

Europe's Migration Crisis

MU-Data Science Capstone



Spring 2018 | John Mataya

This presentation describes the migration crisis affecting Europe and recommends how to respond

We'll Define the Problem by Asking the Following Questions:

Is the crisis over or evolving?

Where do migrants come from?

How do migrants get to Europe?

Where do migrants go in Europe?

Are there humanitarian issues to consider?

Recommendations:

What types of data science tools can we employ?



WHAT'S THE DIFFERENCE BETWEEN A REFUGEE AND AN ASYLUM SEEKER?

Asylum seeker

- Individual who is seeking international protection
- someone whose claim has not yet been finally decided on by the country in which he or she has submitted it
- Not every asylum seeker will ultimately be recognized as a refugee, but every refugee is initially an asylum seeker.

Refugee

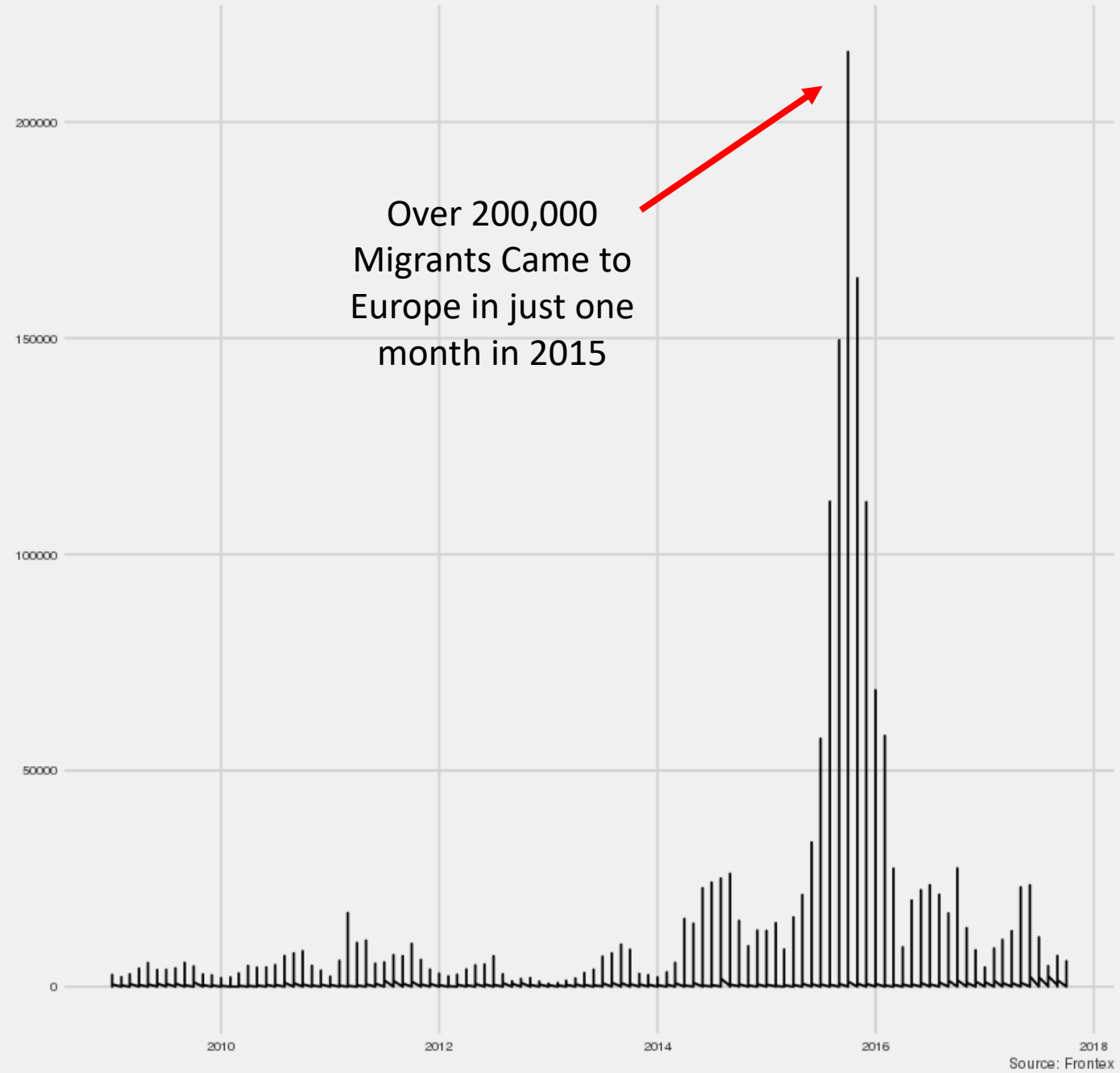
- Refugees are specifically defined and protected in international law
- When people flee their own country and seek sanctuary in another country, they apply for asylum – the right to be recognized as a refugee and receive legal protection and material assistance.



An aerial photograph of a small boat packed with hundreds of migrants, viewed from above as they travel across the dark blue sea. The boat is a narrow, elongated vessel, and the migrants are packed closely together, their colorful clothing creating a mosaic of reds, blues, yellows, and greys. The sea is a deep, dark blue, and white waves are visible around the boat.

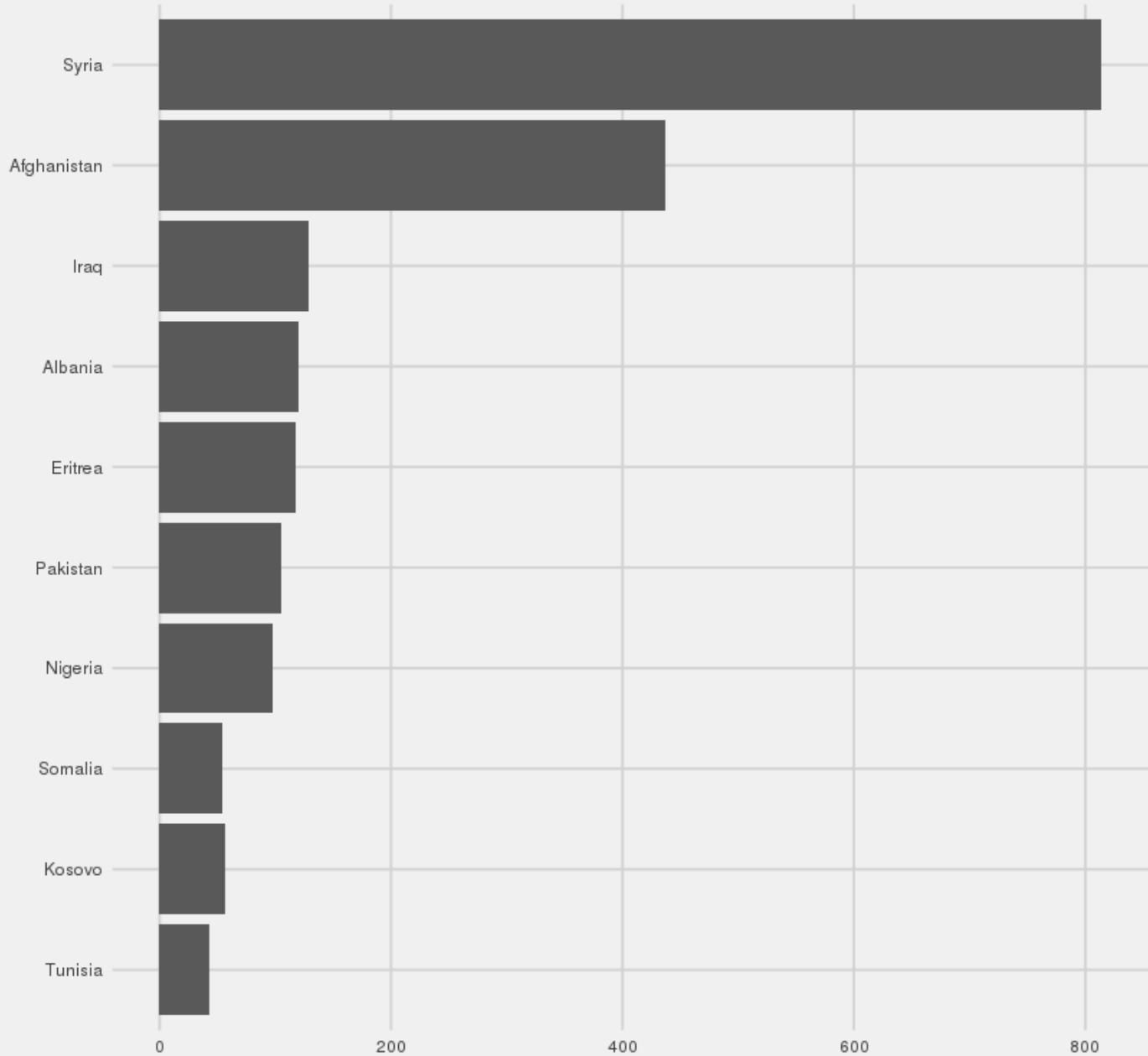
EUROPE WITNESSED AN EXPLOSION OF MIGRATION STARTING IN 2015

Migrants Traveling to Europe by Date



Top 10 Migrants to Europe by Nationality

Shown in Thousands



Source: Frontex

**SINCE, 2012
SYRIANS
REPRESENT THE
LARGEST SHARE
OF MIGRANTS
COMING TO
EUROPE**

Why are Syrians Coming to Europe?

The ongoing civil conflict in Syria has generated one the world's worst migrant crisis on record. UNHCR estimates more than 5 million Syrians have been displaced to other countries and nearly 6.3 million Syrians have been internally displaced.

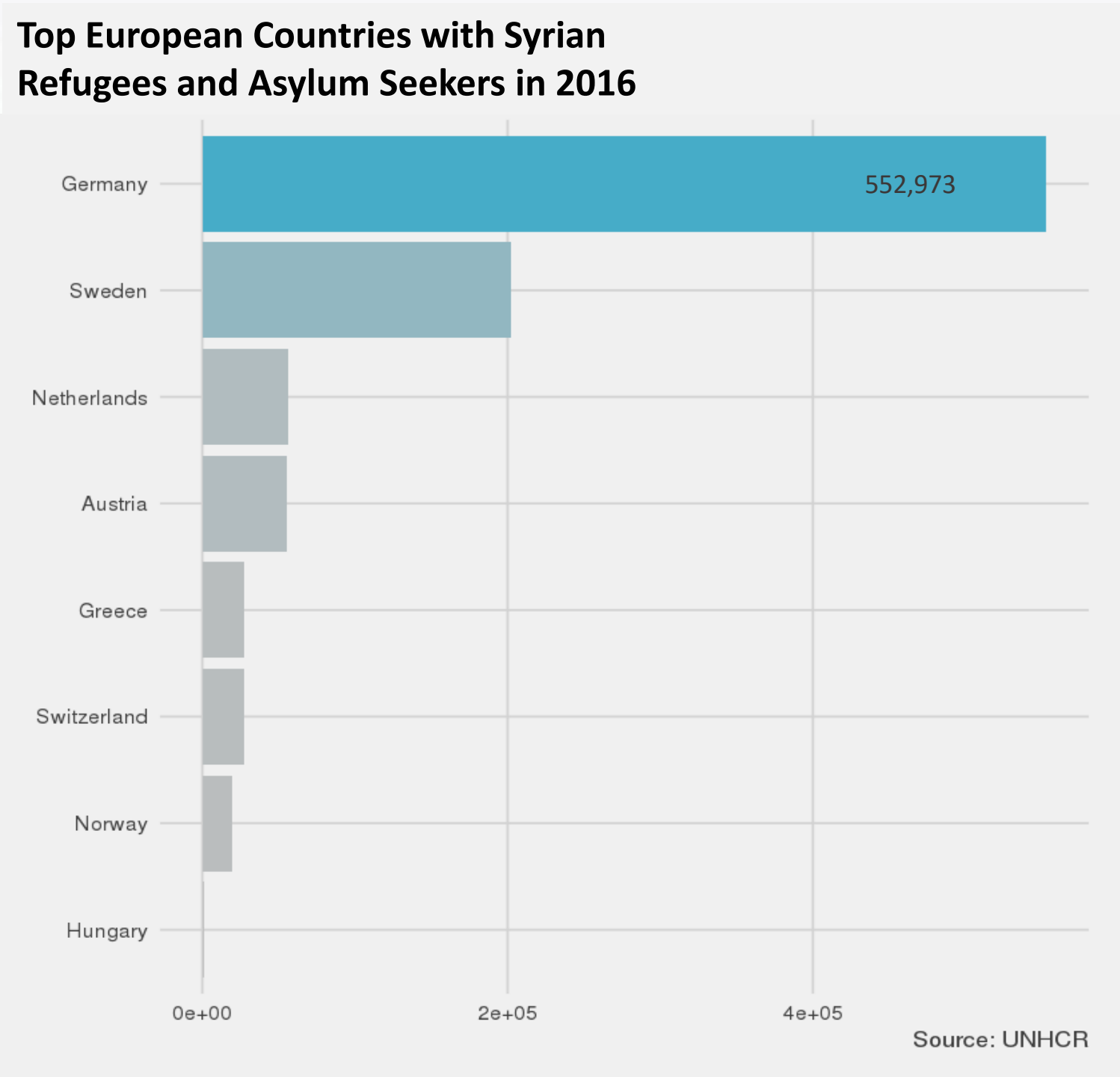


**After 7 years the Syrian conflict
rages on with no end in sight**



Which European Countries are Most Affected by Syrians Fleeing to Europe?





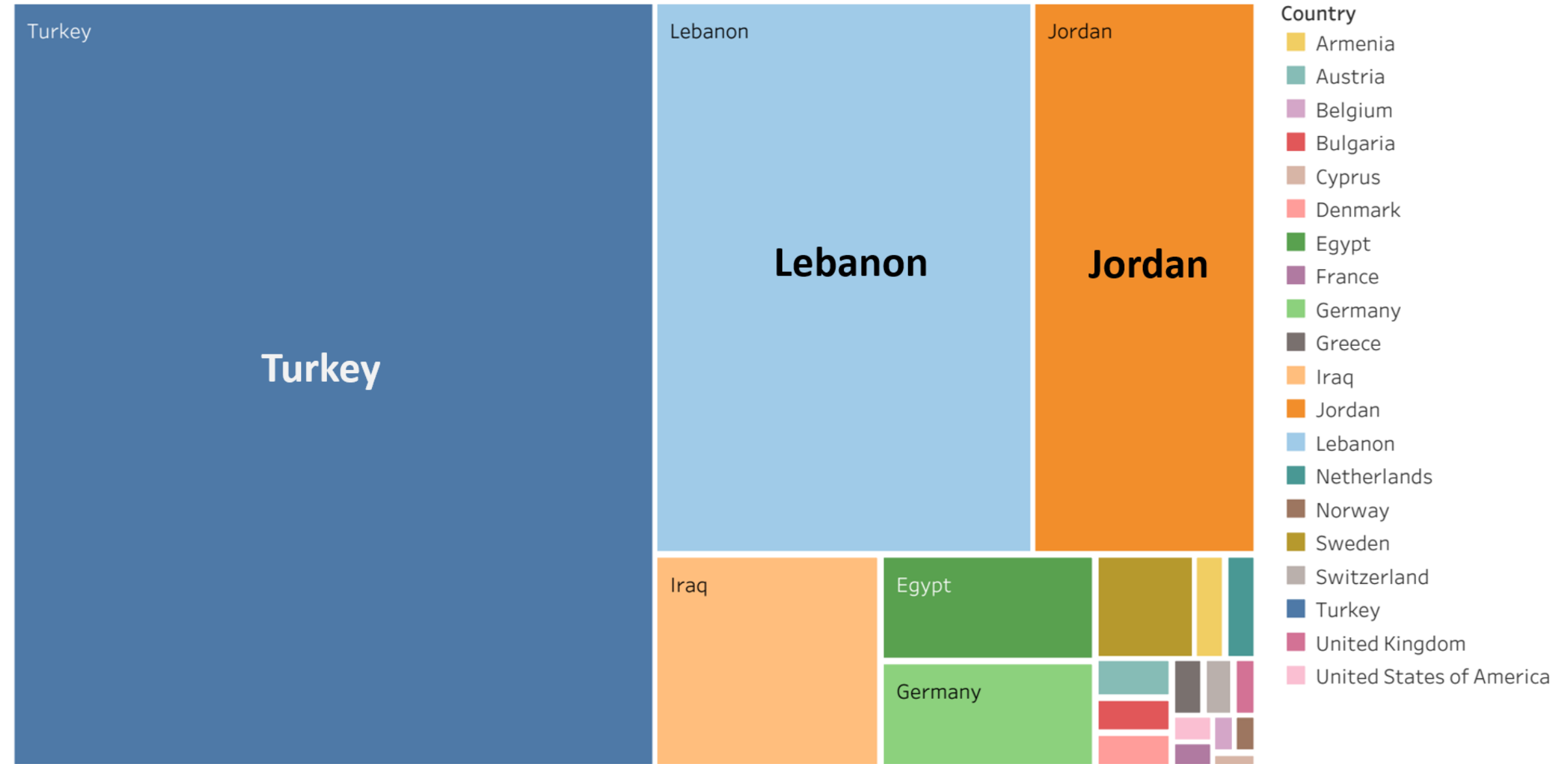


So Are Most Syrians Coming to Europe?



The image features a central white banner with the text 'So Are Most Syrians Coming to Europe?' in bold black font. Above the banner, there is a horizontal band of light gray silhouettes representing a large crowd of people and a line of trees. Below the banner, the lower half of the image is filled with dark brown silhouettes of individuals, including men, women, and children, many of whom are carrying large backpacks or bags, suggesting they are refugees or migrants in motion.

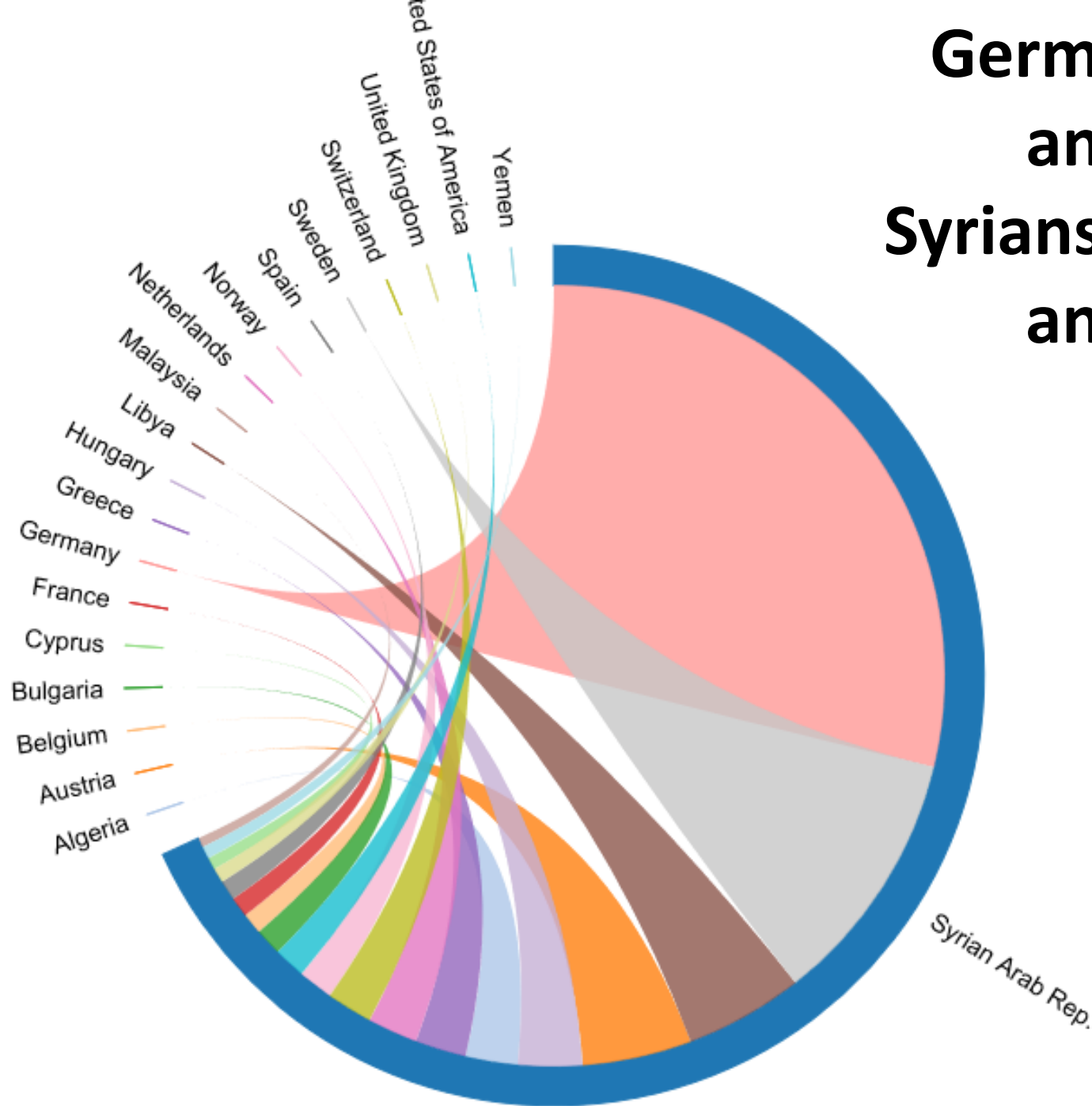
Turkey, Lebanon, and Jordan accept the largest number of Syrian Refugees



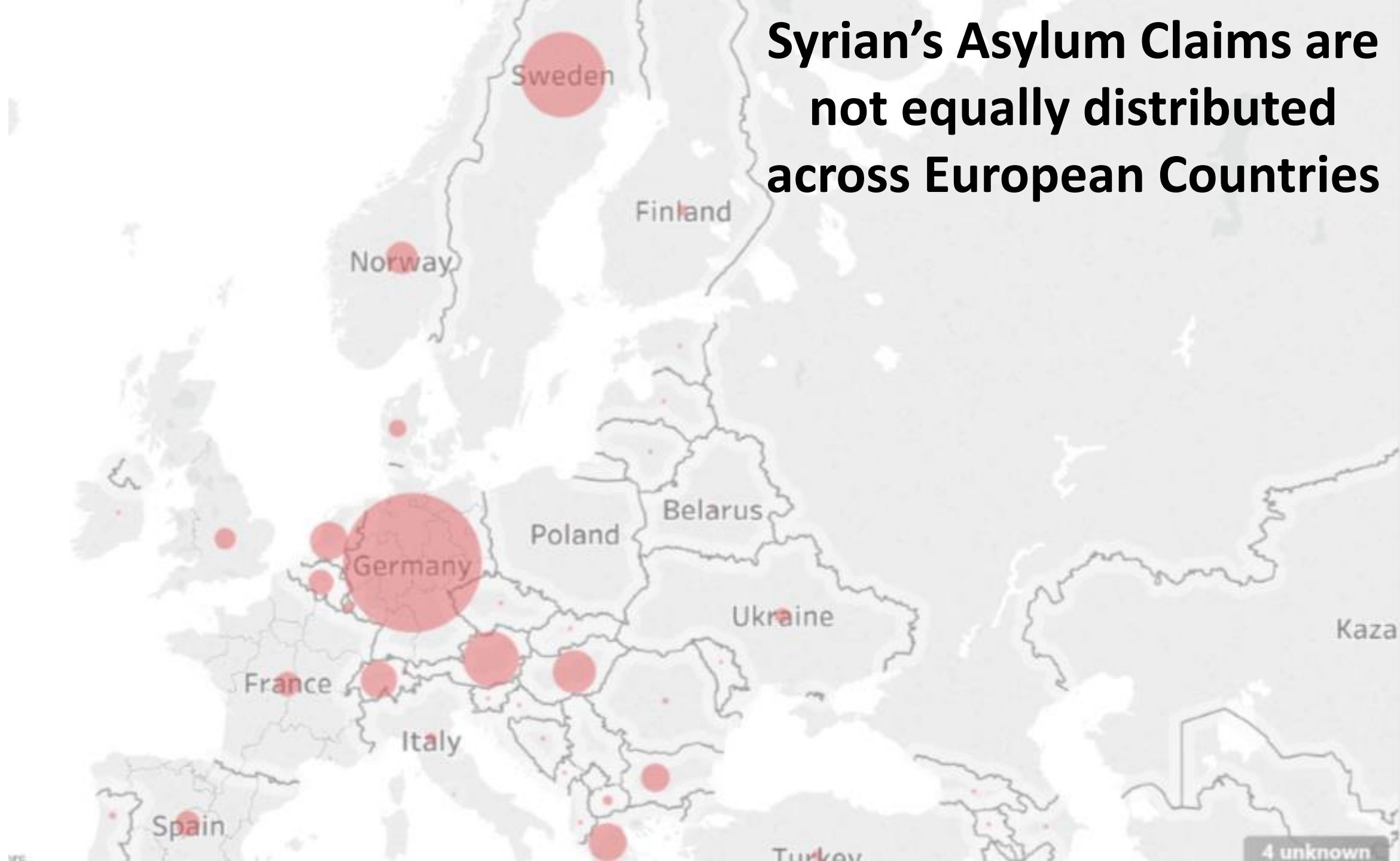
Source: UNHCR

Country. Color shows details about Country. Size shows Number of Records and Refugees. The marks are labeled by Country.

**Germany, Sweden, Austria,
and Hungary have more
Syrians Seeking Asylum than
anywhere in the Europe**



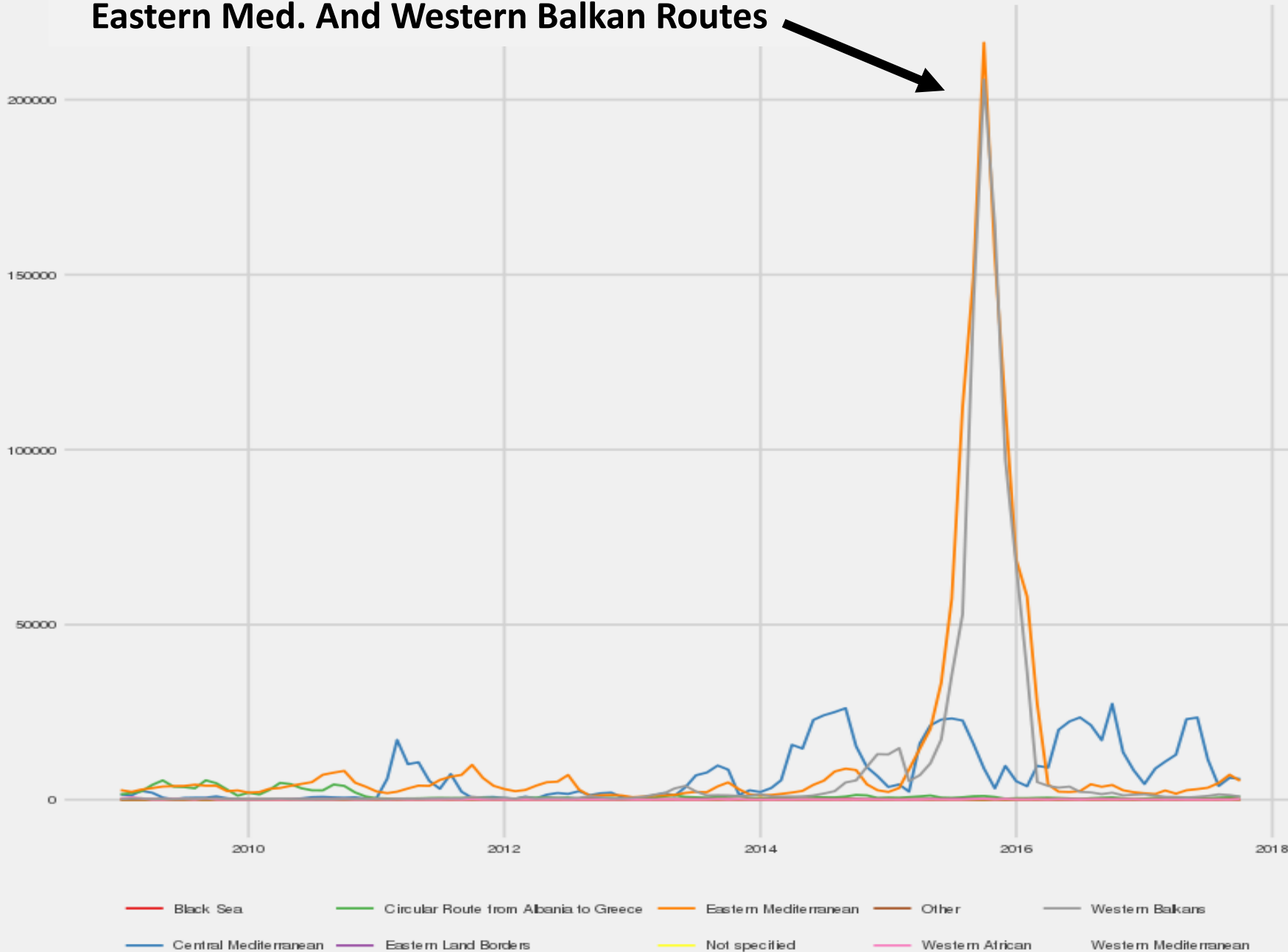
Syrian's Asylum Claims are not equally distributed across European Countries



How Do Syrian Migrants get to Europe?



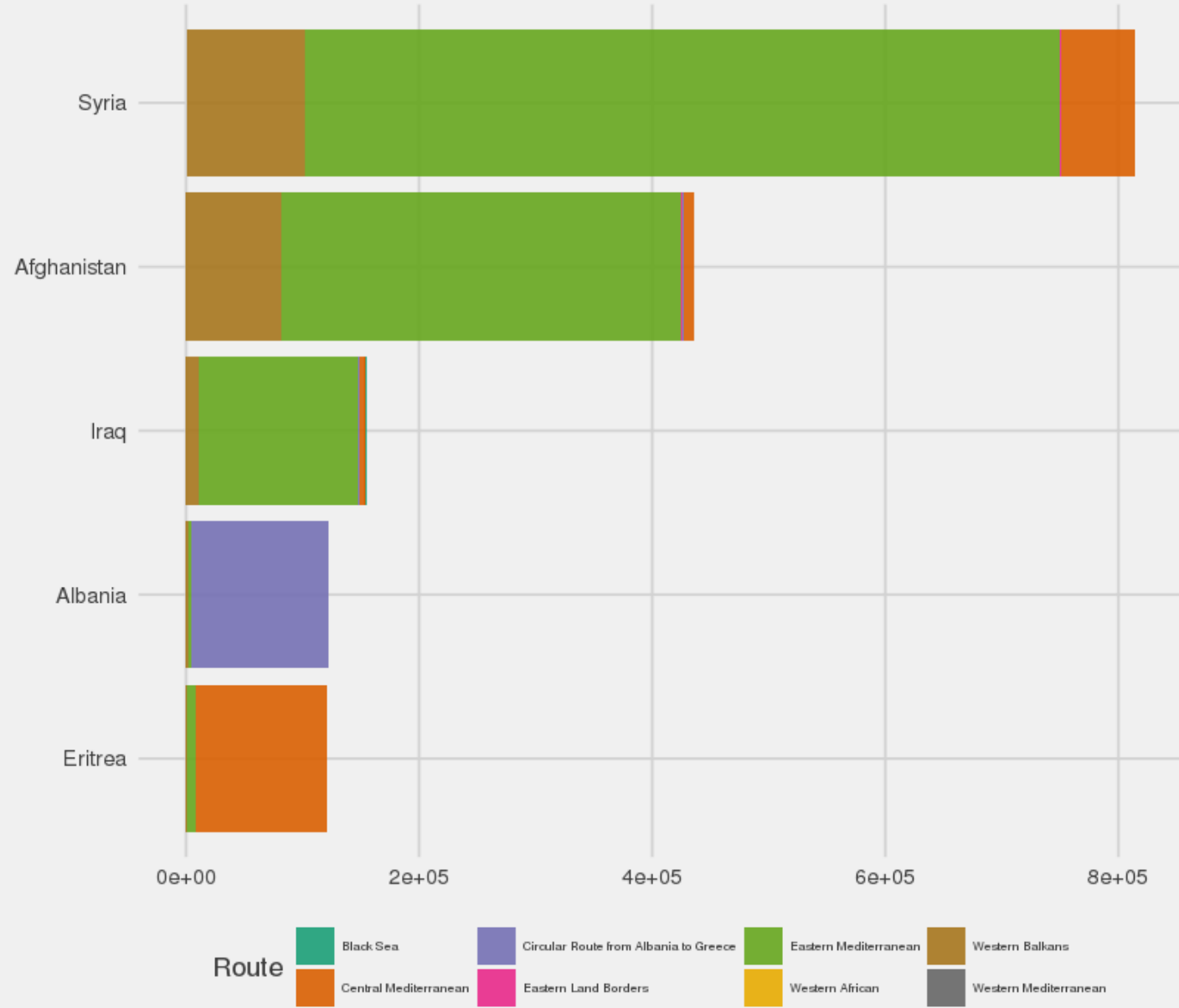
Eastern Med. And Western Balkan Routes



In 2015, Migrants poured into Europe via the East. Med and Western Balkan Routes



Routes used by Countries with Largest Share of Migrants Coming to Europe



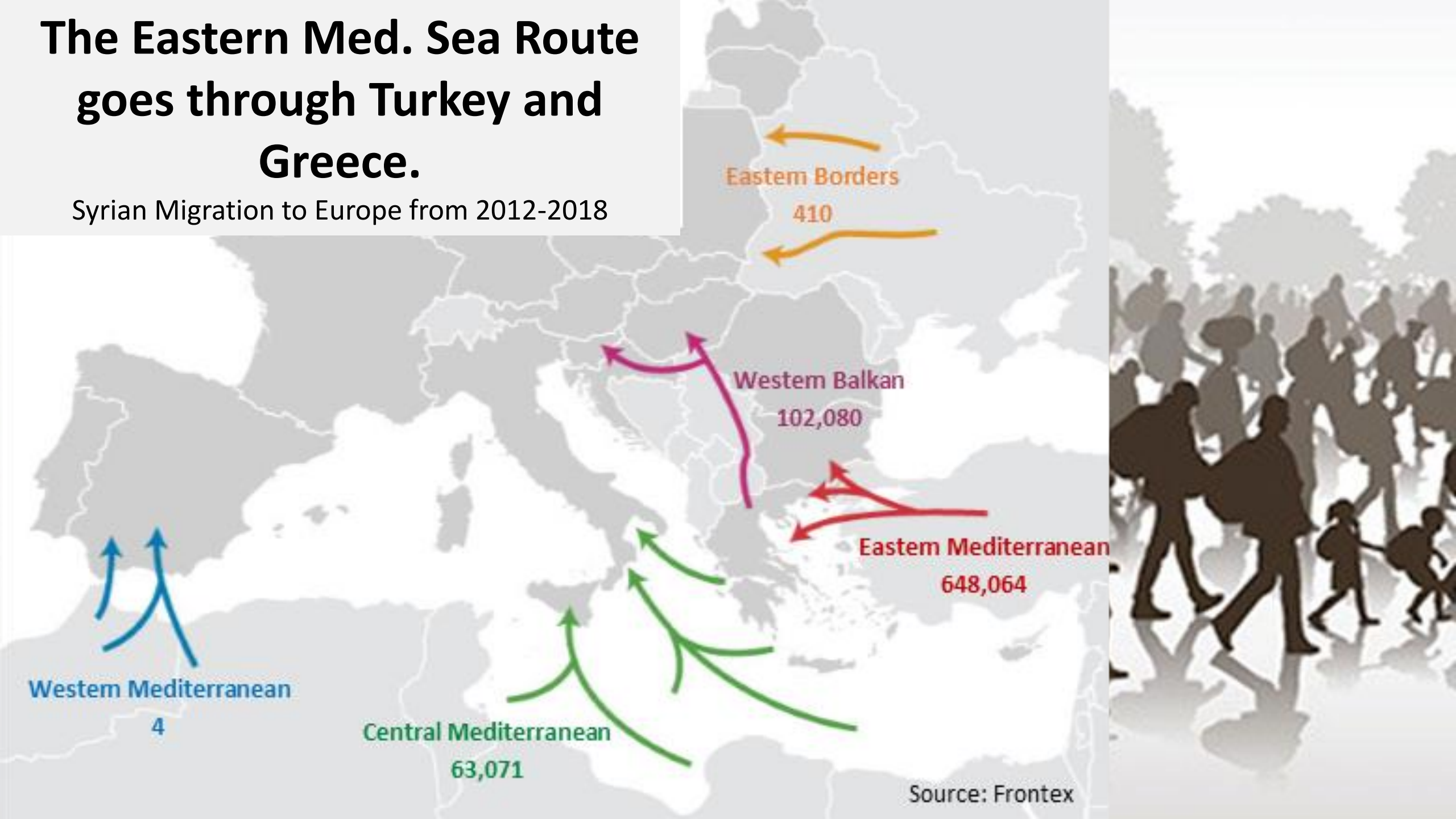
Syrian's largely use the Eastern Med. Sea Route



Source: Frontex

The Eastern Med. Sea Route goes through Turkey and Greece.

Syrian Migration to Europe from 2012-2018



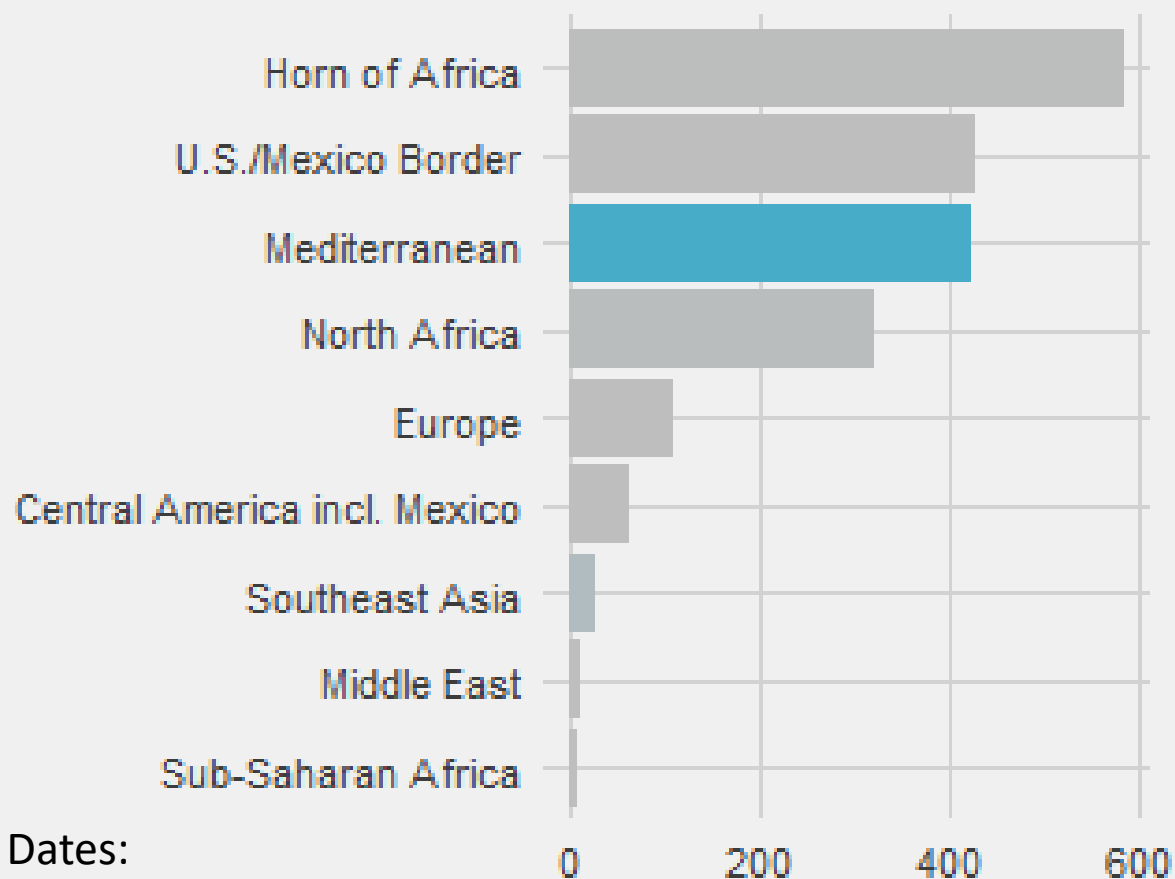
What are the humanitarian costs?



Mediterranean Sea is a Dangerous Place for Migrants

Nearly 15,000 migrants have gone missing or perished in the Mediterranean Sea since 2014

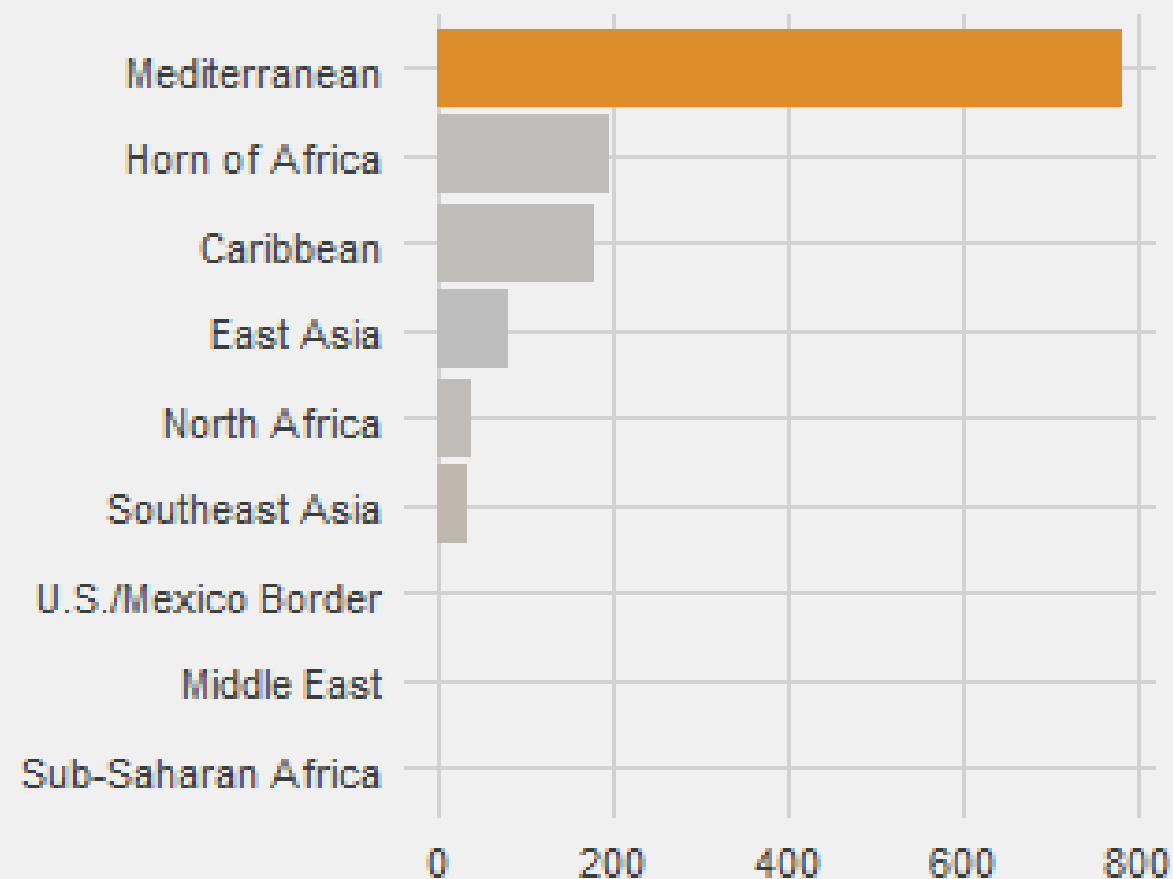
Migrant Deaths per 100,000 Migrants by Region



Dates:
2014-2018

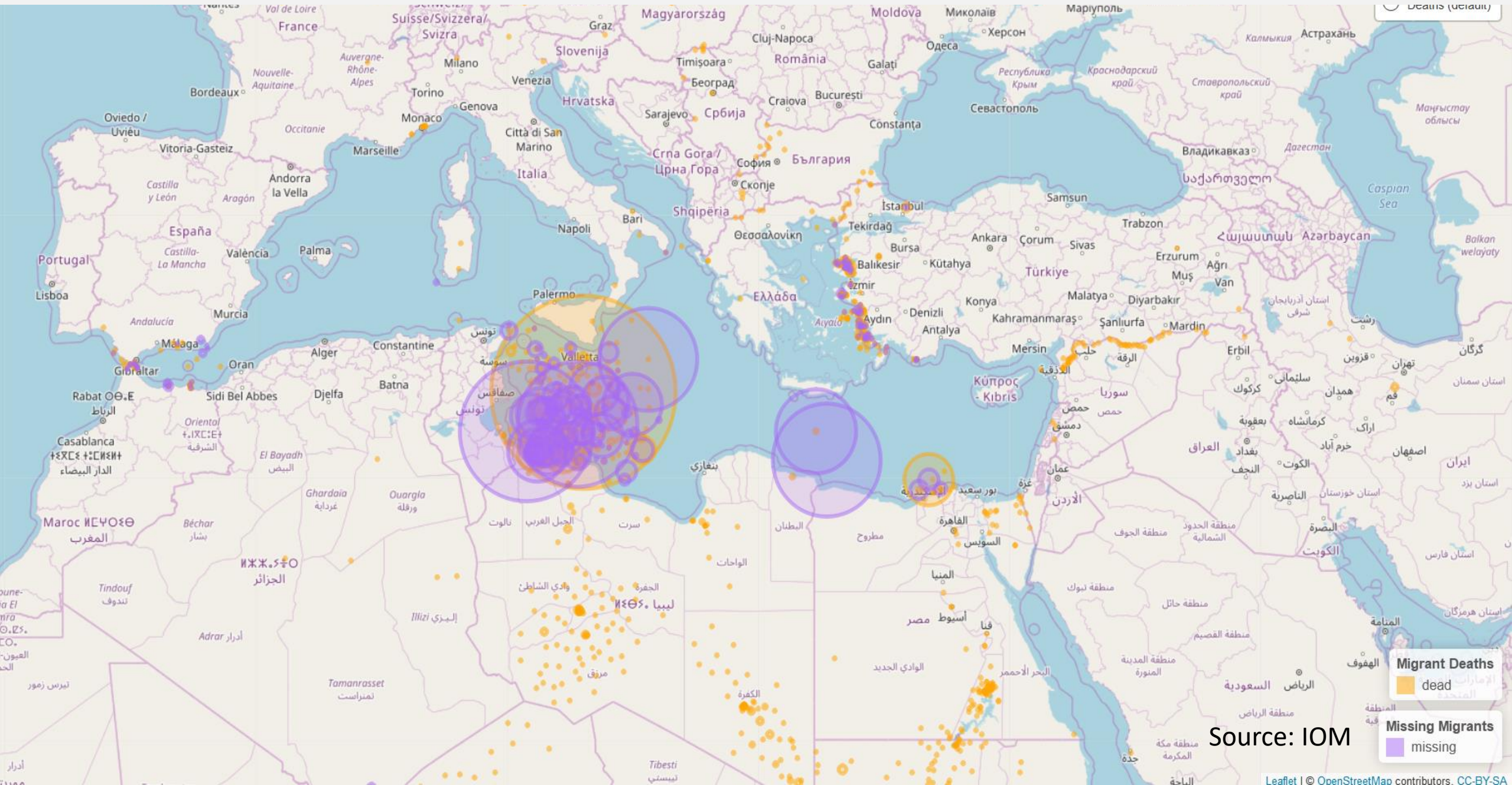
Source: IOM

Missing Persons per 100,000 Migrants by Region



Source: IOM

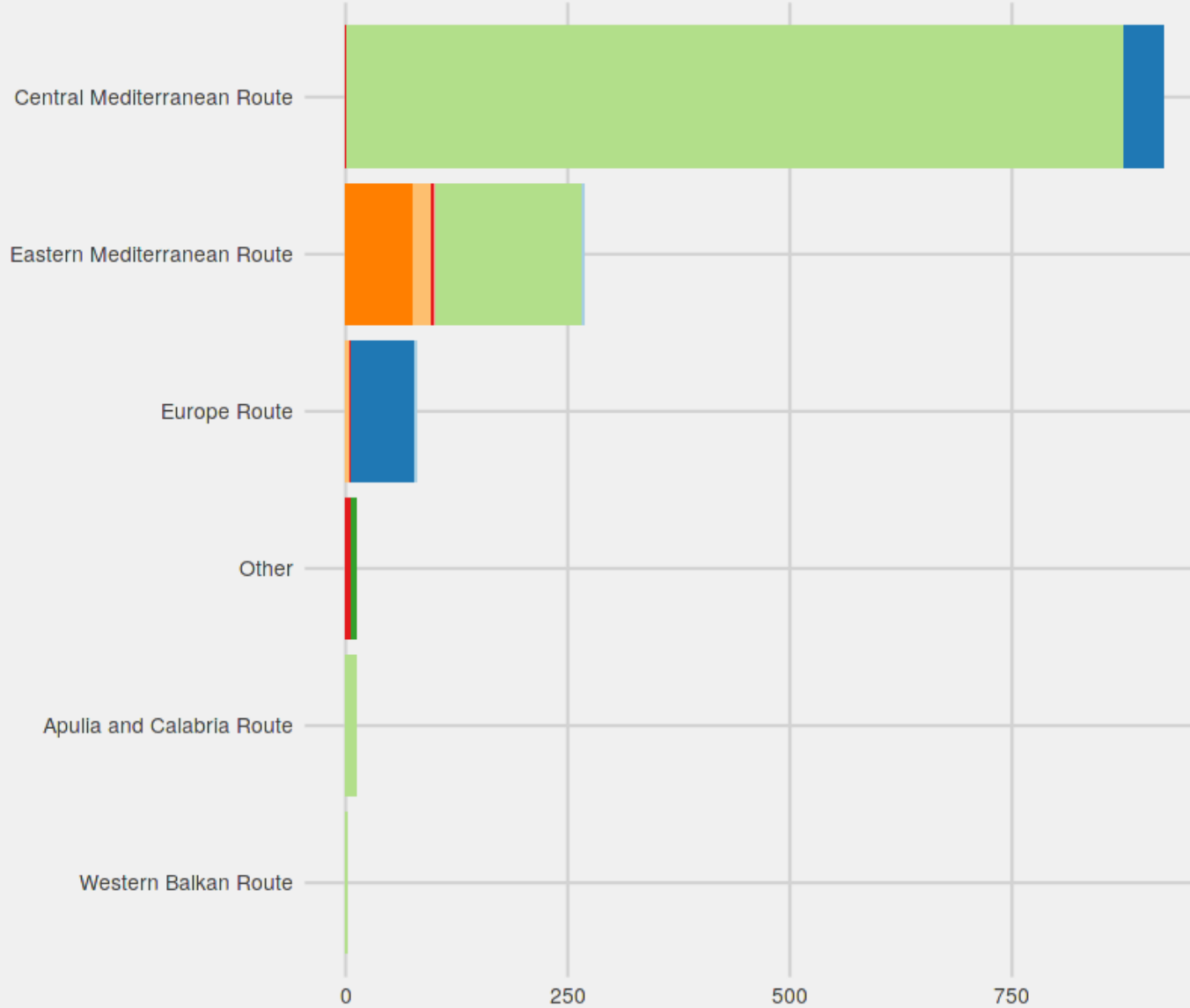
Migrants Reported Missing and Dead 2014-2018



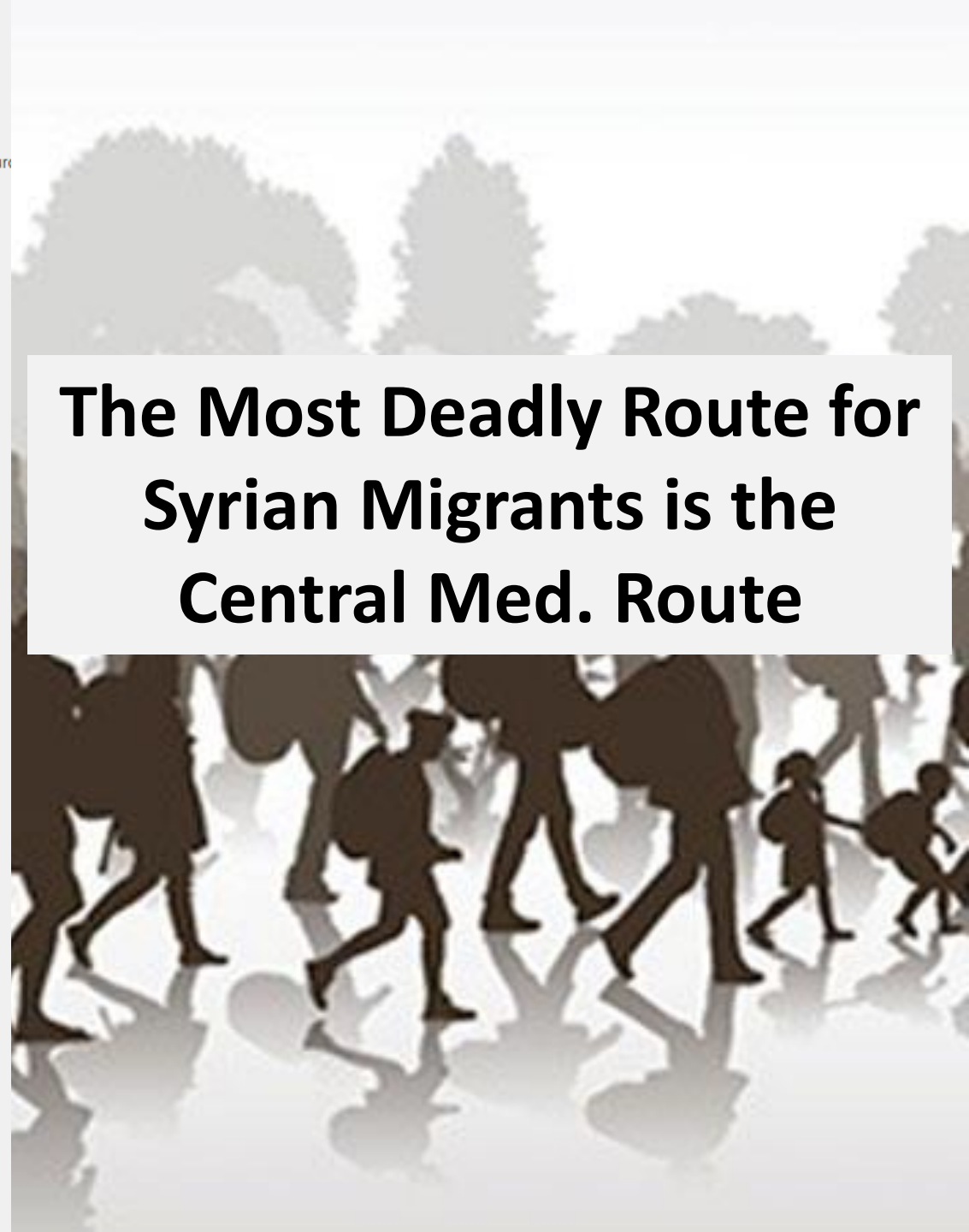
Deadly Routes for Syrian Migrants

cause_death

Accident	Drowning	Medical	Vehicle Accident
Asphyxiation	Exhaustion, Starvation, Dehydration, Exposure	Unknown	Violence, Assault, Murder



The Most Deadly Route for Syrian Migrants is the Central Med. Route



What's recommended?



Observations

- **Most Syrian refugees remain in the Middle Eastern Countries surrounding Syria**
- **Most Syrian Asylum cases are not equally distributed throughout Europe**
- **Most Refugees travel to Europe via the Eastern Mediterranean and Western Balkans**
- **There's a large number of deaths and missing persons on the Central Mediterranean Sea Route to Europe**
- **Europe may still be open to another migration crisis. The conflict in Syria is still ongoing and the Middle East could see another civil crisis causing migrants to come to Europe**

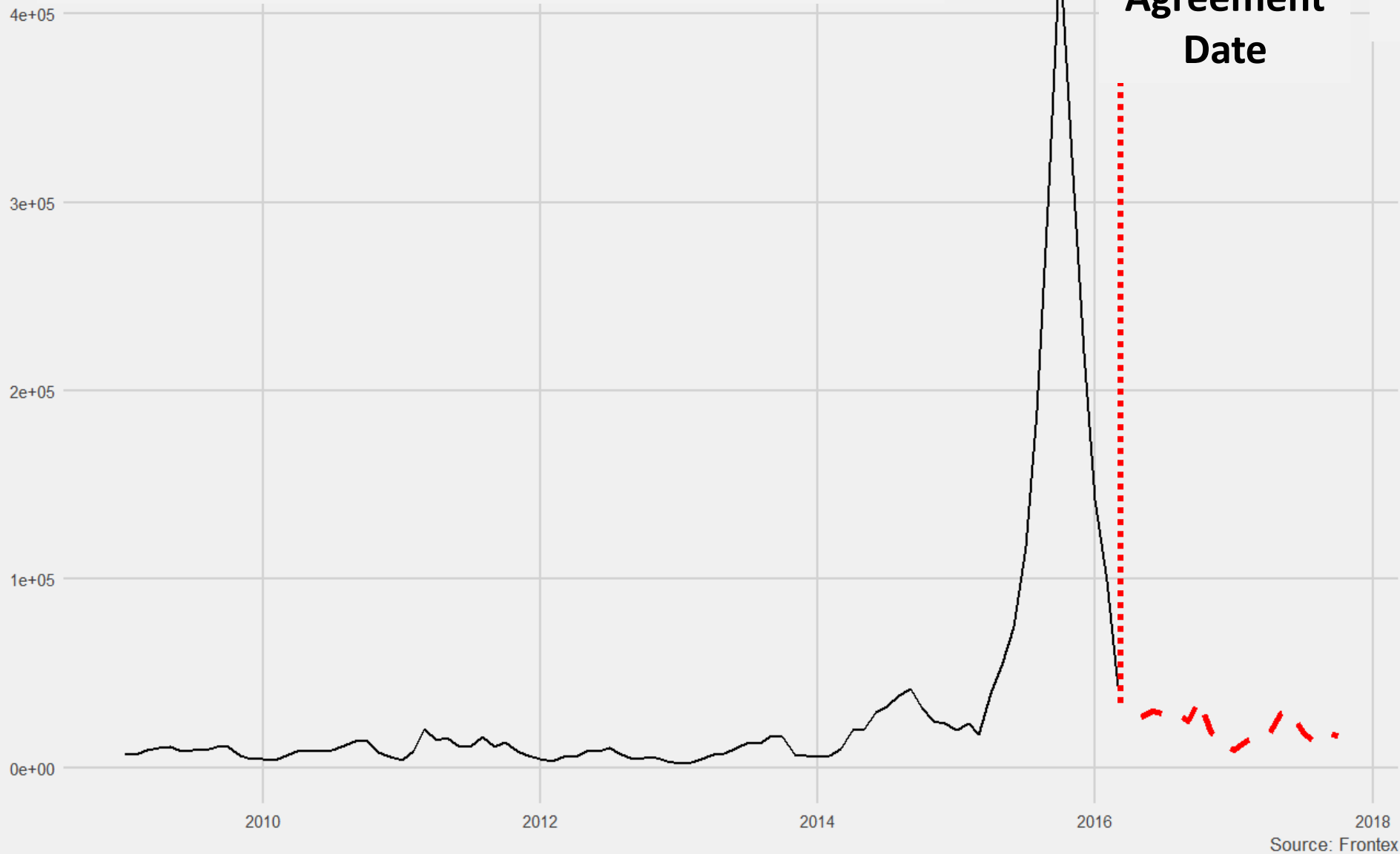
Additional Observation

BBC
NEWS

In 2016 the EU and Turkey Struck a Deal to Stop the Flow of Illegal Migrants coming to Europe

- **Returns:** All "irregular migrants" crossing from Turkey into Greece from 20 March will be sent back. Each arrival will be individually assessed by the Greek authorities.
- **One-for-one:** For each Syrian returned to Turkey, a Syrian migrant will be resettled in the EU. Priority will be given to those who have not tried to illegally enter the EU and the number is capped at 72,000.
- **Visa restrictions:** Turkish nationals should have access to the Schengen passport-free zone by June. This will not apply to non-Schengen countries like Britain.
- **Financial aid:** The EU is to speed up the allocation of €3bn (\$3.3 bn; £2.3 bn) in aid to Turkey to help migrants.

EU-Turkey Agreement Implemented After March 2016



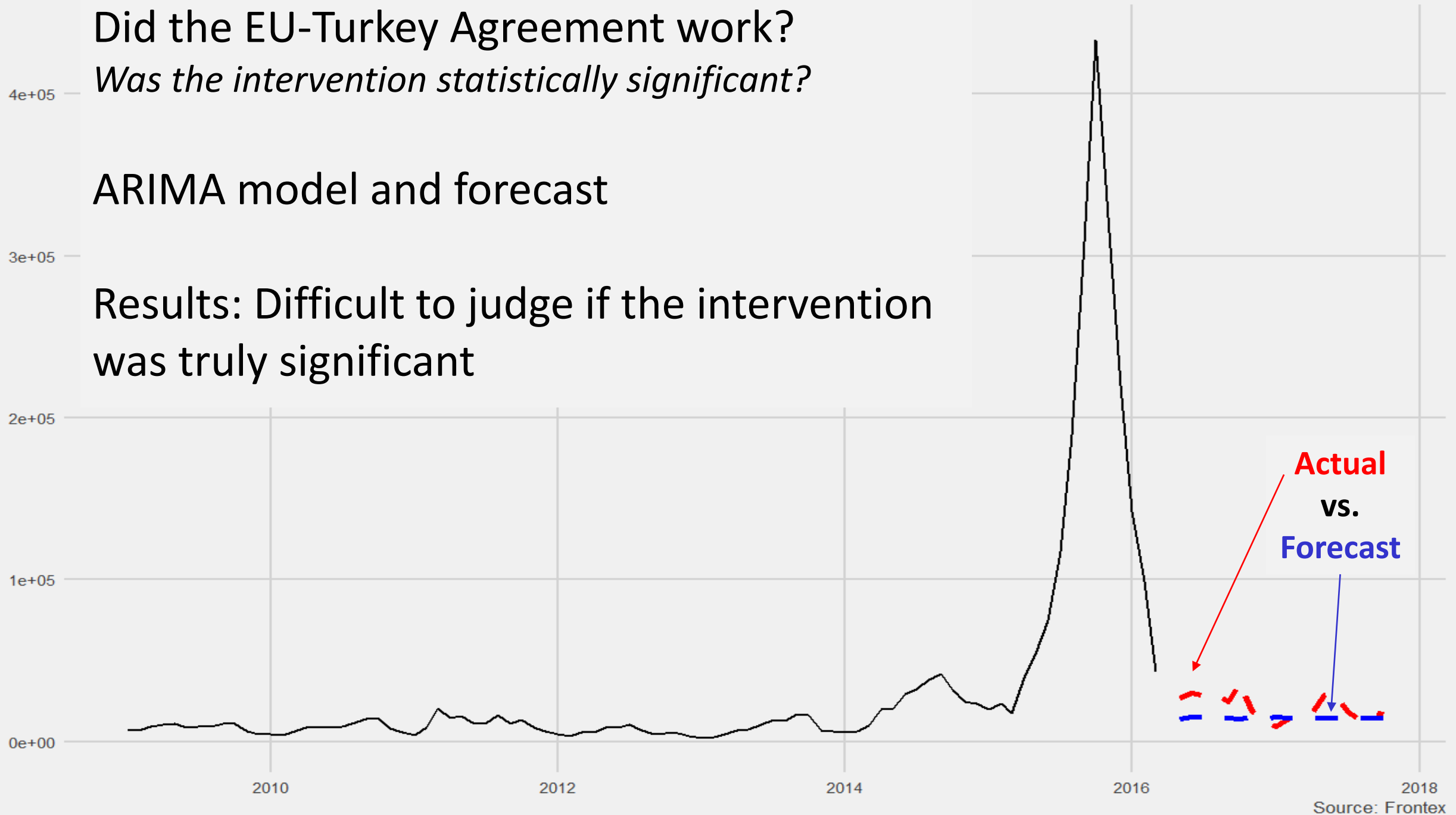
**The Agreement
Seems to be
Working**



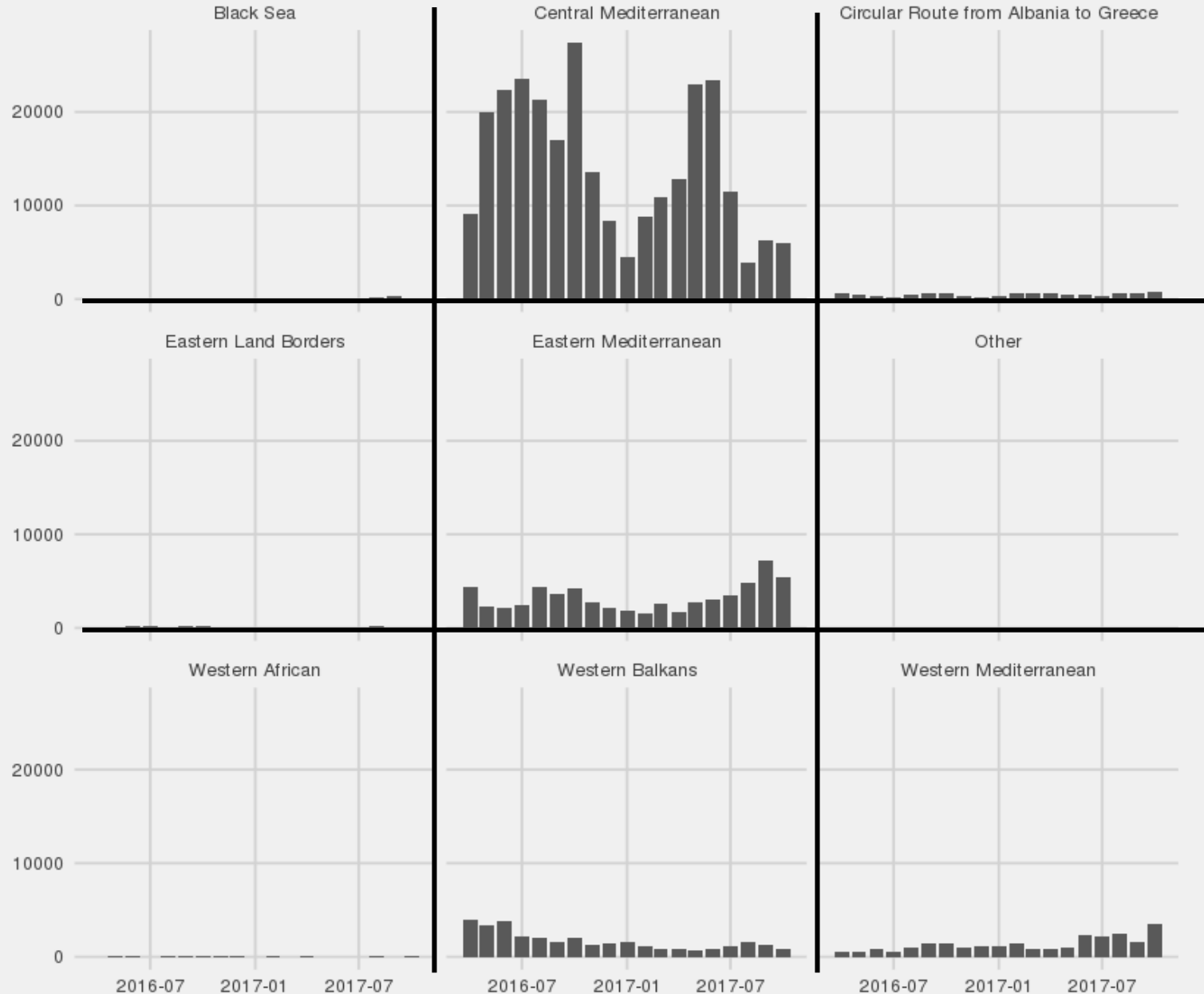
Did the EU-Turkey Agreement work?
Was the intervention statistically significant?

ARIMA model and forecast

Results: Difficult to judge if the intervention
was truly significant



Illegal Border Crossing to Europe by Route After EU-Turkey Agreement



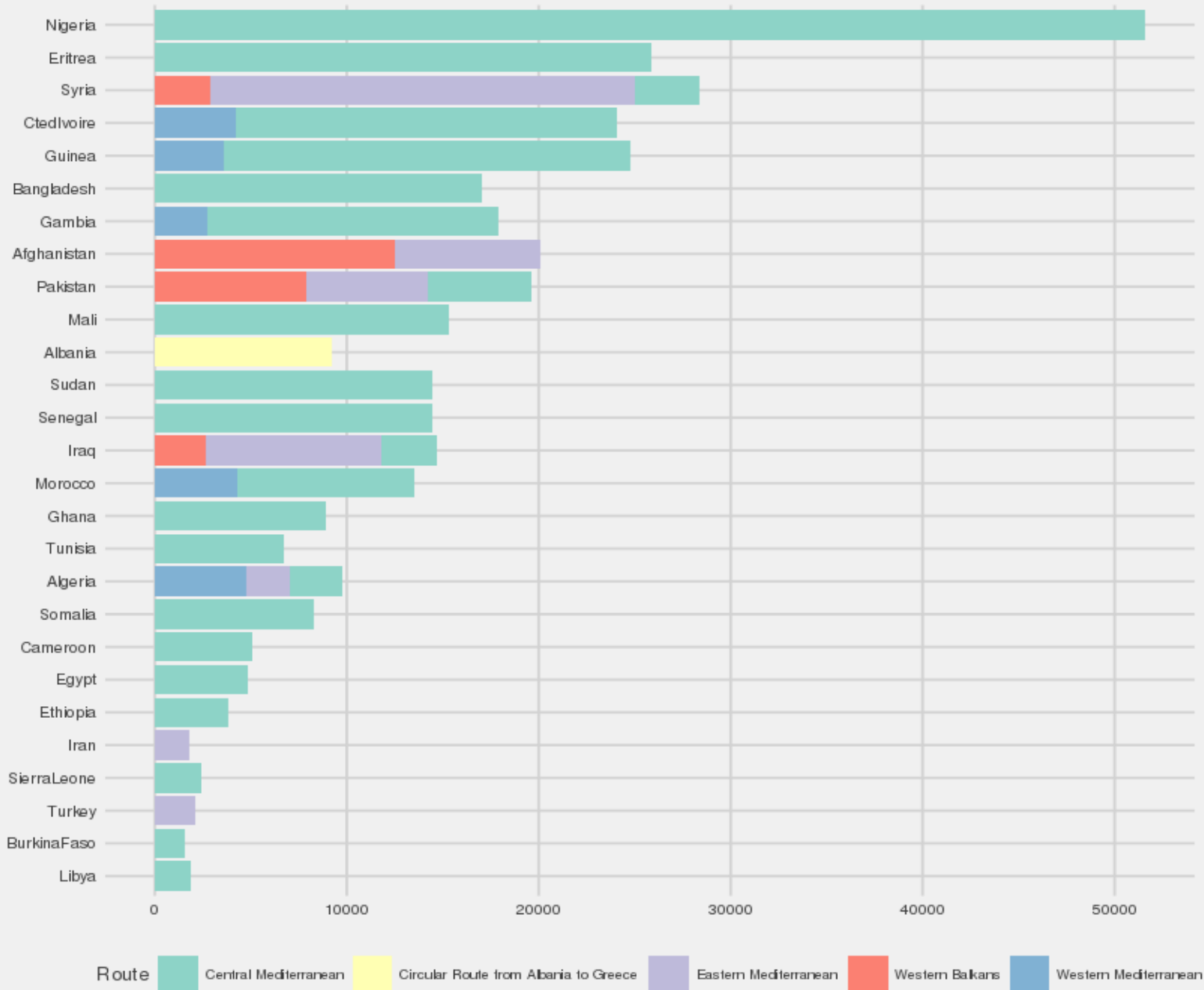
Source: Frontex

Q: What Happened After the EU-Turkey Agreement?

A: Migration via Turkey appears to have slowed

Most Migration to Europe is now happening via the Central Med. Route

Number of Migrants Illegally Traveling to Europe by Origin and Route After EU-Turkey Agreement



Source: Frontex

Q: Who's Coming to Europe After the EU-Turkey Agreement and how are they getting to Europe?

A: Central Med. Route. Africans and Syrians



Observations Revised

- **Migration via the Eastern Mediterranean and Western Balkans has slowed since the EU-Turkey agreement in 2016**
- **Since the EU-Turkey Agreement, most migrants heading to Europe are using the Central Med. Route**
- **Most Syrian refugees remain in the Middle Eastern Countries surrounding Syria**
- **Refugees making it to Europe and claiming Asylum are NOT being distributed equally throughout Europe**
- **There's essentially a humanitarian crisis in the Mediterranean Sea where migrants drown coming to Europe**
- **Europe may still be open to another migration crisis. The conflict in Syria is still ongoing and the Middle East could see another civil crisis causing migrants to come to Europe**



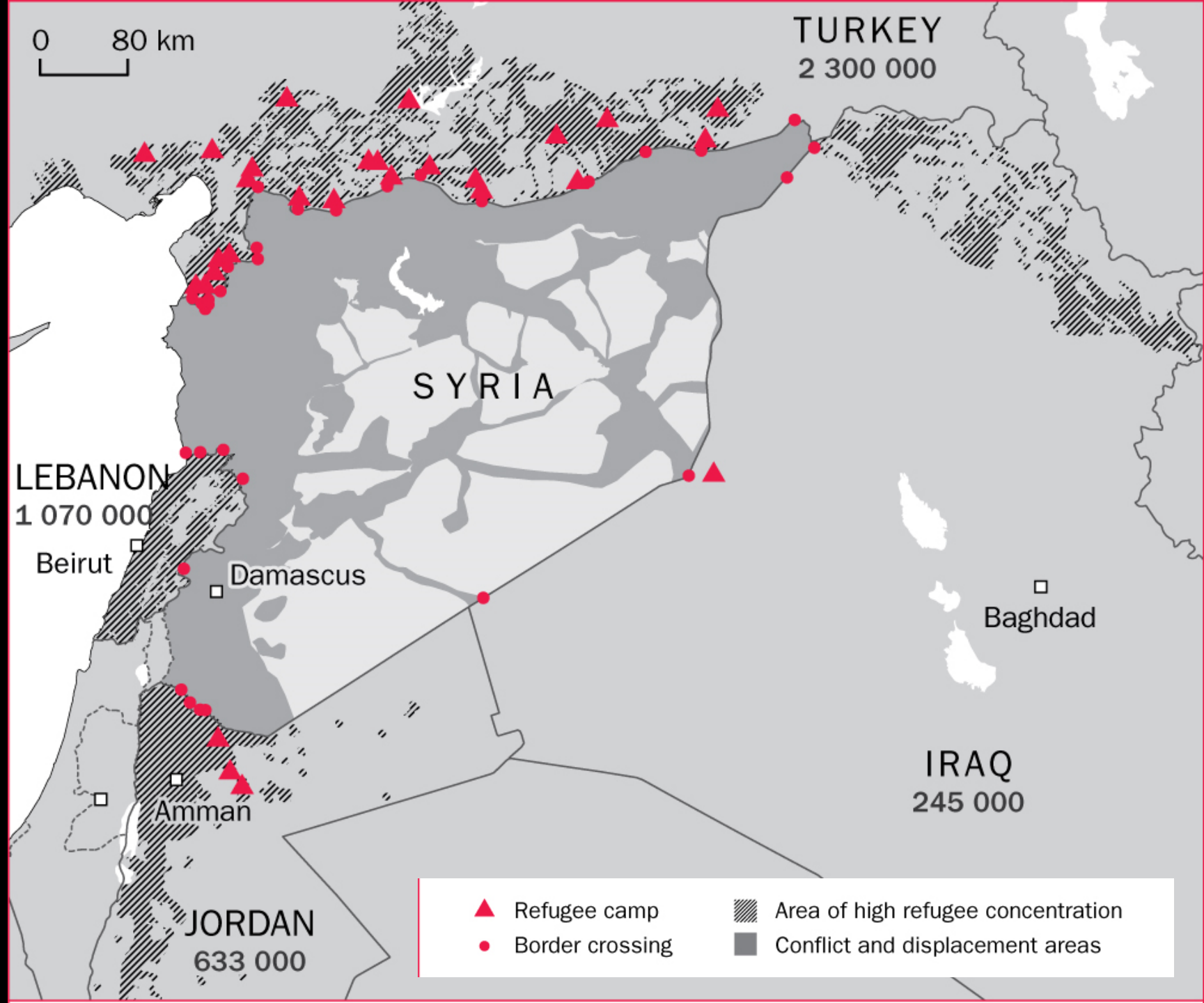
Given the Situation What's Recommended?



Recommendations:

- 1) Focus Asylum Screening and
- 2) Humanitarian Aid to “hotspots” with Refugees

Starting Point:
Refugee Camps

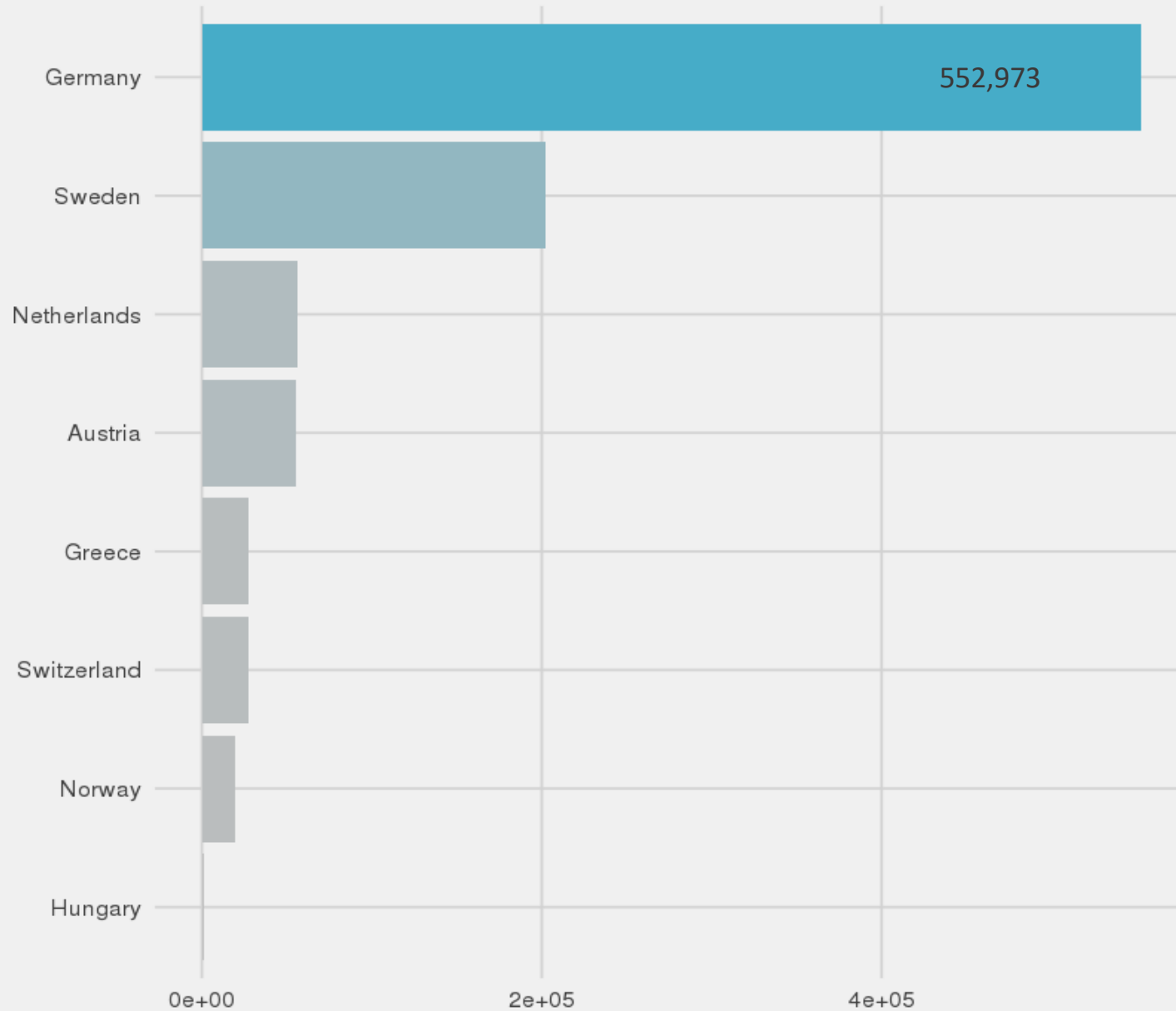


Recommendation 3

Europe should act together to equally distribute Asylum seekers throughout EU Countries



Top European Countries with Syrian Refugees and Asylum Seekers in 2016



Source: UNHCR

Recommendation 3

- Most Syrians are claiming asylum in Germany
- Europe can do more to share the burden



**How Can Machine Learning Help to
Implement these Recommendations?**

What are the possibilities?



Implementing the Recommendations

ML Possibilities

- Discovery of new refugee camps
- Monitoring of refugee camps for approximate size (changes)



Implementation Challenges

Most Syrian migrants are not found in refugee camps

Only a limited number of official refugee camps are officially sanctioned by countries hosting Syrian refugees. In turn, it is not always clear where refugee/migrant settlements are located.

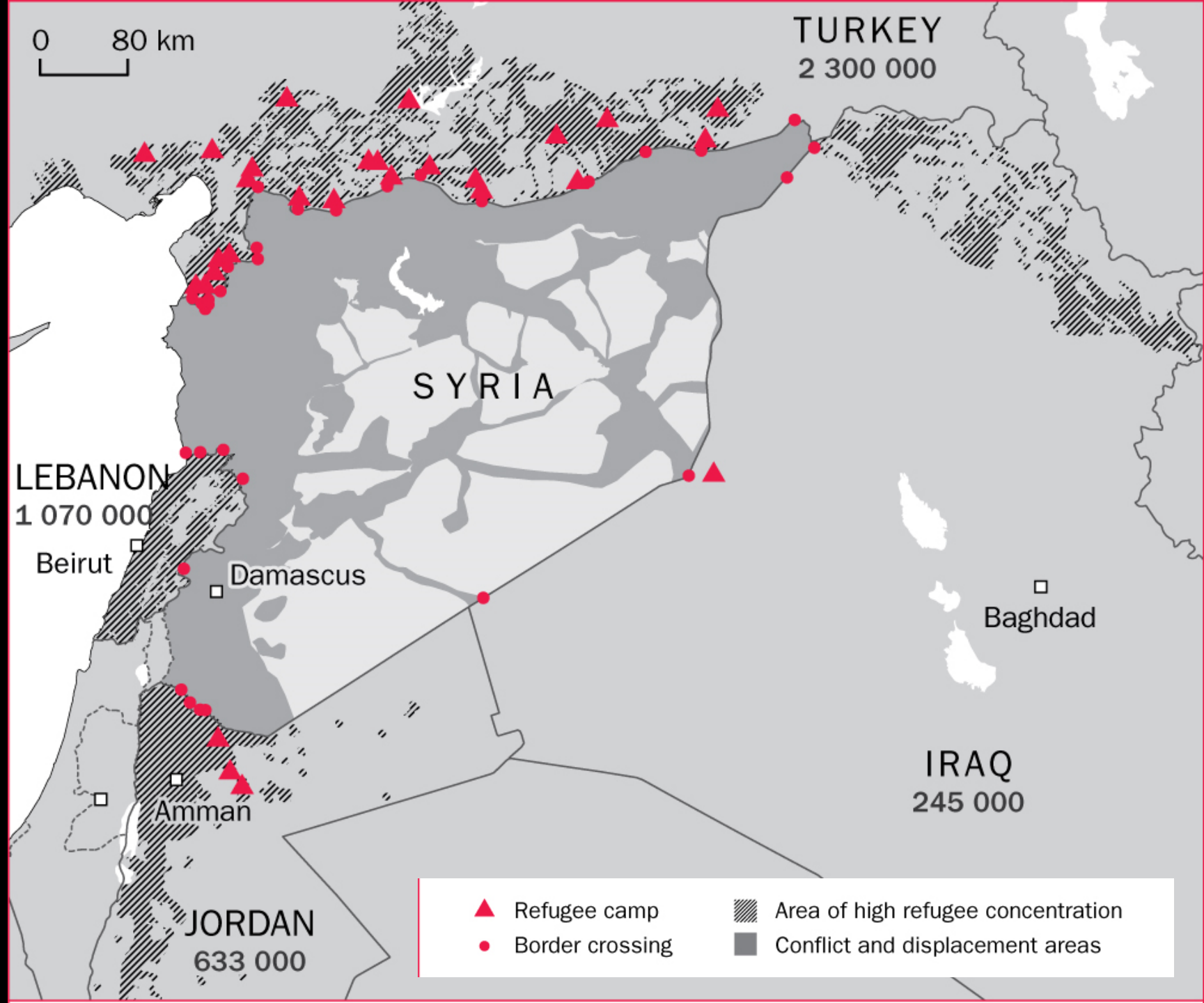
Lebanon has no official refugee camps and hosts nearly 1.5 million refugees. This creates challenges when focusing resources to “hotspots”

The multidimensional Syrian conflict quickly displaces people across borders

Implementing Recommendations:

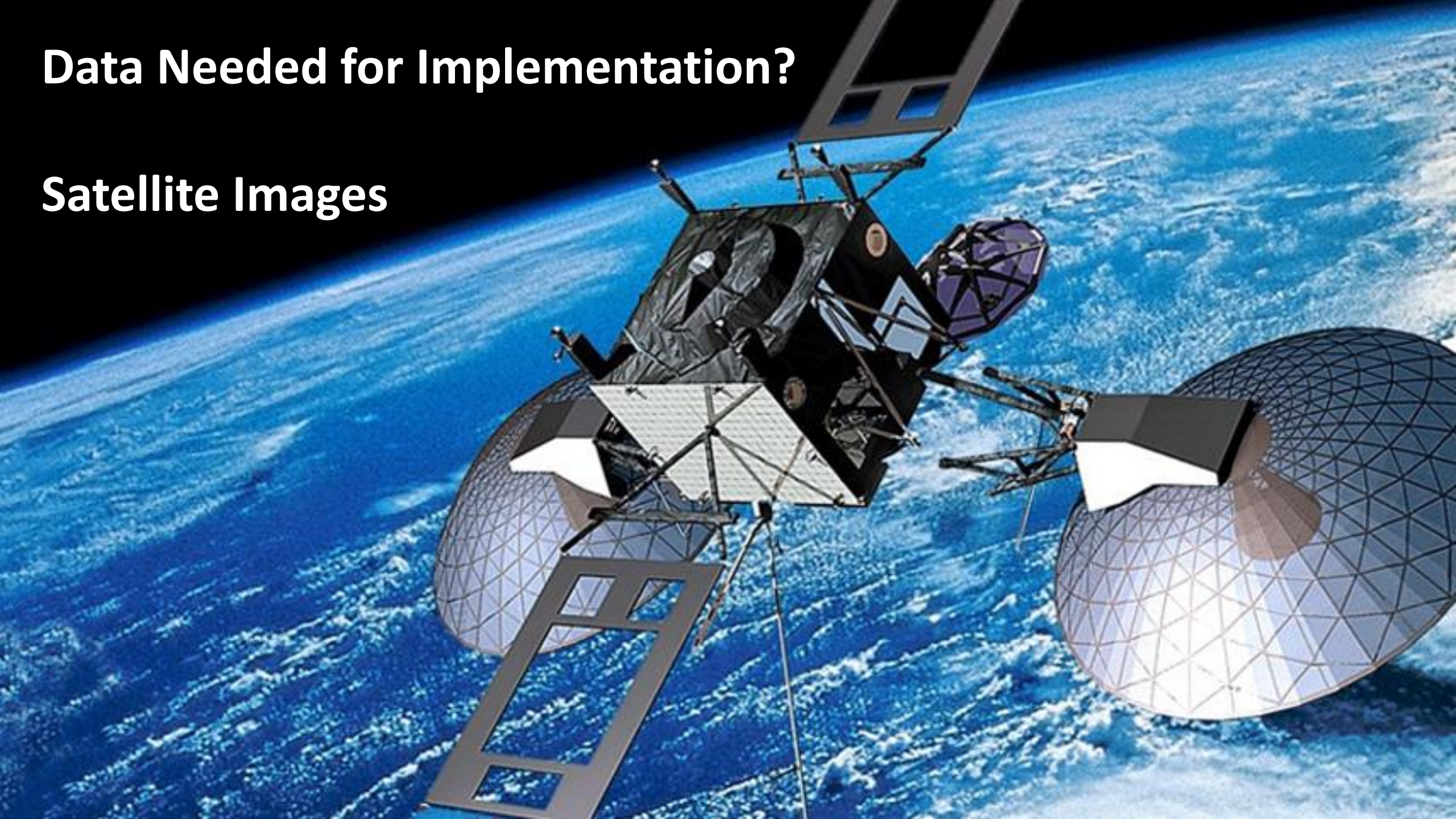
1) Focus Asylum Screening and
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Starting Point:
Refugee Camps



Data Needed for Implementation?

Satellite Images





Implement Recommendation 1 and 2 by Building an Image Classifier

Discovery of Camps: Classification Problem

Refugee Camp



Non Camp



Image Processing and Classification

Original Image



Create Image Chips



Camp



Noncamp



Key Features

- **Tent Dominated Areas**
- **Edges/Clear Borders**
- **White Areas**
- **Outside of Cities or Developed Areas**



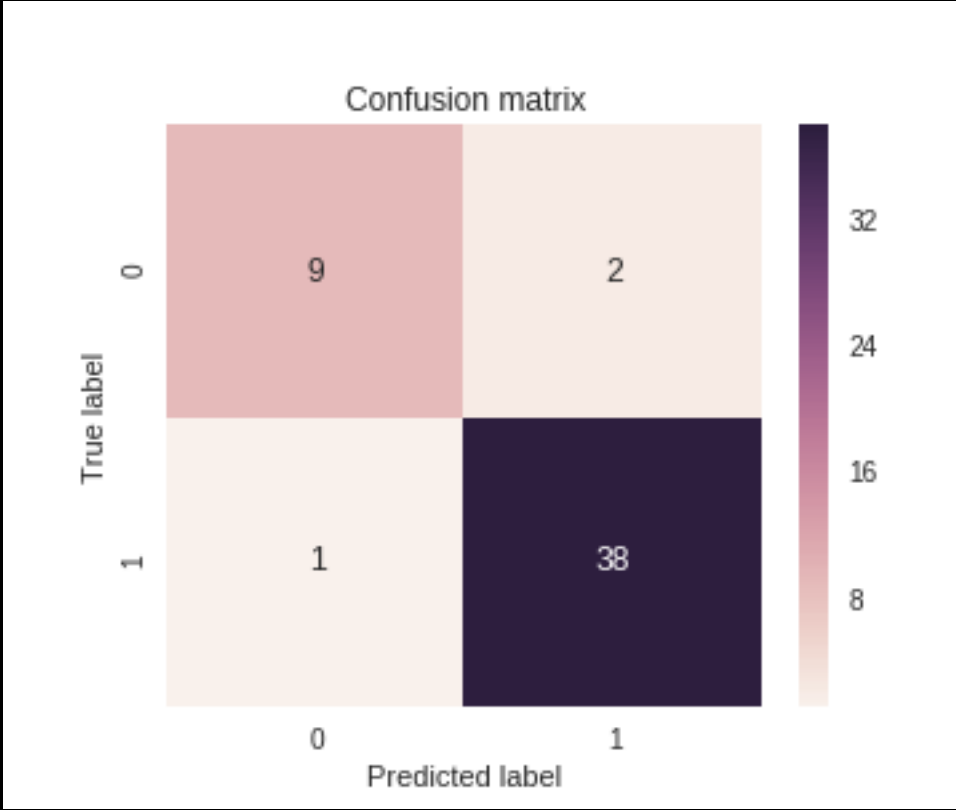
Data Augmentation

- Limited Data
Required a Data
Augmentation
Approach
- Rotate Images



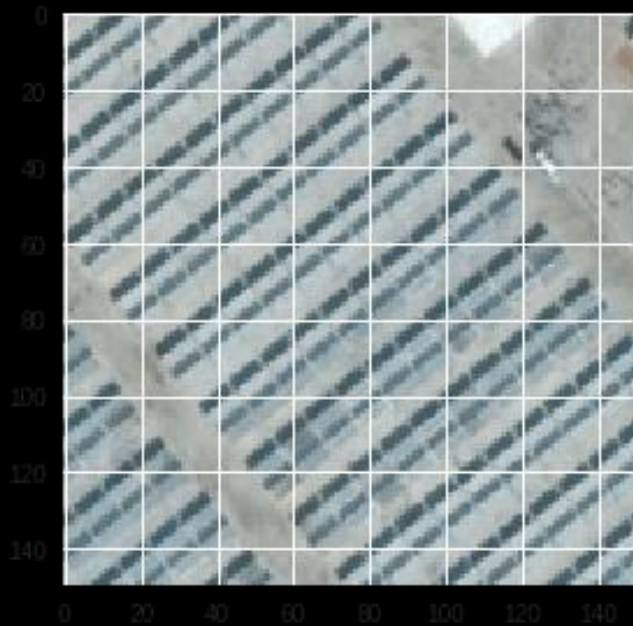
Evaluation Results

	Precision	Recall	F1-score	Support
Refugee Camp	0.90	0.82	0.86	11
Noncamp	0.95	0.97	0.96	39
Avg/Total	0.94	0.94	0.94	50

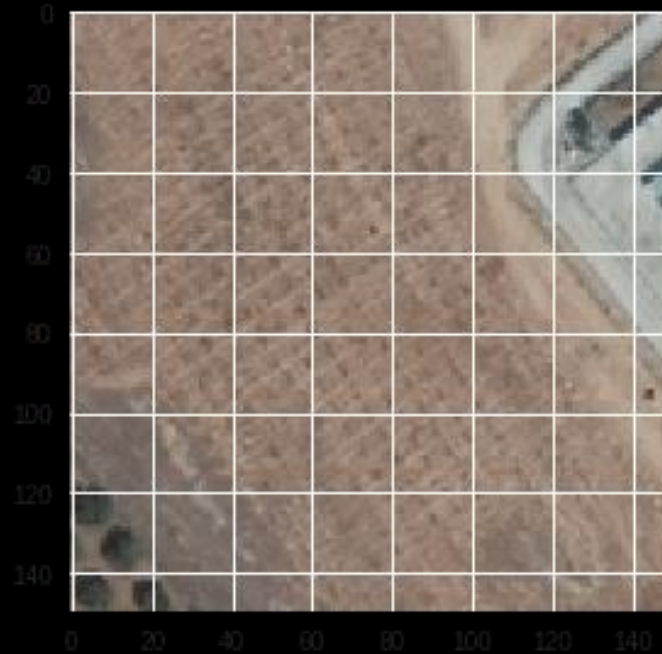


Limits to the Model

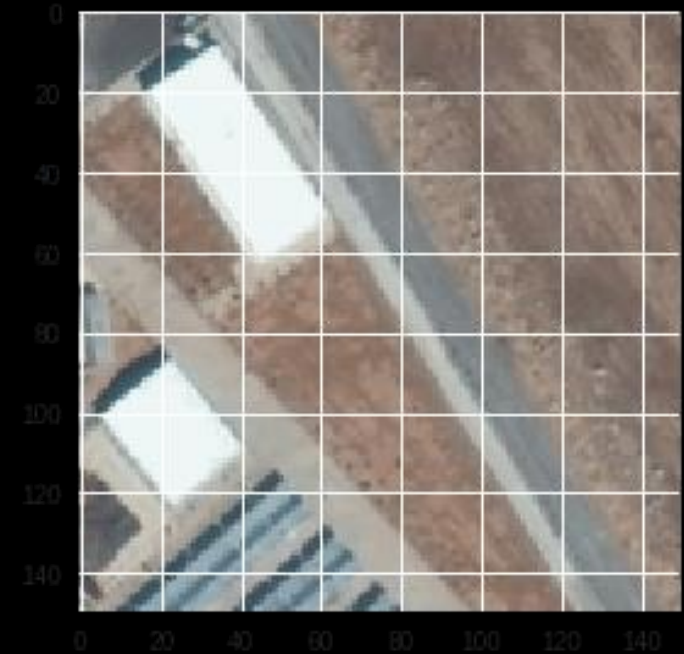
Model Prediction:
Refugee Camp



Model Prediction:
Non Camp



Model Prediction:
Refugee Camp



Limits to the Model

Important Disclaimers

Small Data Set Limited ability to...

- do cross validation
- Evaluation results could be very different on larger data set

There are relatively few refugee camps that actually exist. This creates a challenge forcing us to deal with limited data. In some ways, the problem is like predicting fraud where we are dealing with a rare event.

Conclusions and Final Thoughts

1) Real World Application Challenges

2) The limits of Geography

- Middle East Climate
- Semi Urban Areas

3) Data Science Next Steps

- Estimate Camp Populations/Size



END

Special Acknowledgments:

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Digital Globe Foundation
foundation.digitalglobe.com