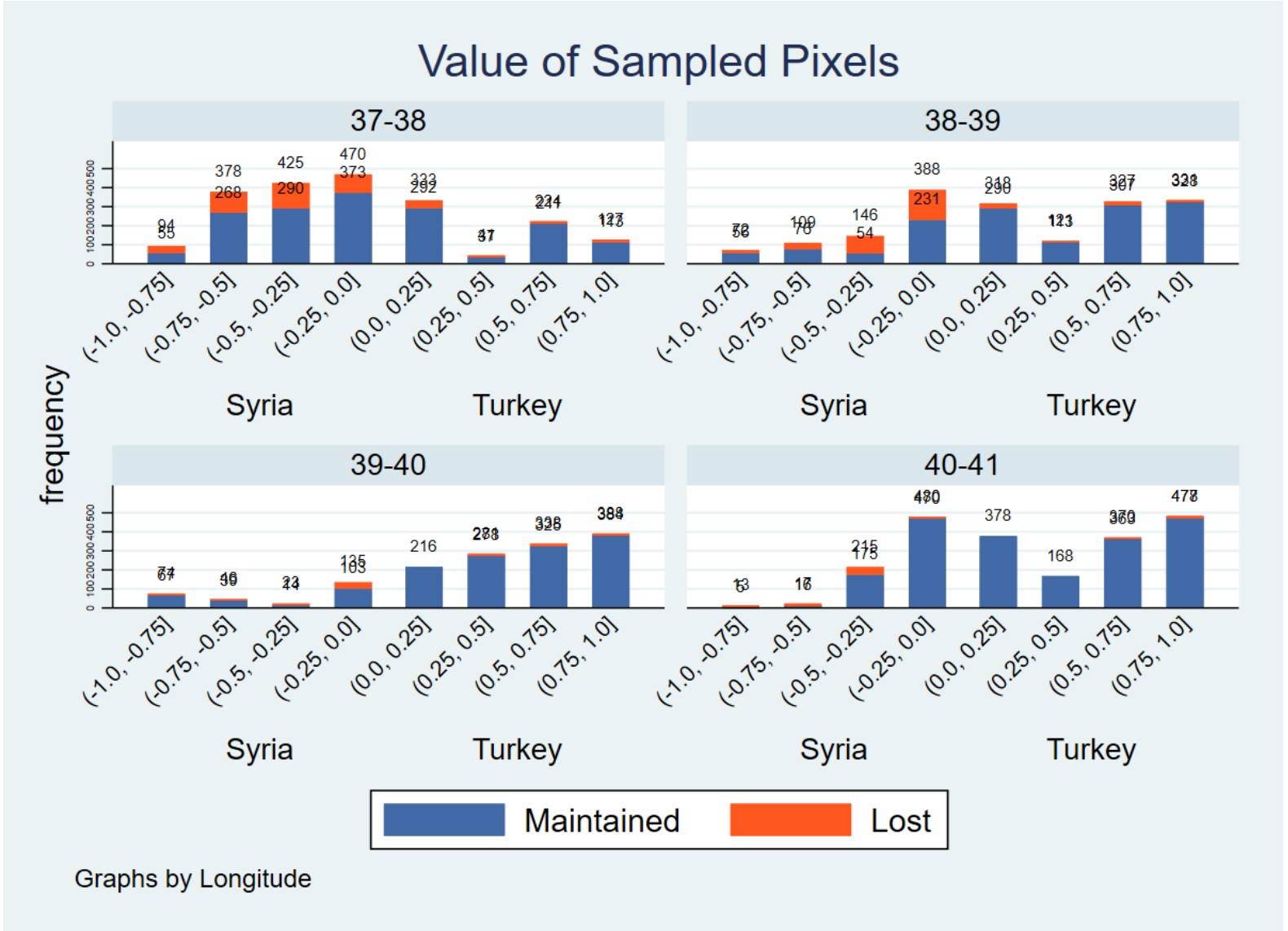


Transition out of cropland between 2009-2017

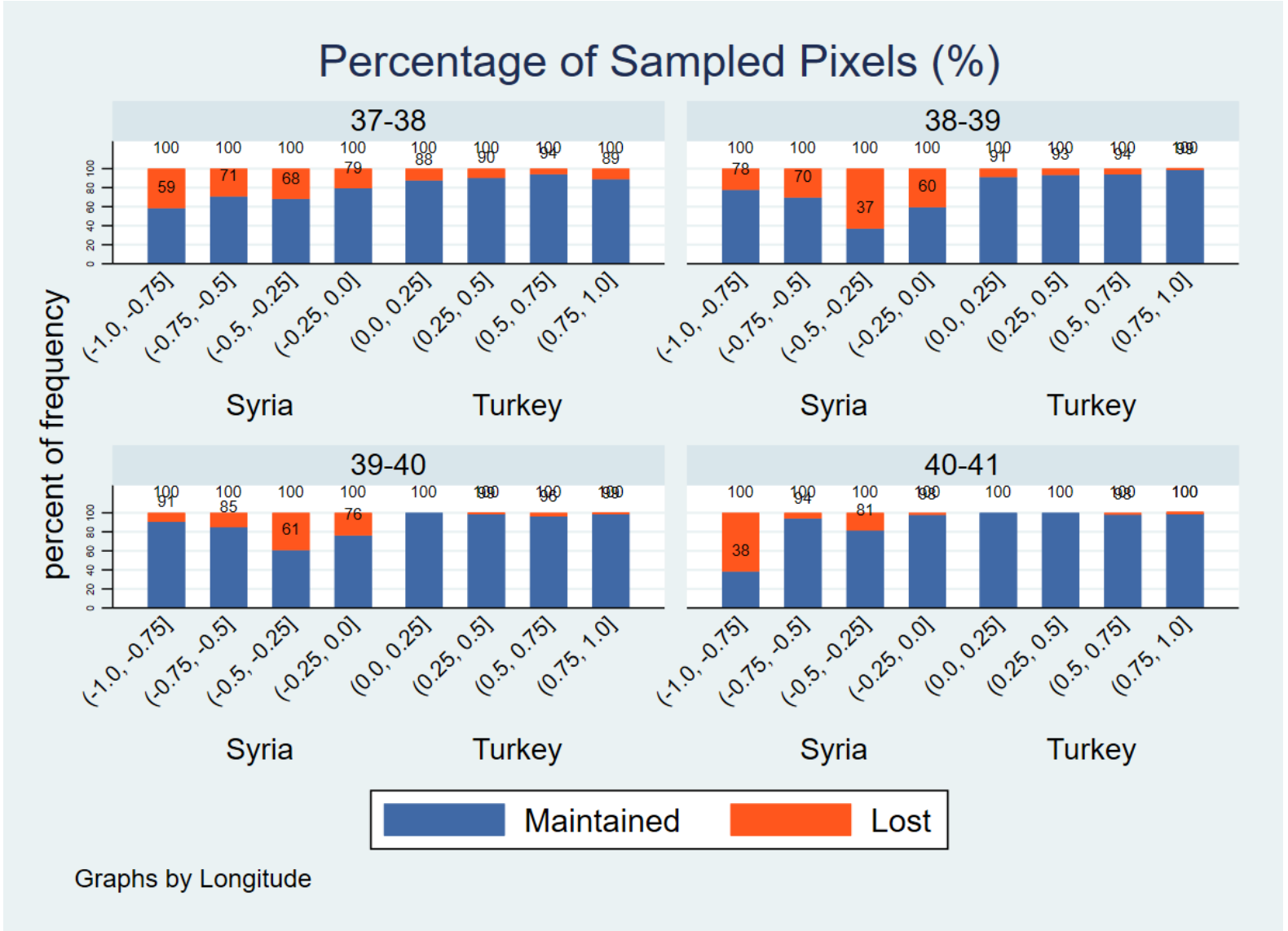




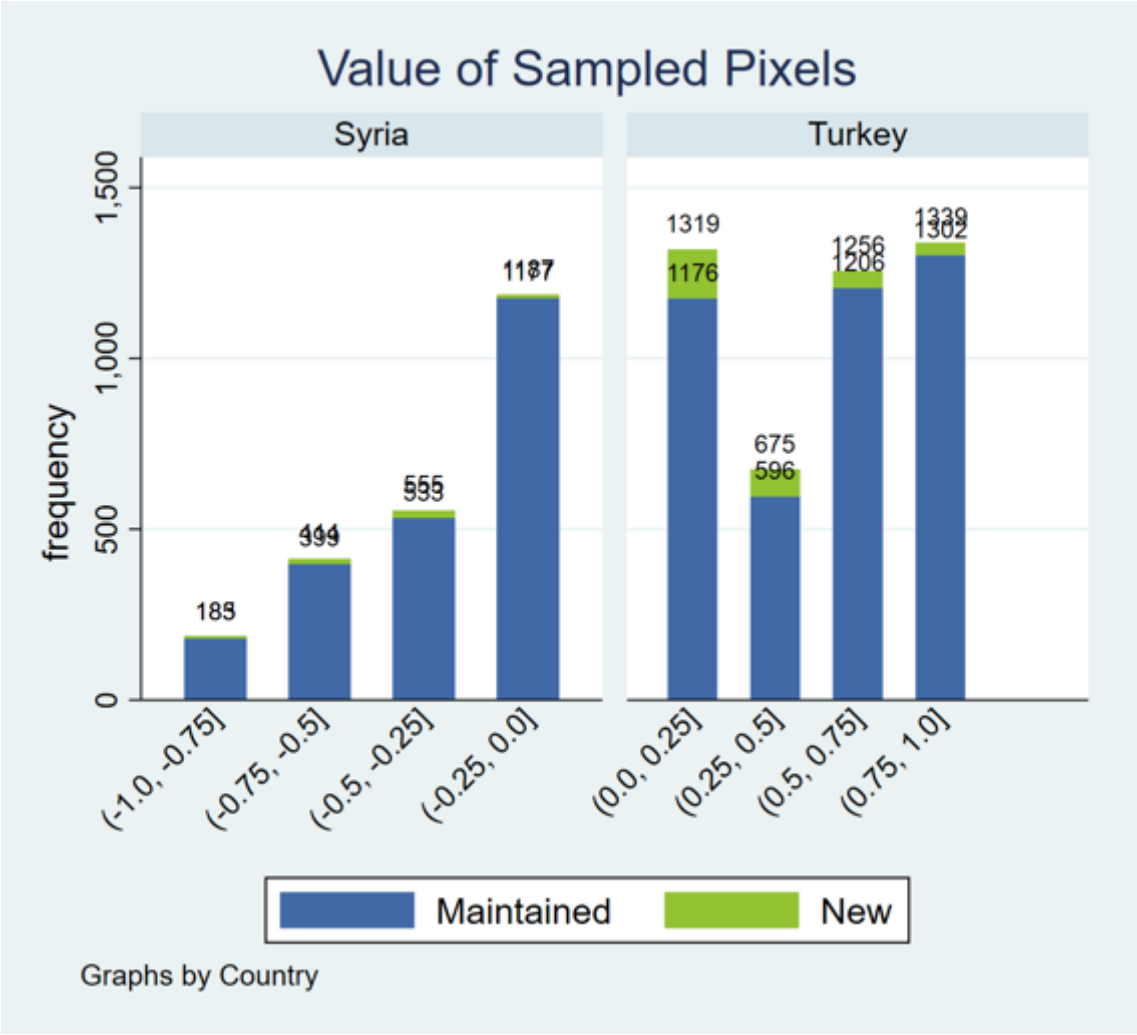
Transition out of cropland between 2009-2017
Value for each longitude bin

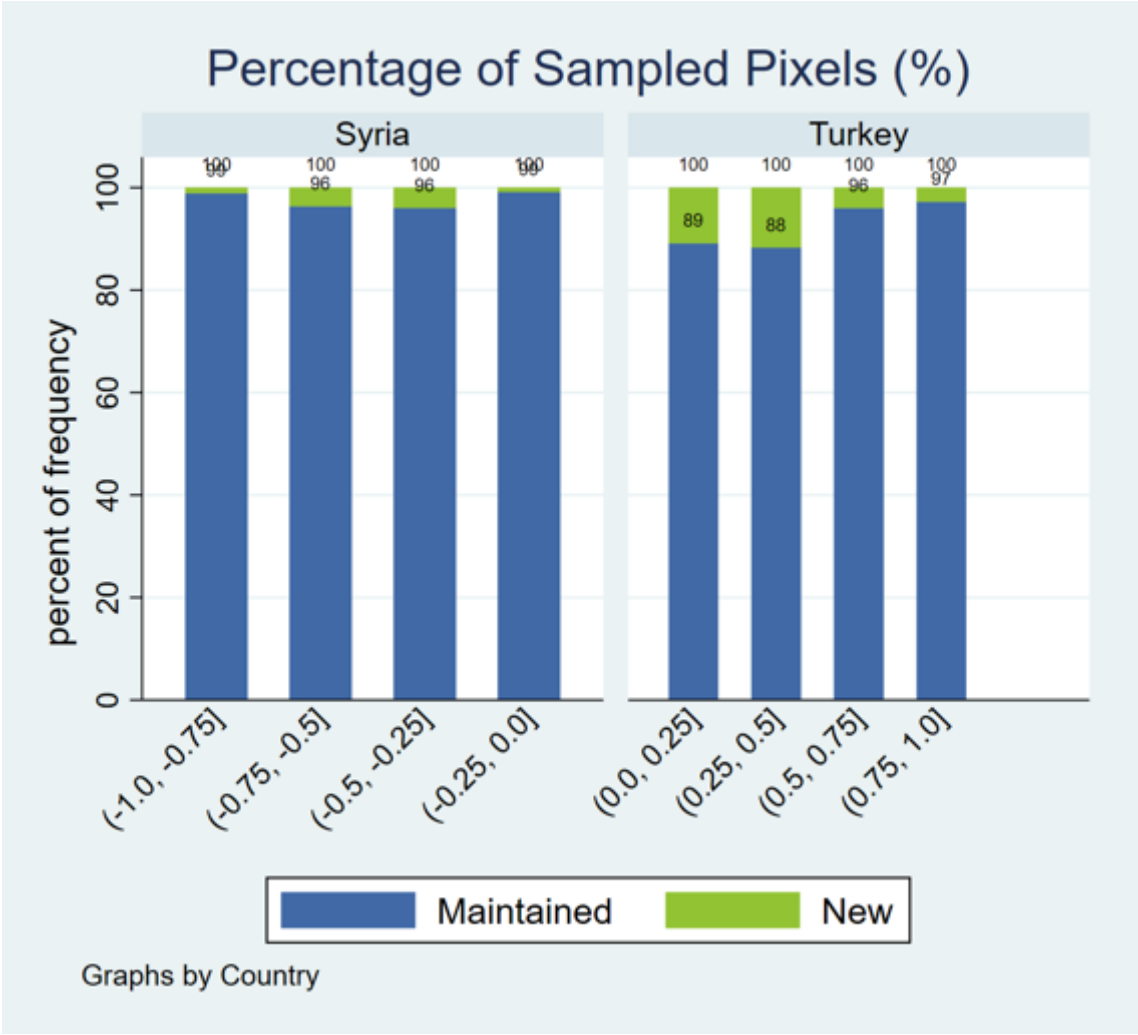


Transition out of cropland between 2009-2017
Percentage for each longitude bin

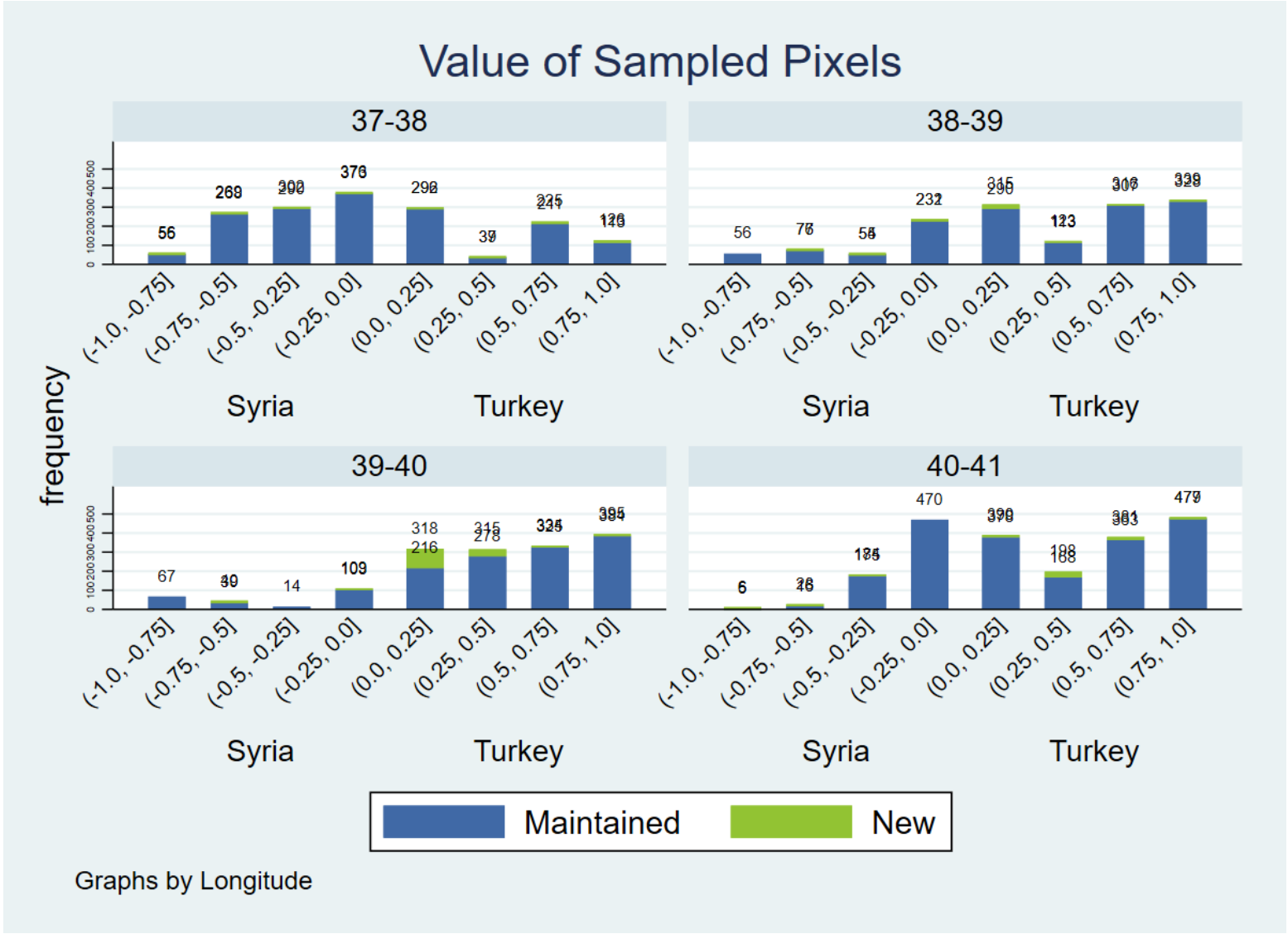


Transition into cropland between 2009-2017

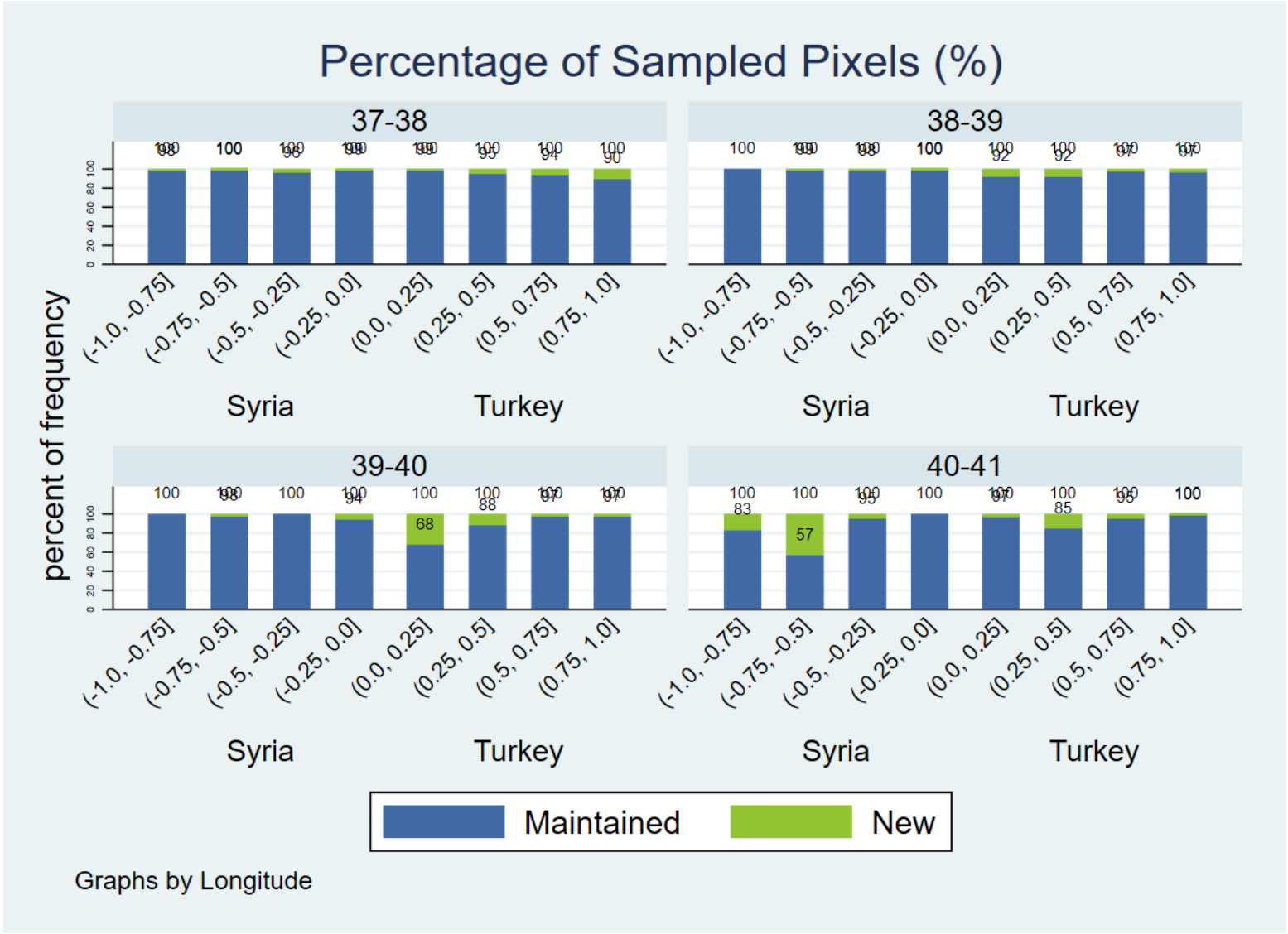




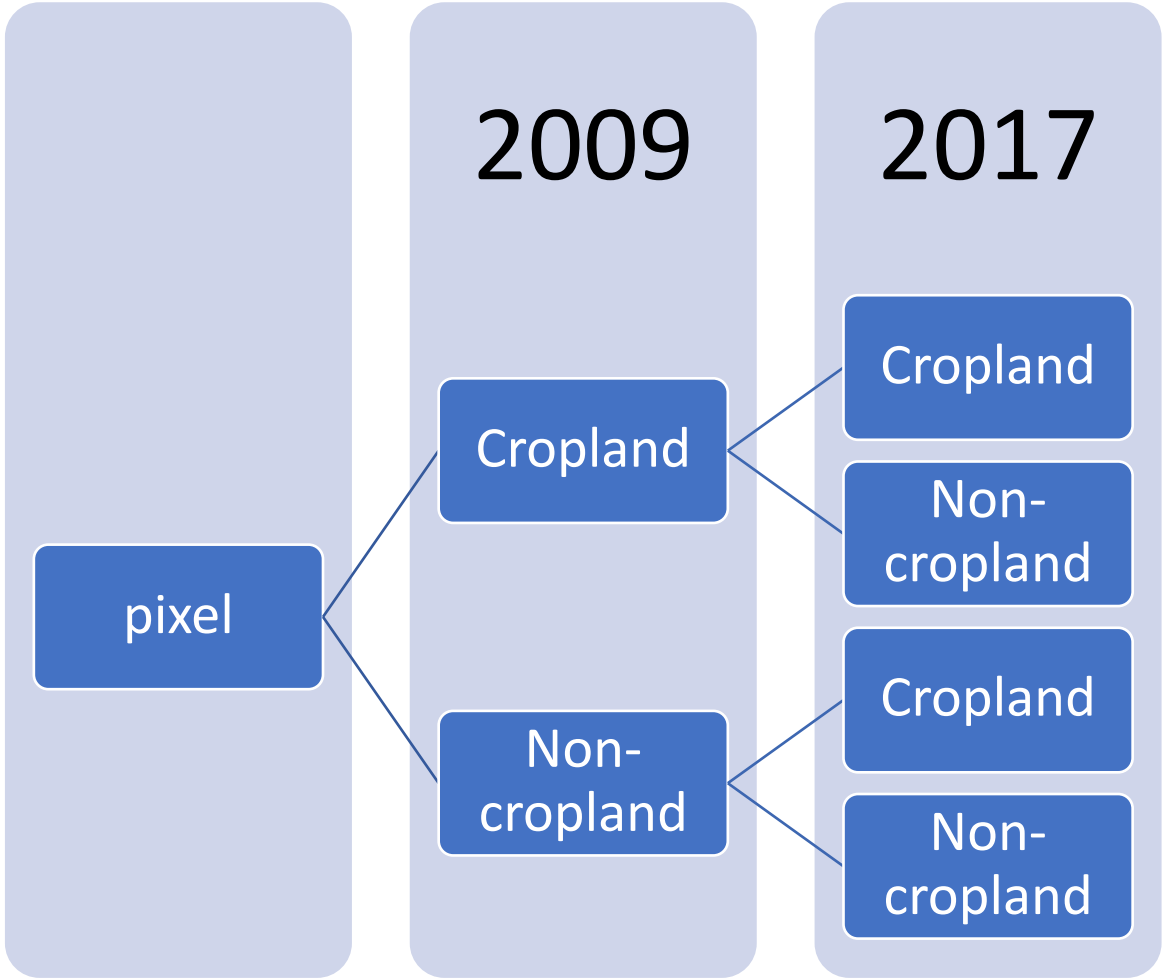
Transition into cropland between 2009-2017
Value for each longitude bin



Transition into cropland between 2009-2017
Percentage for each longitude bin



Land Cover Change Model



Estimation

- Linear regression

  reg cropland ib7.bins *if Longitude==`l'*

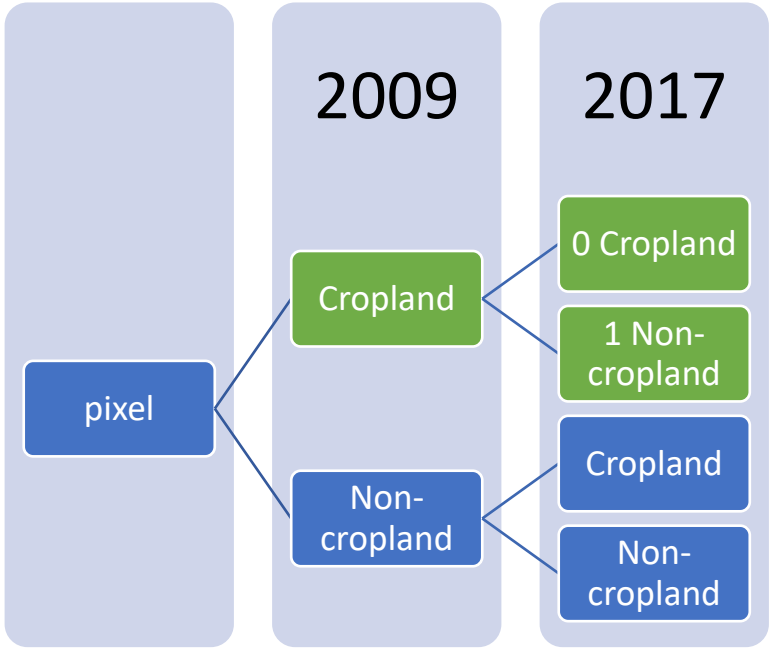
- Logit regression

  logit cropland ib7.bins *if Longitude==`l'*

Omit from regression: Northern buffer in Turkey
ib7 = leaves out the last buffer in Turkey – sets its coefficient to zero.

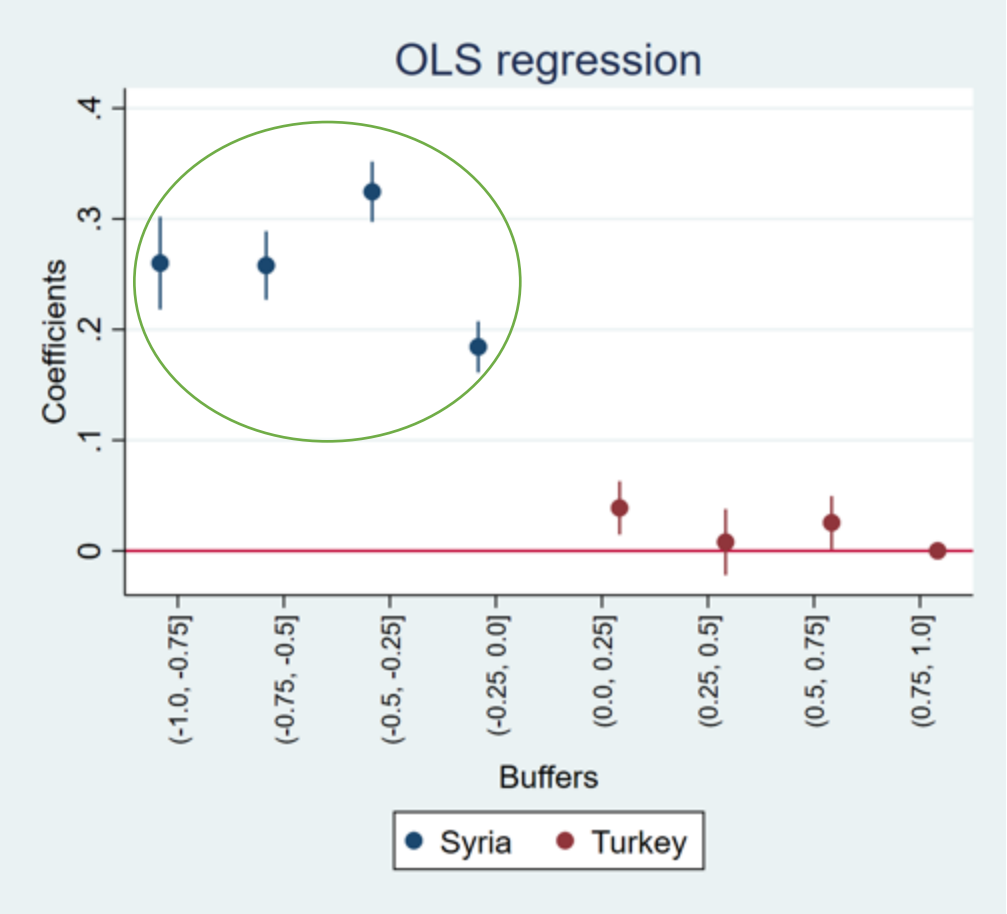
Model 1: Losses

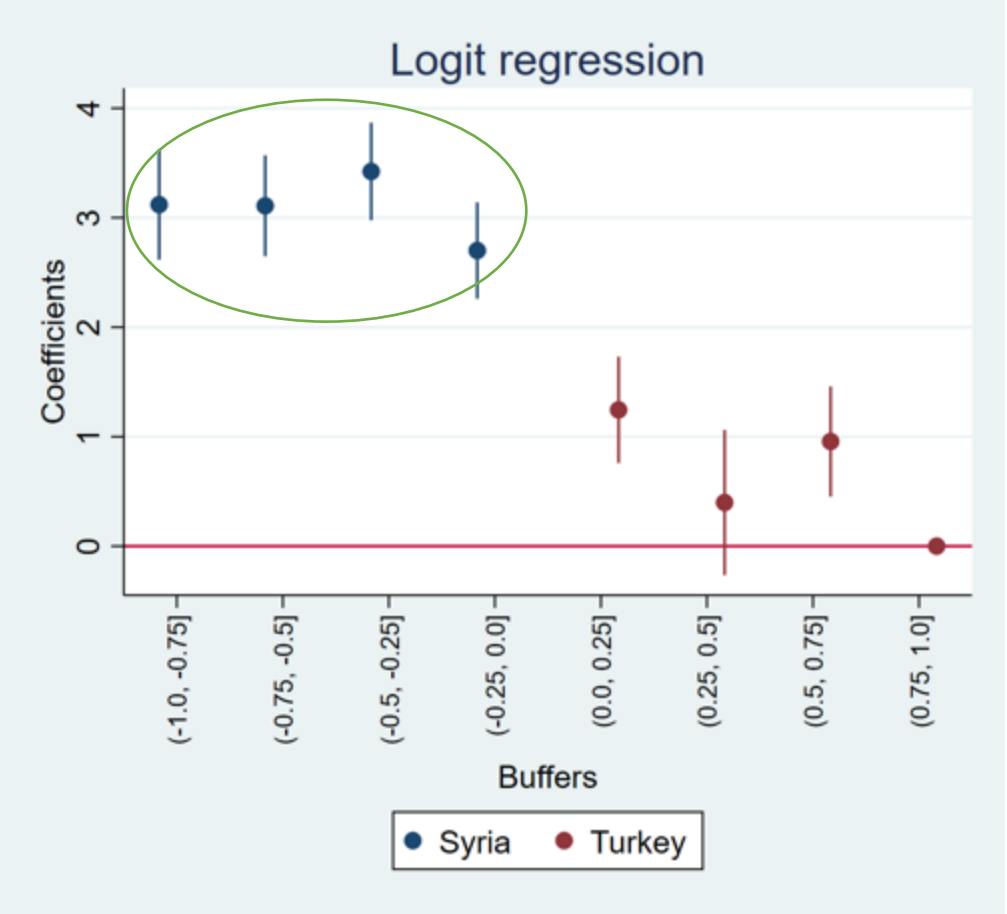
- Interpretation
  - Crossing the border into Syria leads to greater losses



Coefficients for distance to the border

Loss of cropland = 1, Maintained cropland = 0

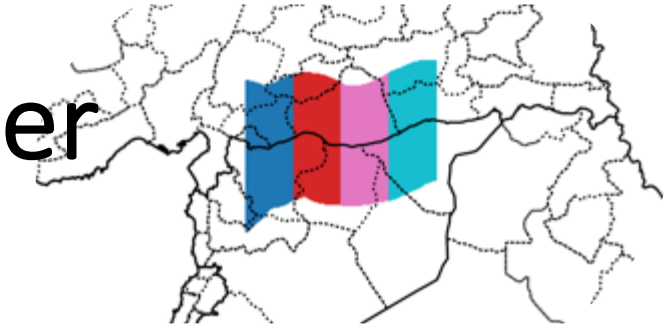


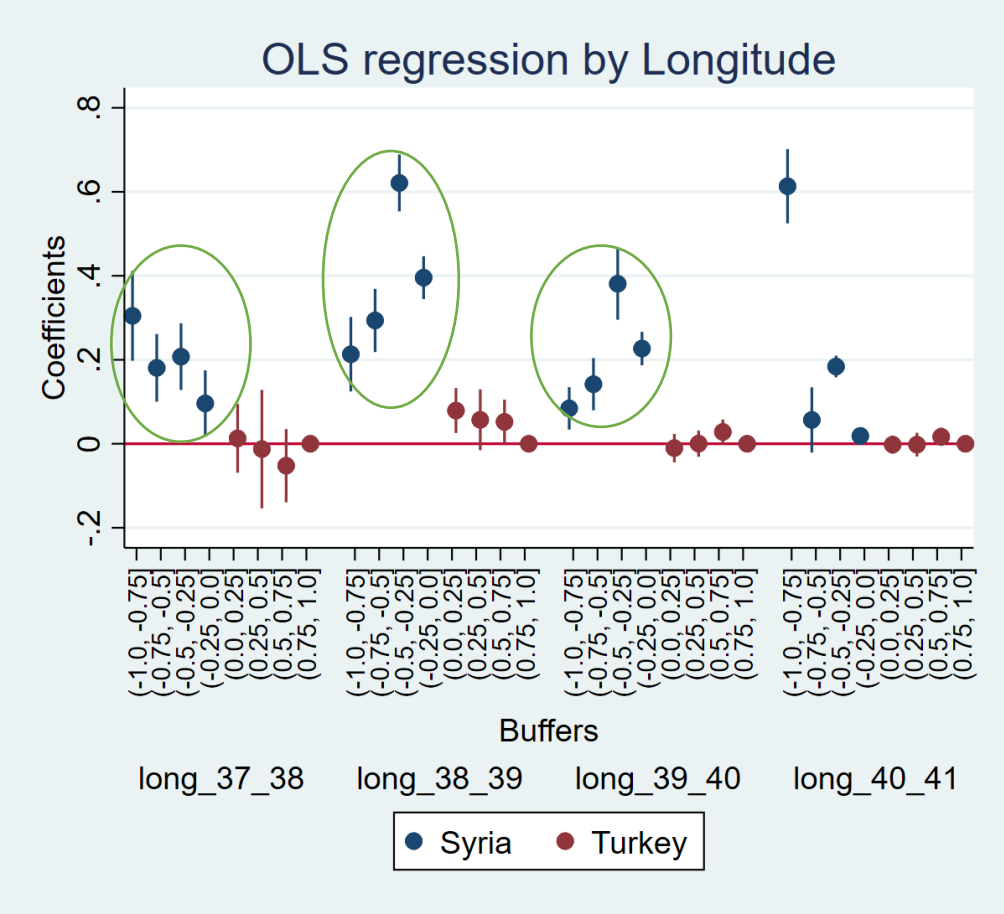


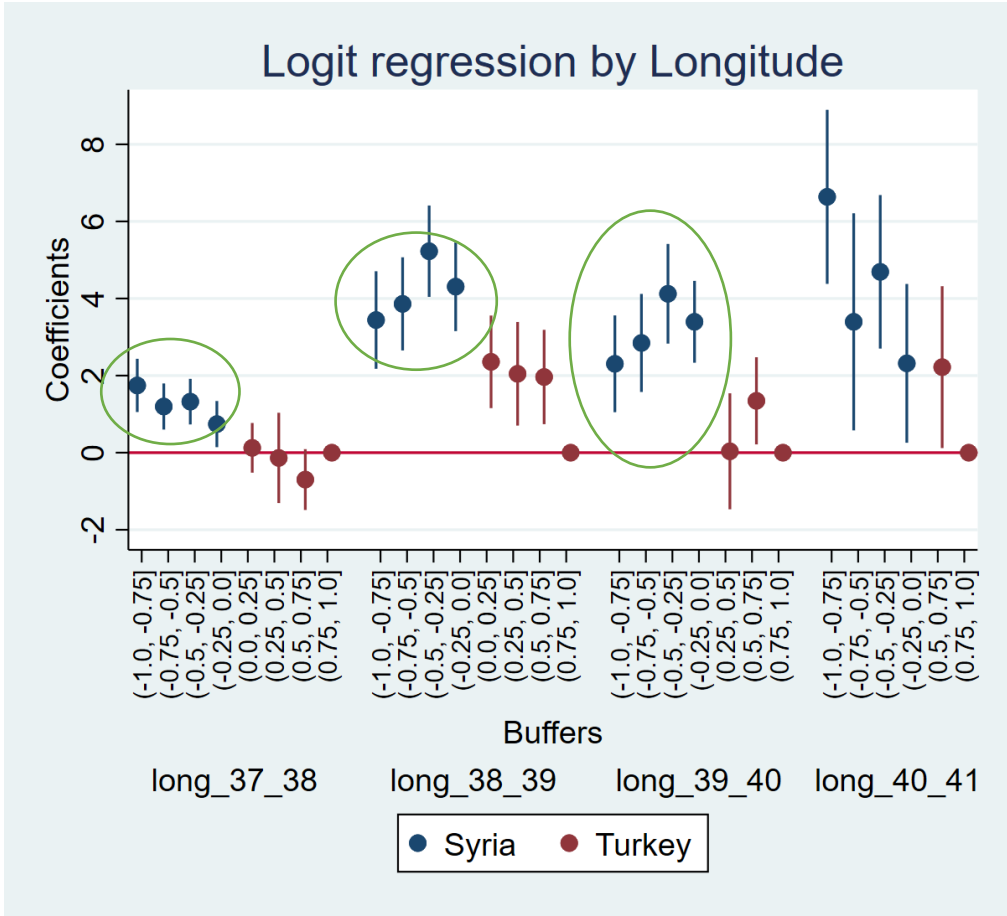
No clear effect of distance from the border, but a clear effect for what side of the border are you in.

Coefficients for distance to the border

Loss of cropland = 1, Maintained cropland = 0

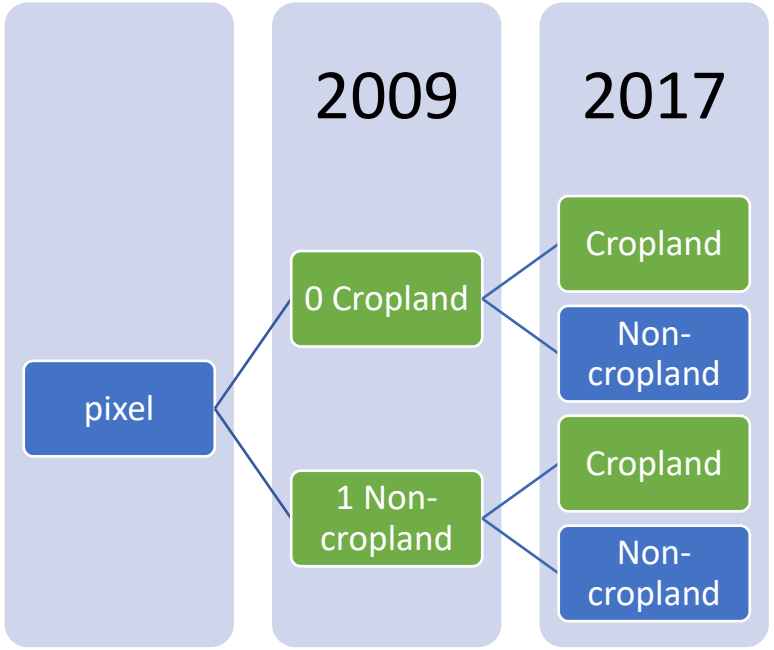






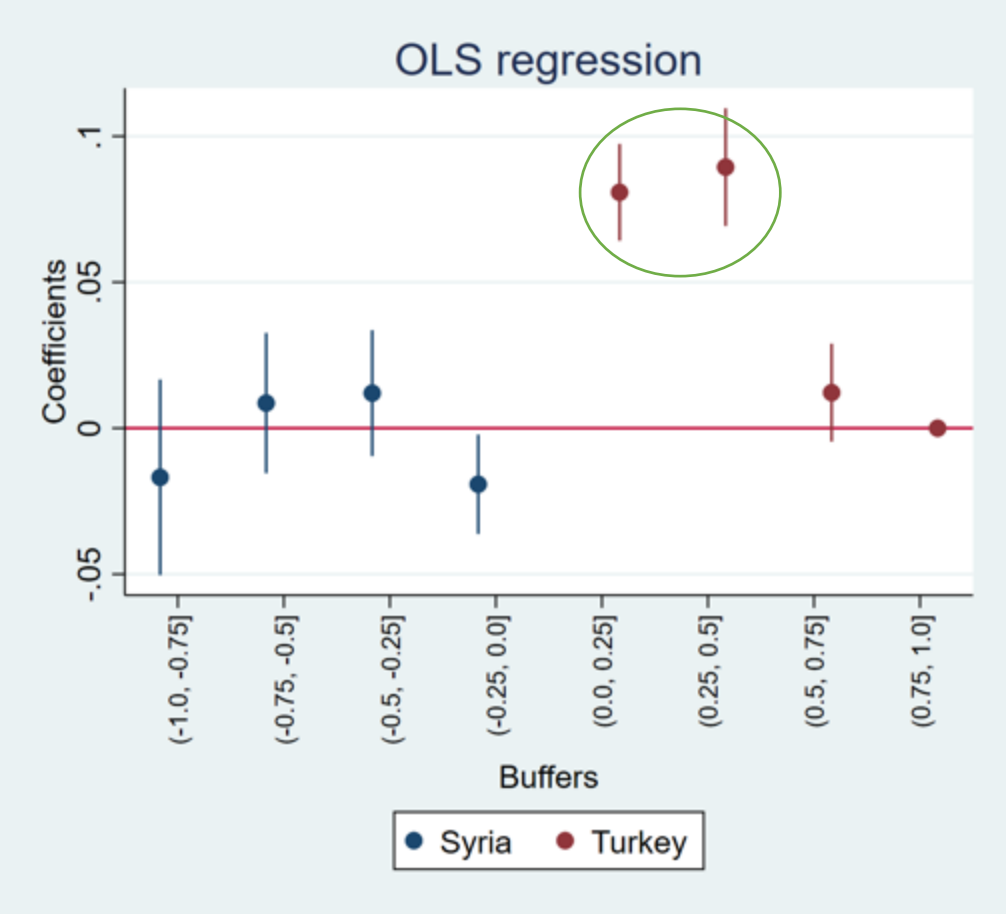
Model 2: Gains

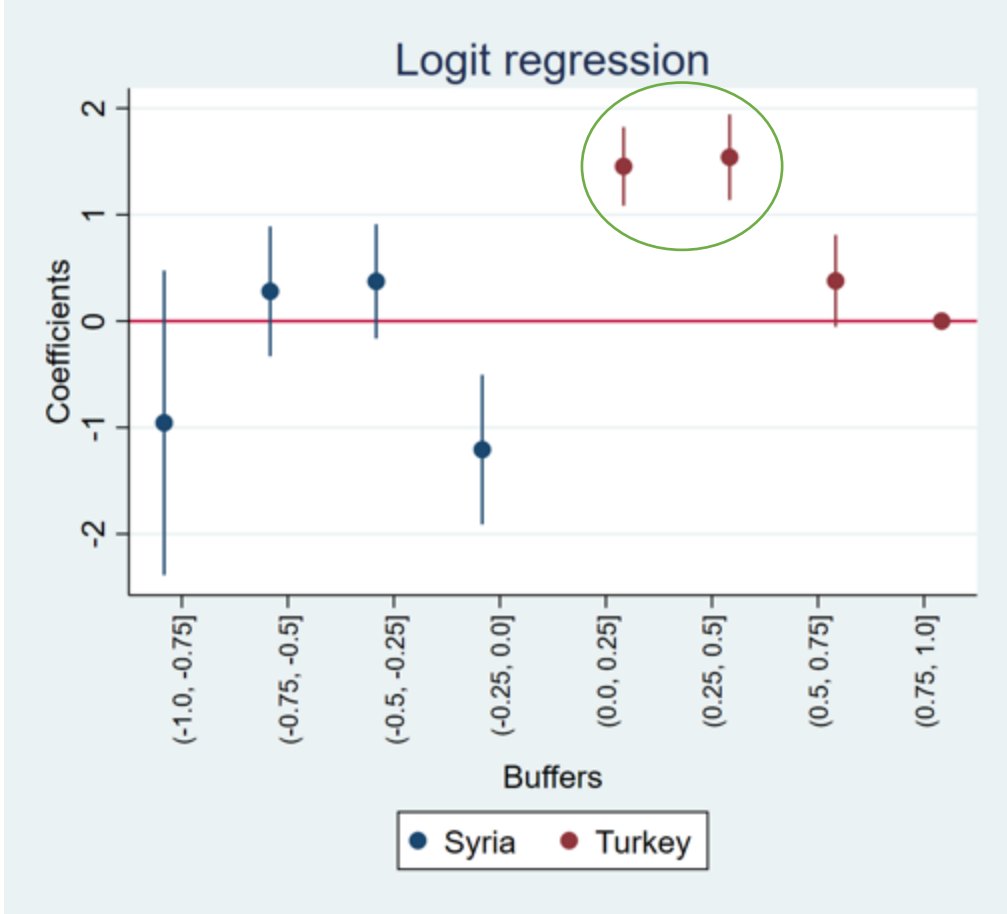
- Interpretation
  - Being in Turkish side close to the border leads to higher gains



Coefficients for distance to the border

Gained cropland = 1, Maintained cropland = 0

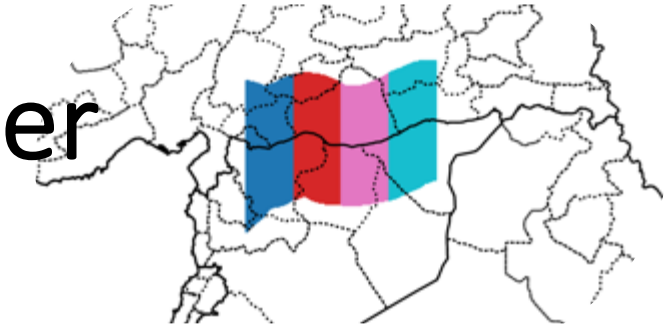


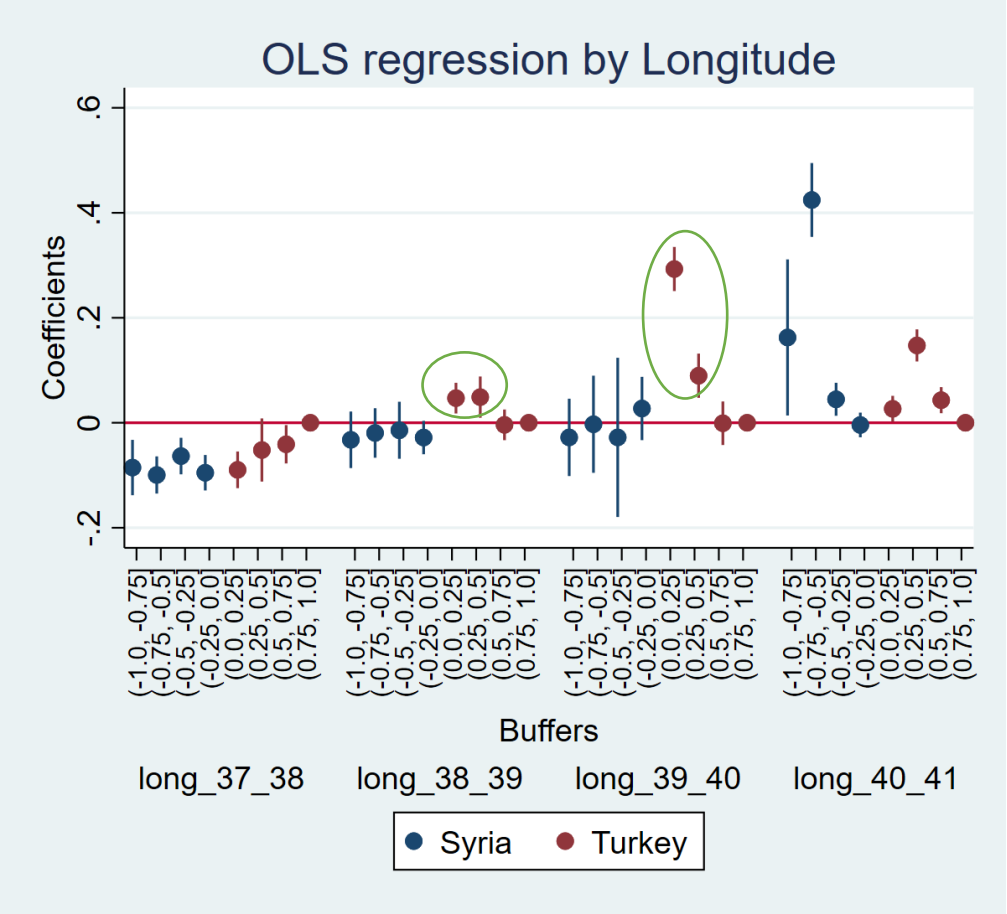


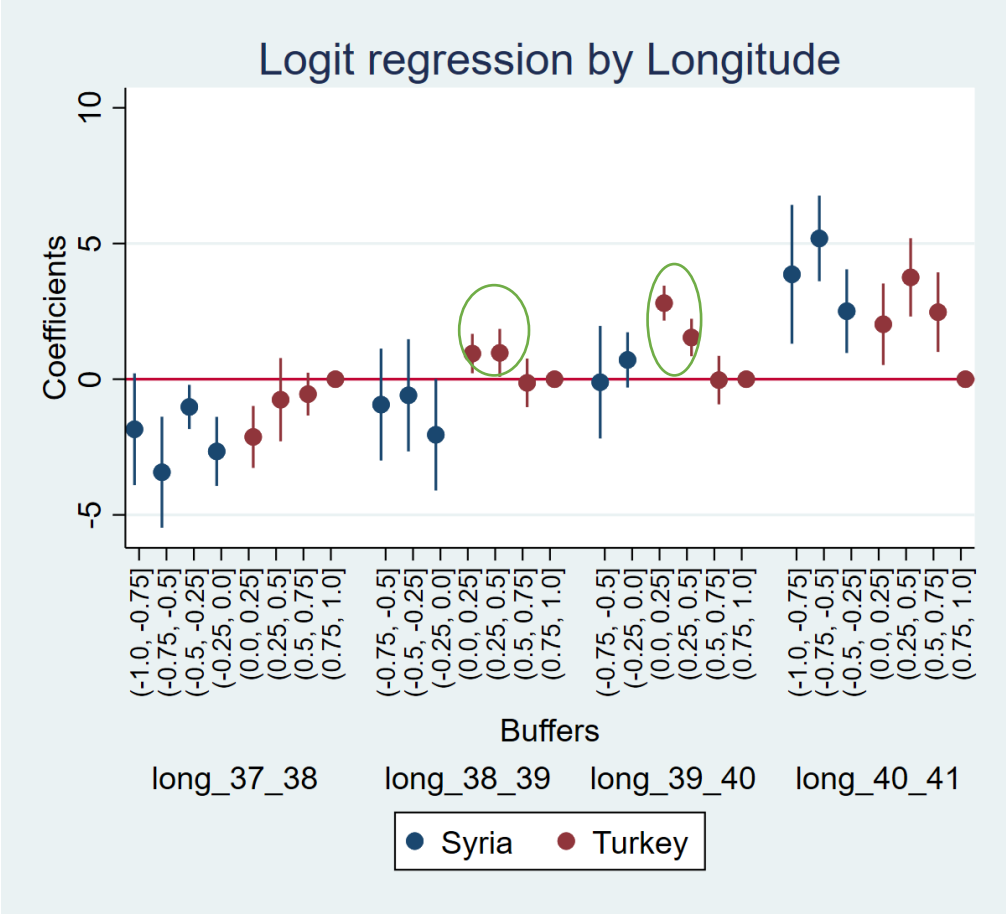
Two Turkish buffers closest to the border are most likely to have new croplands

Coefficients for distance to the border

Gained cropland = 1, Maintained cropland = 0







Next steps

- Adding control variables (precipitation, elevation)
- Endogenous borders – ISIS in Iraq
- Mechanisms
  - Proximity to violence from UCDP data
  - Population movement – cropland gain in Turkey
- Extensive versus intensive margin
- Temporary versus permanent effects
- Other outcomes (nighttime lights)

Two papers:

1. A Spatial Econometric Model of Land Use Change due to Conflict and Displacement along the Syria-Turkey border

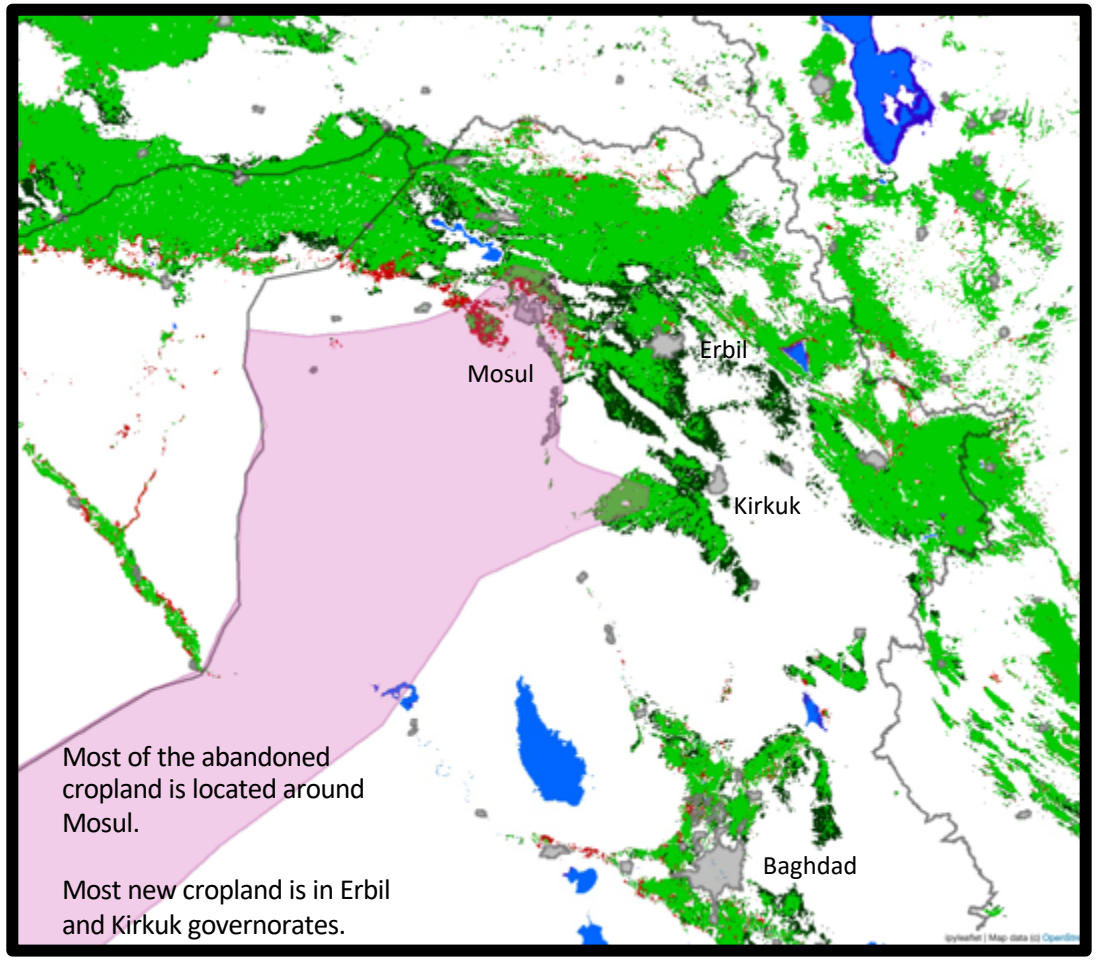
2. A Spatial Econometric Model of Land Use Change due to Conflict and Displacement in Iraq

Iraq land cover was also affected by ISIS occupation

Map 5: ISIS controlled area (2015)

Source: Political Geography www.polgeonow.com

Map 6: Land cover type change (North Iraq, 2009-2017)



Source: MCD12Q1.006 MODIS Land Cover Type Yearly Global 500m

Thanks!

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