Middle East's thirst for **water**

Dashboard design

Palmer D'Orazio, Sarah Moss-Horwitz, Arnita Saini
IxDS2, Spring '17

Diving in - what is an ecoregion?

Ecoregion

"large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions".

Brainstorming - what are our data points?

Species

Arabian woodlands and shrublands
Asiatic cheetah
Sand cat
Bees in Lebanon
Acacia trees

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Natural communities

Refugee - movement of people who are '***climate refugees***'
Population growth - some countries have highest in the world
GDP - some countries are poorest in the world
Socotra island in Yemen
Mesopotamian marshes (home to migrant birds) - Iraq, Iran
Red Sea coral reefs
Drilling for groundwater
Freshwater available

Environmental conditions

Temperature
Heat stress
Water

Brainstorming - what are our data points? - Crucial ones?

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Brainstorming - what are our data points? - Crucial ones? - **Why?**

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Acacia trees

Acacia trees regulate biodiversity in the desert areas. Most of middle east is desert so this becomes an important data point

Natural communities

Middle east story cannot be told without considering the ongoing refugee crisis. Syria's prolonged drought ultimately culminated into the refugee crisis it has been facing since 2010.

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Extreme water shortage, displacement of refugees and decreasing GDP are all factors that are fuelled by the very high population growth rates in middle east.

Water is an EXTREMELY valuable resource here - for drinking, domestic and agriculture

Environmental conditions

Of all the regions in the world, middle east is the first to see the effects of global warming. Temp. increments will hit most hard in middle east and this region will heat up sooner. Severe heat waves and deadly temperatures will render uninhabitable many parts of middle east.

Temperature
Heat stress
Water

Water being such a crucial resource, drives the choice of agricultural or industrial activities in the middle east. Rainfall, precipitation, salinity and sea-water levels were all studied.

Research - Key historical/real-time/predicted **data?**

*Interesting stories on some countries' responses to the **WATER issue** -*

Positive action

***Saudi Arabia** has decided to conserve water by relying on importing food grains! And on the opposite side of the spectrum, countries like **Yemen** are absolutely abusing water by growing their extremely thirsty narcotic cash crop.*

Negative action

~~Acacia trees~~

Acacia trees regulate biodiversity in the desert areas. Most of middle east is desert so this becomes an important data point

Desert-adaptive thus not endangered due to heat stress. Not pursued with further.

Middle east story cannot be told without considering the ongoing refugee crisis. Syria's prolonged drought ultimately culminated into the refugee crisis it has been facing since 2010.

Refugee movement - Good metric for REAL-TIME data, a burning crisis

Refugee - movement of people who are '***climate refugees***'

Population growth - some countries have highest in the world

GDP - some countries are poorest in the world

Extreme water shortage, displacement of refugees and decreasing GDP are all factors that are fuelled by the very high population growth rates in middle east.

We observed huge disparity in GDP, some countries such as Israel, UAE, are highly developed whereas countries like Yemen, Syria are some of the poorest GDPs in the world. What if we show GDP differences?

Environmental conditions

Temperature

Heat stress

Water

Of all the regions in the world, middle east is the first to see the effects of global warming. Temp. increments will hit most hard in middle east and this region will heat up sooner. Severe heat waves and deadly temperatures will render uninhabitable many parts of middle east.

How will temperatures rise? How will this affect **agriculture** and food grains in future?

What are some major food grains?

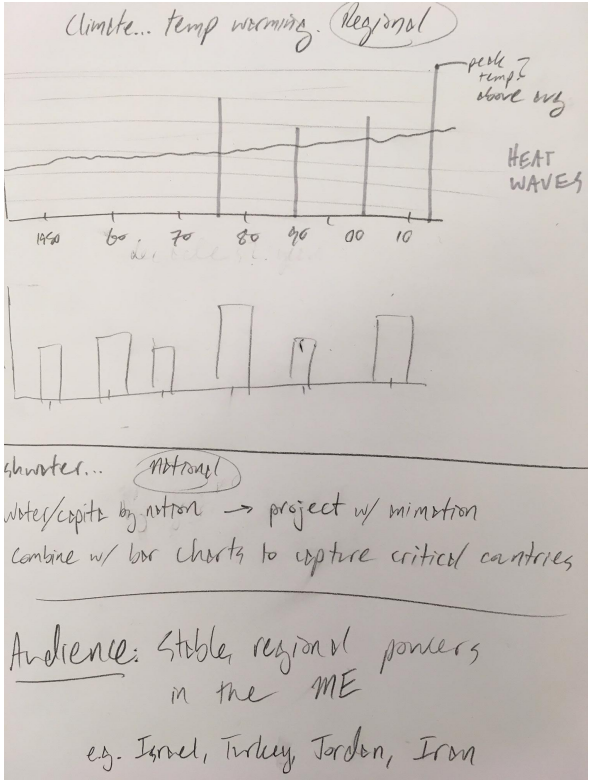
Water being such a crucial resource, drives the choice of agricultural or industrial activities in the middle east. Rainfall, precipitation, salinity and sea-water levels were all studied.

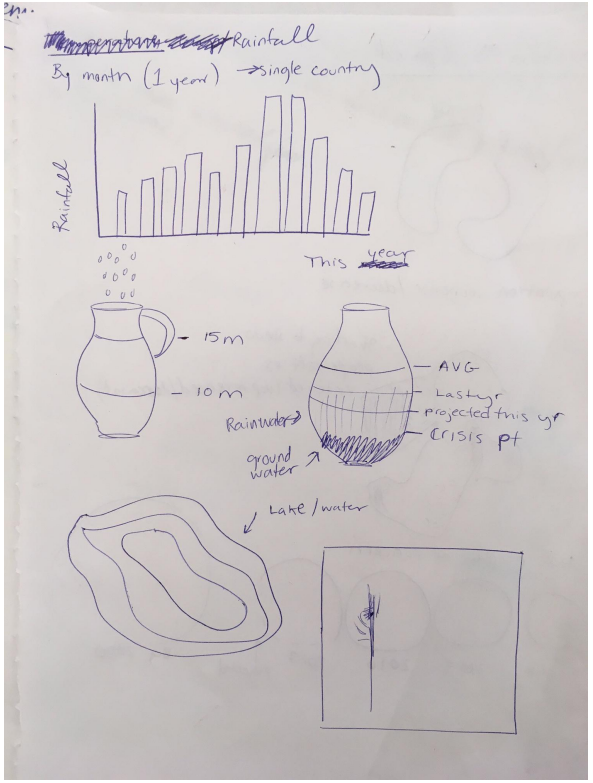
Freshwater available

Water is an EXTREMELY valuable resource here - for drinking, domestic and agriculture

Lots of reports on unhealthy drinking water -> *what's the freshwater per capita?*

Thinking about individual factors - How to show water, temperature?

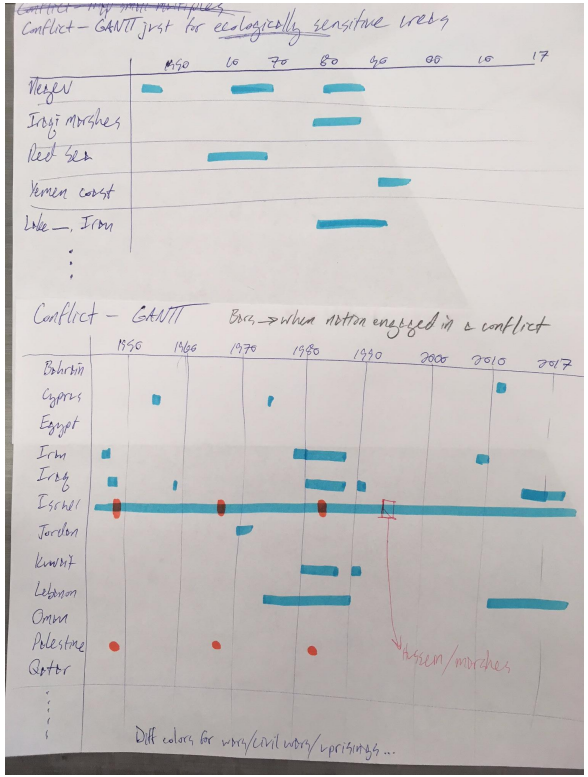


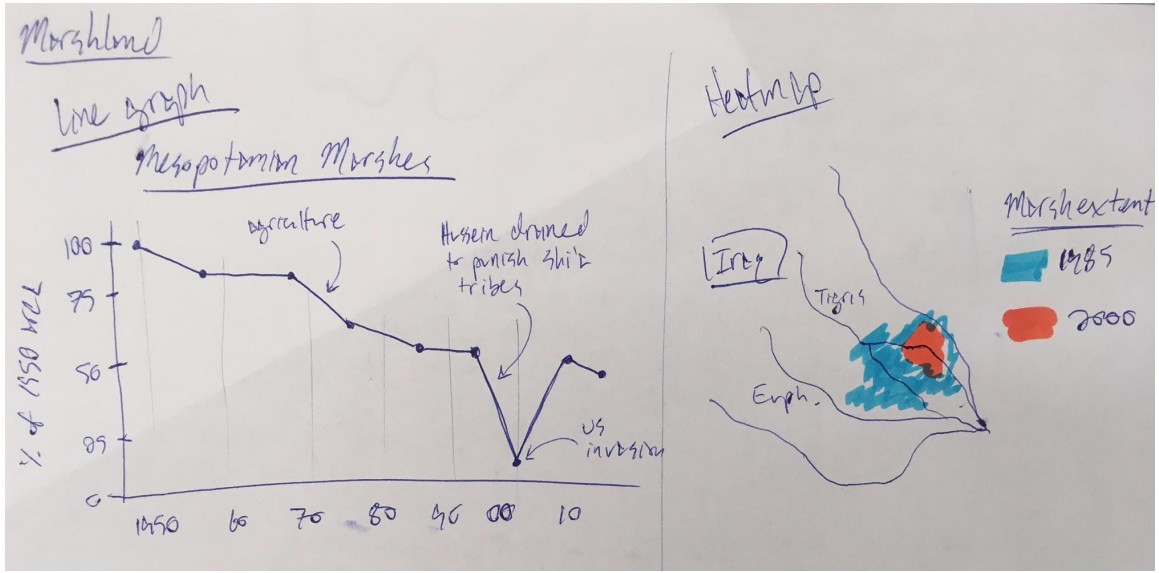


Finding: **Heat waves** are going to be deadly.
Exploration: Predict into the future and show effects on other parameters like water, agriculture, etc. (left top)

Finding: Rainfall trends over time. How are seasons changing. Rainfall is becoming less regular in the months June to September and becoming more scattered over the months. (right)
Also groundwater is depicted like water in a jar and marked with critical groundwater threshold. (right)

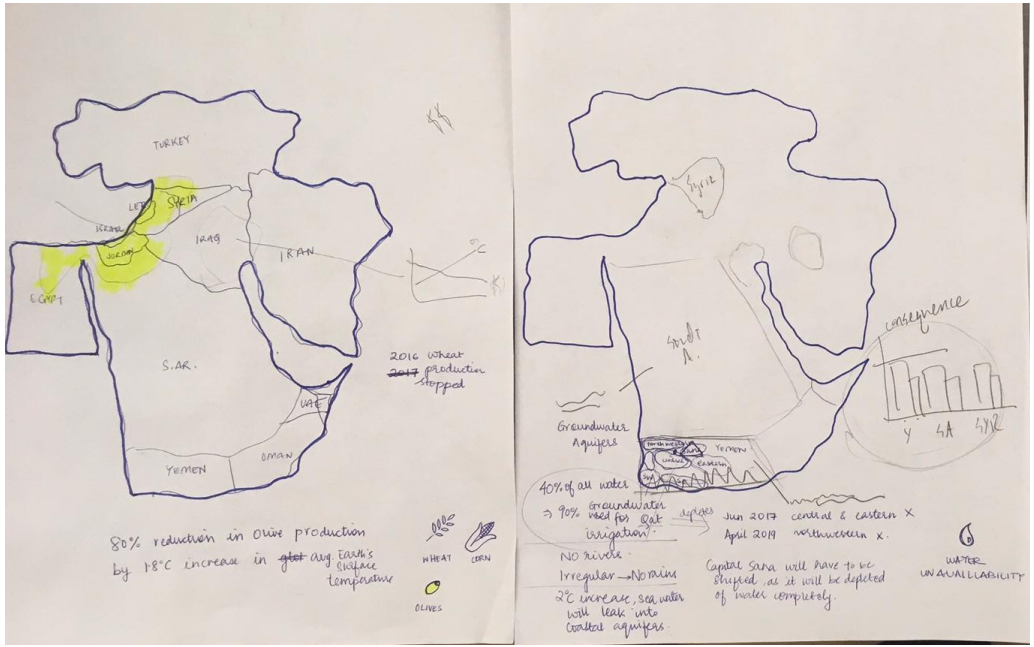
Thinking about individual factors - How to show **conflict effects on biodiversity?**





Finding: **Conflicts** in Iraq led to a significant habitat destruction for migrant birds. Particularly, Saddam Hussein's act to drive out Shia Marsh Arabs out of Iraqi marshlands was the major destructive action taken in 2000s.
Exploration: Heat map or area wise plotting of marshland sizes. (top right) Timeline based effects on biodiversity of conflict by various countries (left)

Thinking about individual factors - How to show **olive, wheat, qat production?**



Finding: **Olives** are going to be severely affected in the mediterranean region due to heat stress.
Exploration: Mark the area of olive cover on map. Could we plot line graph?

Finding: Water tables or **groundwater** are going to deplete due to heat stress and illegal drilling for agriculture in future drastically especially in Yemen, Saudi Arabia and U.A.E.
Research papers show Yemen's groundwater will start to deplete around 2016 and completely dry out by 2040.
Exploration: Shown here in area on a map (middle). Can show historical trend as well as predict into future on line graph.

"It is speculated that the capital city Sanaa will need to be moved as it will completely dry out of water by 2040."

- Middle East climatologist Geoffrey Kemp

Putting it all together (approach 1) - Divide Middle East into 3 types of regions

diagram showing effect of **global warming, resource scarcity, conflict and displacement**

diagram showing **temperature**

Chart showing conflict affected biodiversity for countries

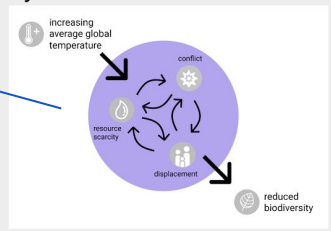
Charts showing **water per capita** for the three regions

Dividing middle east into different regions

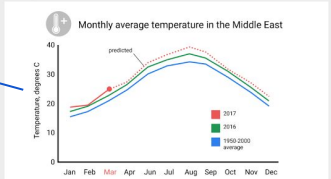
Water and agriculture co-relation. How countries are saving water by reducing water for agriculture.

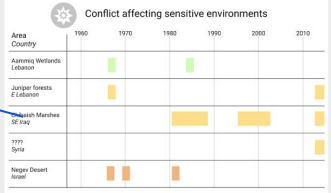
The Middle East
Climate Dashboard

System Overview

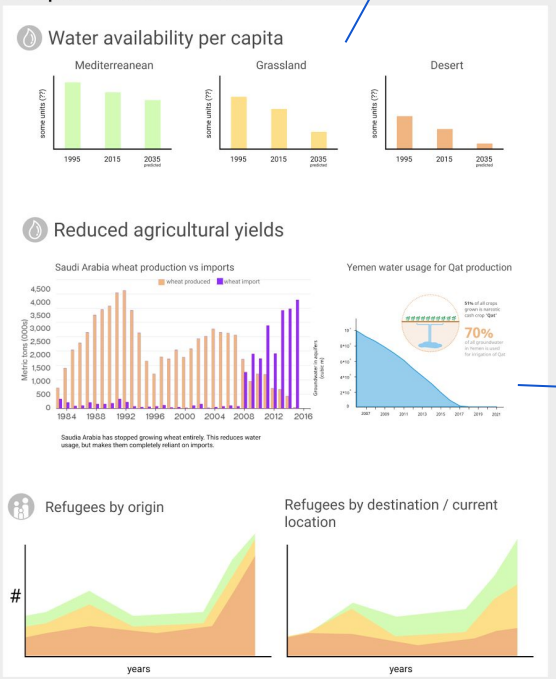


Inputs / context

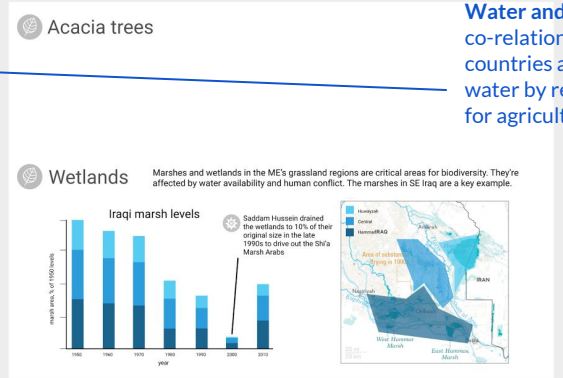




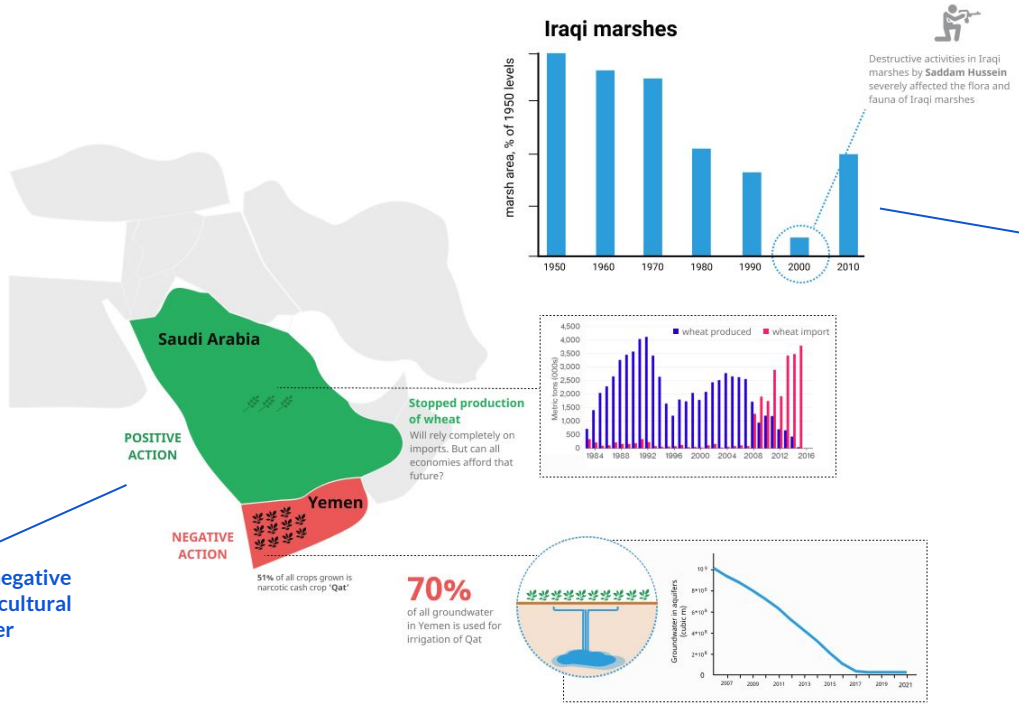
People / resource issues



Biodiversity consequences



Putting it all together (approach 2) - Talk about individual water/temp/conflict stories

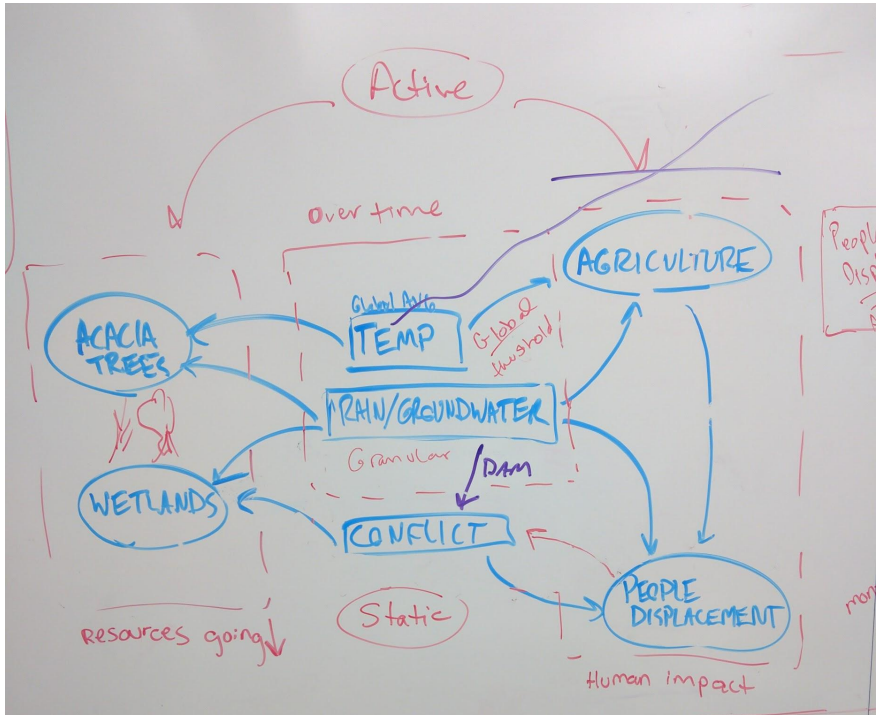


Effect of conflict on Iraqi marshes

Positive and negative effects of agricultural policy on water availability

Feedback in Crit:
Narrow down. Find out one major key issue and tie in all data to it, be it historical stories or real-time or futuristic predictions.

Narrowing down - What if we focussed only on temperature effects on agriculture?



As temperatures warm up, production of olive will reduce in middle east, soil will saline so acacia trees will reduce in deserts, wetlands will naturally dry out (rainfall will also reduce).

Water and agriculture deprived locations will be left behind leading to mass displacement.

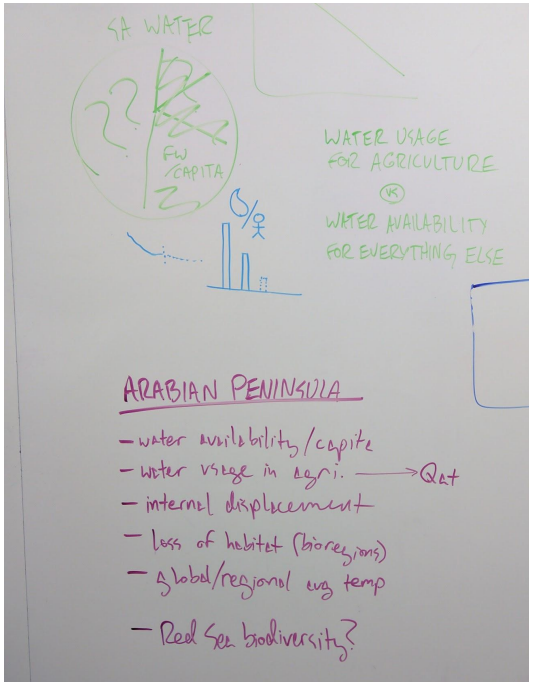
Cons:

Doesn't touch upon the key aspect of freshwater availability which is a huge concern.

Couldn't find much data on acacia trees population.

We found data on refugees escaping due to water crisis but not due to food unavailability and difficult to predict such a factor into the future.

Narrowing down - What if we focussed only on Arabian Peninsula?



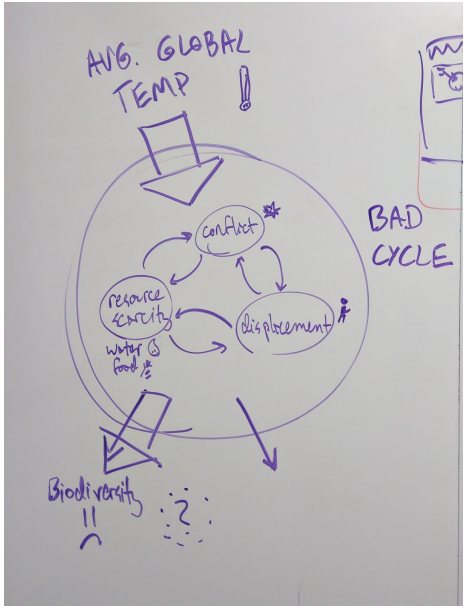
Since Arabian peninsula is the main desert region of middle east with countries such as Saudi Arabia, Yemen, Oman, U.A.E comprising most of their areas as deserts. Also, these desert regions are most prone to effects of heat stress and depleting groundwater. Arabian peninsula also doesn't have any rivers which makes it all the more dependent on climate and rainfall for enriching its natural aquifers.

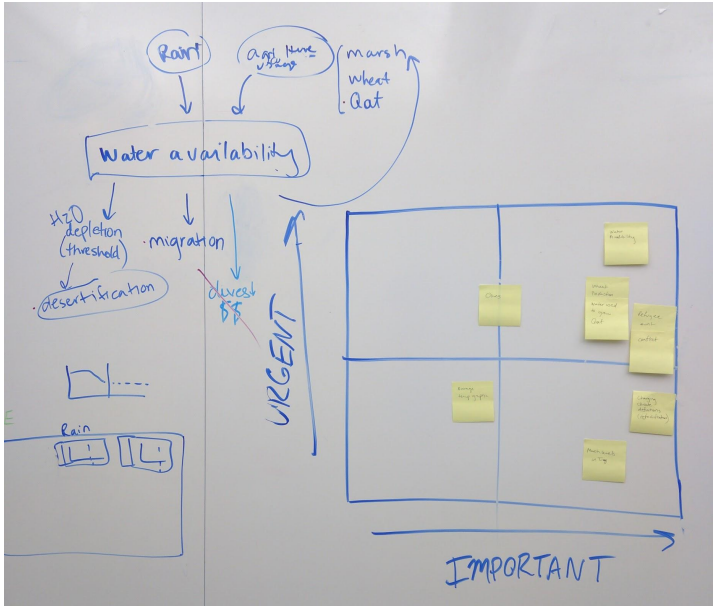
Cons:

Refugee crisis cannot be captured in a region like this and perhaps the story of Middle East without talking of refugee crisis is not complete.

Couldn't find interesting data trends in Red sea coral reefs health and growth which is key biodiversity in the region. Red sea coral reefs are actually more salinity and temperature tolerant than most coral reefs in the world!

Narrowing down - What if we focussed only on the water story?





We plotted all our data points on a scale of **Urgent vs. Important** and almost all the highly urgent AND important ones were rooted in **Water** as a key reason.

Pros:

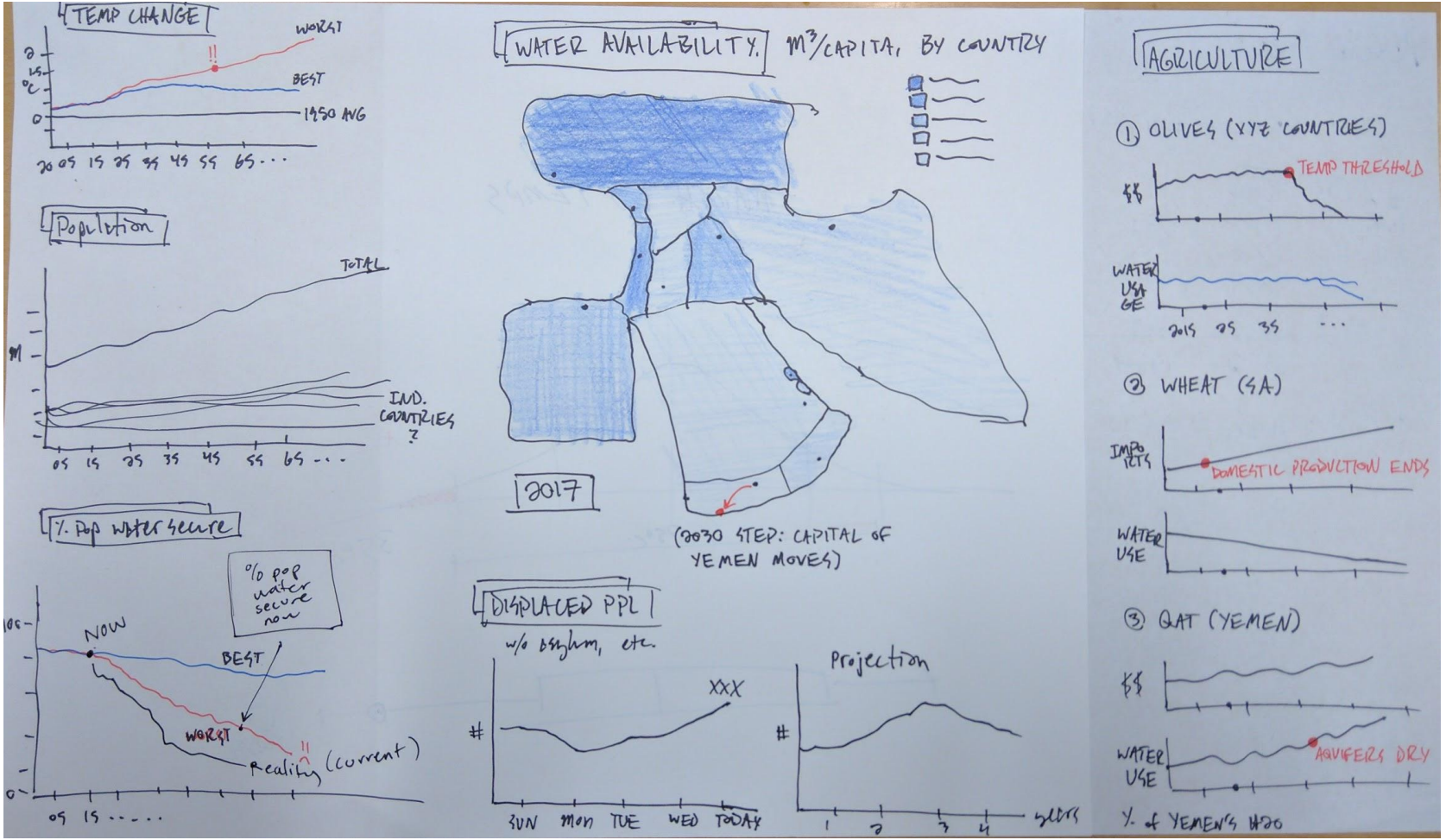
Water is the main factor (even though it's availability is majorly affected by temperature and heat stress), that comes across as the main reason -

- Behind countries reducing agriculture to save water,
- Refugee crisis in Syria and Yemen,
- Improper agriculture depleting groundwater in Yemen,
- Freshwater per capita - key measure.

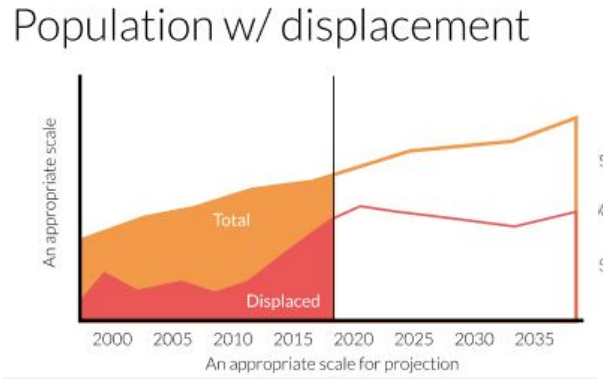
Revisiting the policy maker - What happens as water becomes the key datapoint?

Nadia Al-harithi,
Senior Water Policy Maker

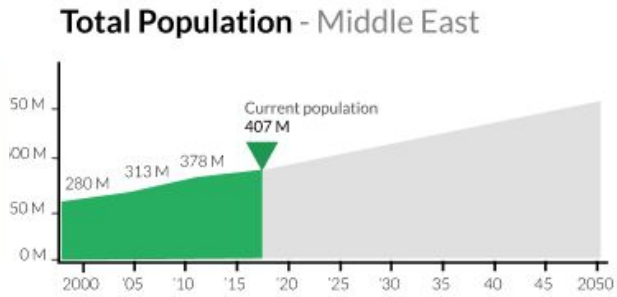
1. Track Water Availability Levels
2. Predict forecasted impact on agriculture and society
3. Identify critical thresholds

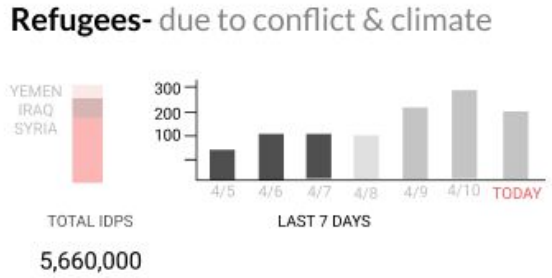

TEMP CHANGE
WORST
BEST
1950 AVG
°C
2
1.5
0
!!
05 15 25 35 45 55 65 ...
Population
TOTAL
M
IND. COUNTRIES
?
05 15 25 35 45 55 65 ...
% Pop Water Secure
% pop water secure now
100
0
NOW
BEST
WORST
!!
Reality (current)
05 15 .....
WATER AVAILABILITY
M³/CAPITA, BY COUNTRY
2017
(2030 STEP: CAPITAL OF YEMEN MOVES)
DISPLACED PPL
w/o asylum, etc.
#
XXX
SUN MON TUE WED TODAY
Projection
#
1 2 3 4 years
AGRICULTURE
① OLIVES (XYZ COUNTRIES)
$$
TEMP THRESHOLD
WATER USAGE
2015 25 35 ...
② WHEAT (SA)
IMPORTS
DOMESTIC PRODUCTION ENDS
WATER USE
③ QAT (YEMEN)
$$
WATER USE
AQUIFERS DRY
% of YEMEN'S H20

Refinement - Refugees

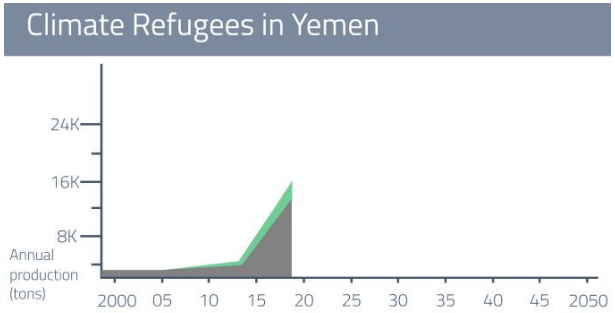


Iteration 1. Total population with percent displaced.



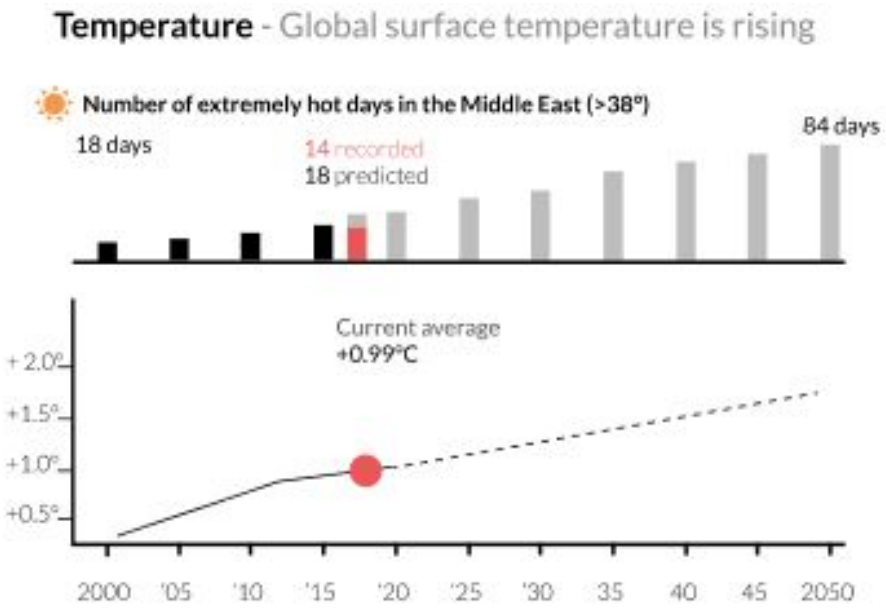


Iteration 2. Two separate graphs- Total population with projection and Refugee population, live updated over the last 7 days.

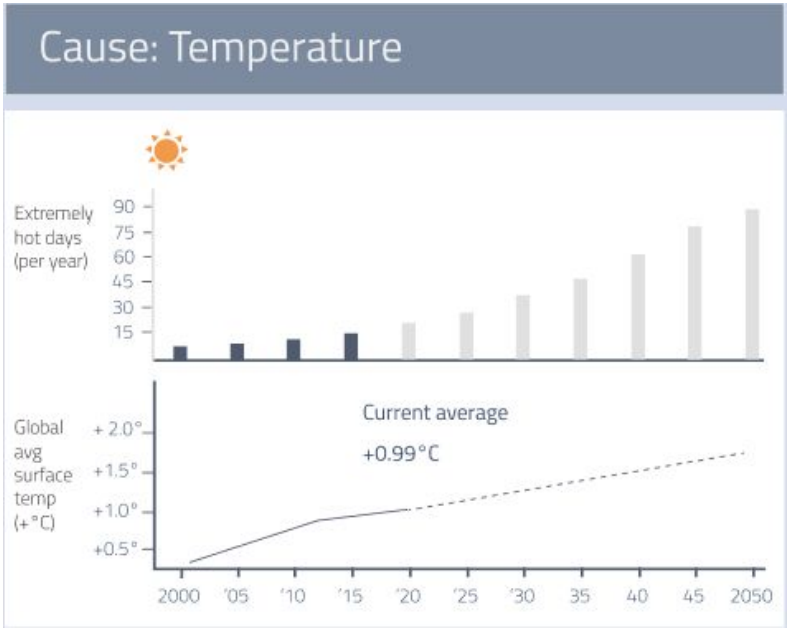


Iteration 3. We chose to focus specifically on climate refugees to better connect the refugee problem with the climate data.

Refinement - Temperature

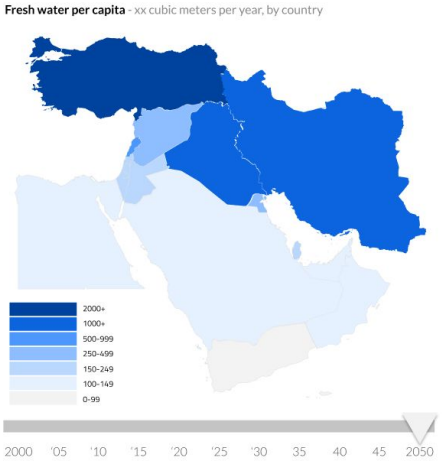


Iteration 1. Number of extremely hot days in the middle east, recorded and predicted this year.

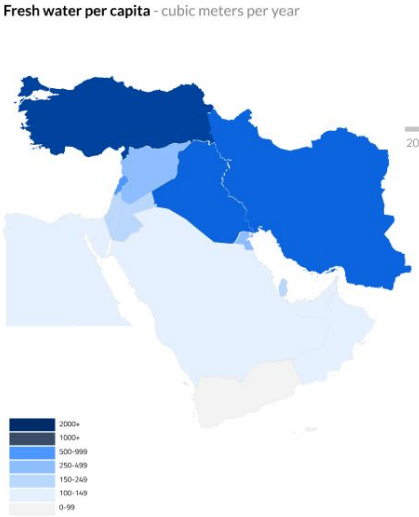


Iteration 2. We kept the concept of this frame generally the same, but made slight alterations- adding the scale to the number of extremely hot days and removing the confusing recorded vs. predicted element.

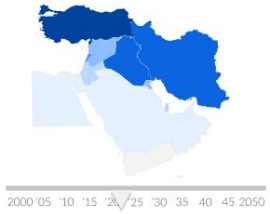
Refinement - Water Availability

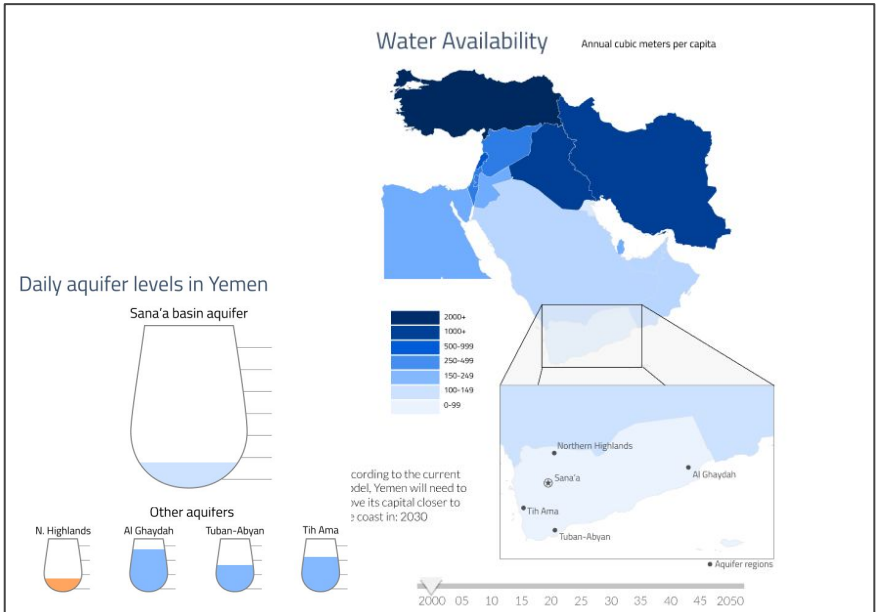


Iteration 1. Fresh water per capita, over time for all of the Middle East.



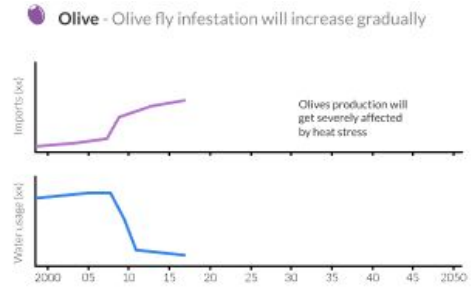
Iteration 2. We explored using multiple animated maps to show the present state and the predicted state over time.

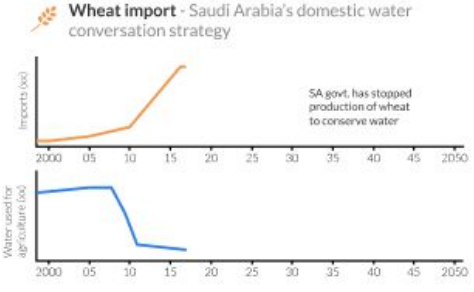


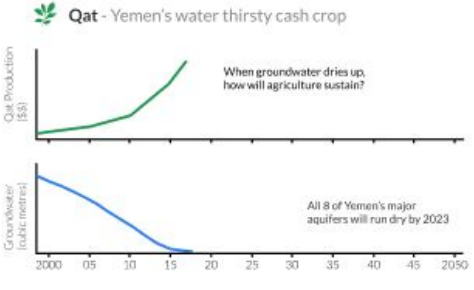


Iteration 3. To focus on the specific case of Yemen, we zoomed in on Yemen and the cities/ aquifers in Yemen while also showing the rest of the Middle East as context.

Refinement - Agricultural Production

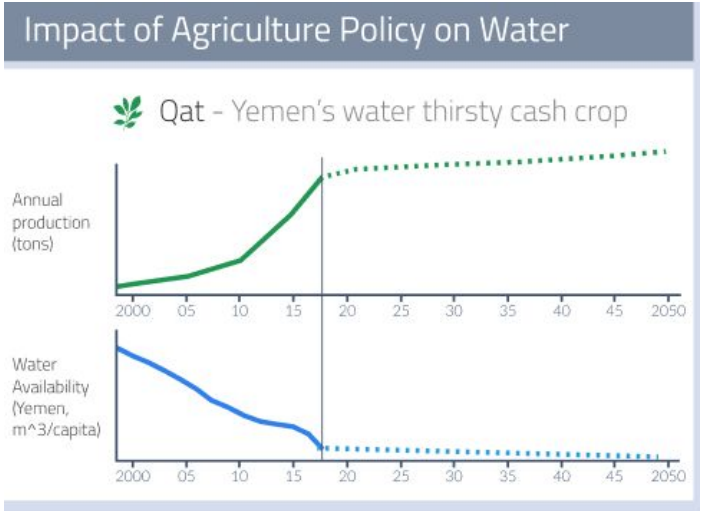


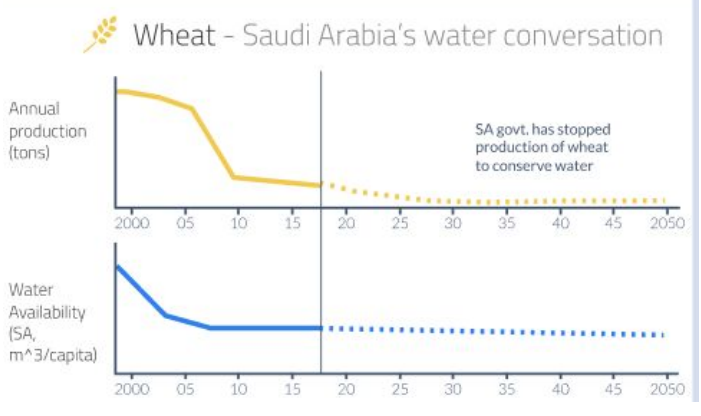




Iteration 1. (Left) We initially had three agricultural data points- olives, wheat and qat, however we realized that, while interesting, olives were disconnected to the story that we were telling as a whole about water availability and production.

Iteration 2 (right). We focused on Qat and Wheat to tell a clearer story of the impact of agricultural production on water availability.

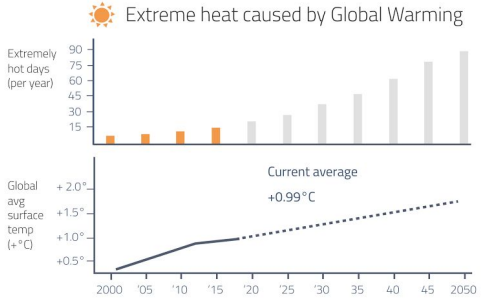




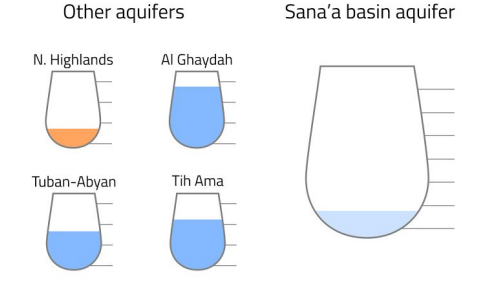
Final visual design - Video attached + online here: https://drive.google.com/open?id=0B1s_VNuGJqYBQ2t0akNWRlRWWnc

Yemen Water Policy Dashboard

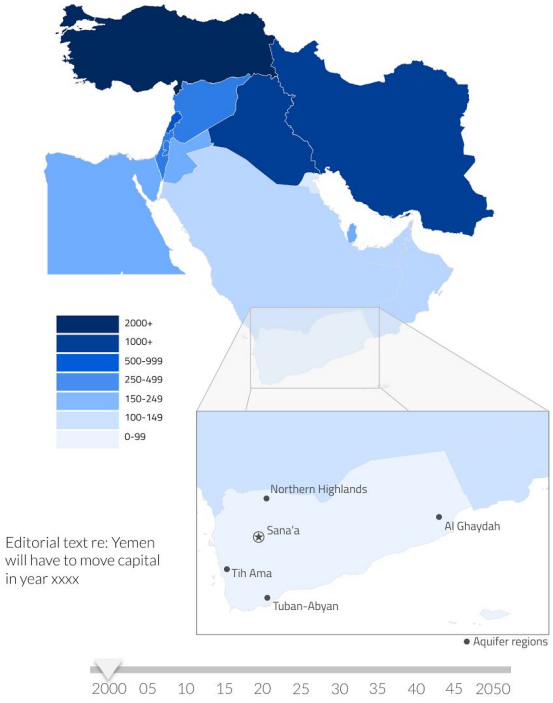
Temperature



Daily aquifer levels in Yemen

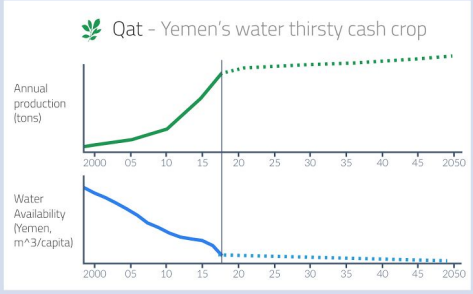


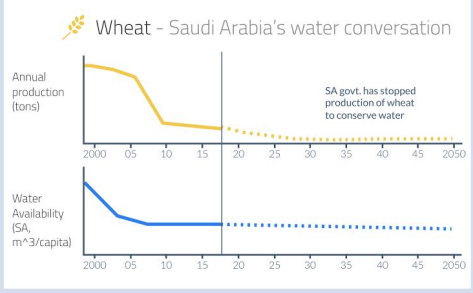
Water availability



Editorial text re: Yemen will have to move capital in year xxxx

Impact of Agriculture Policy on Water





Climate Refugees in Yemen