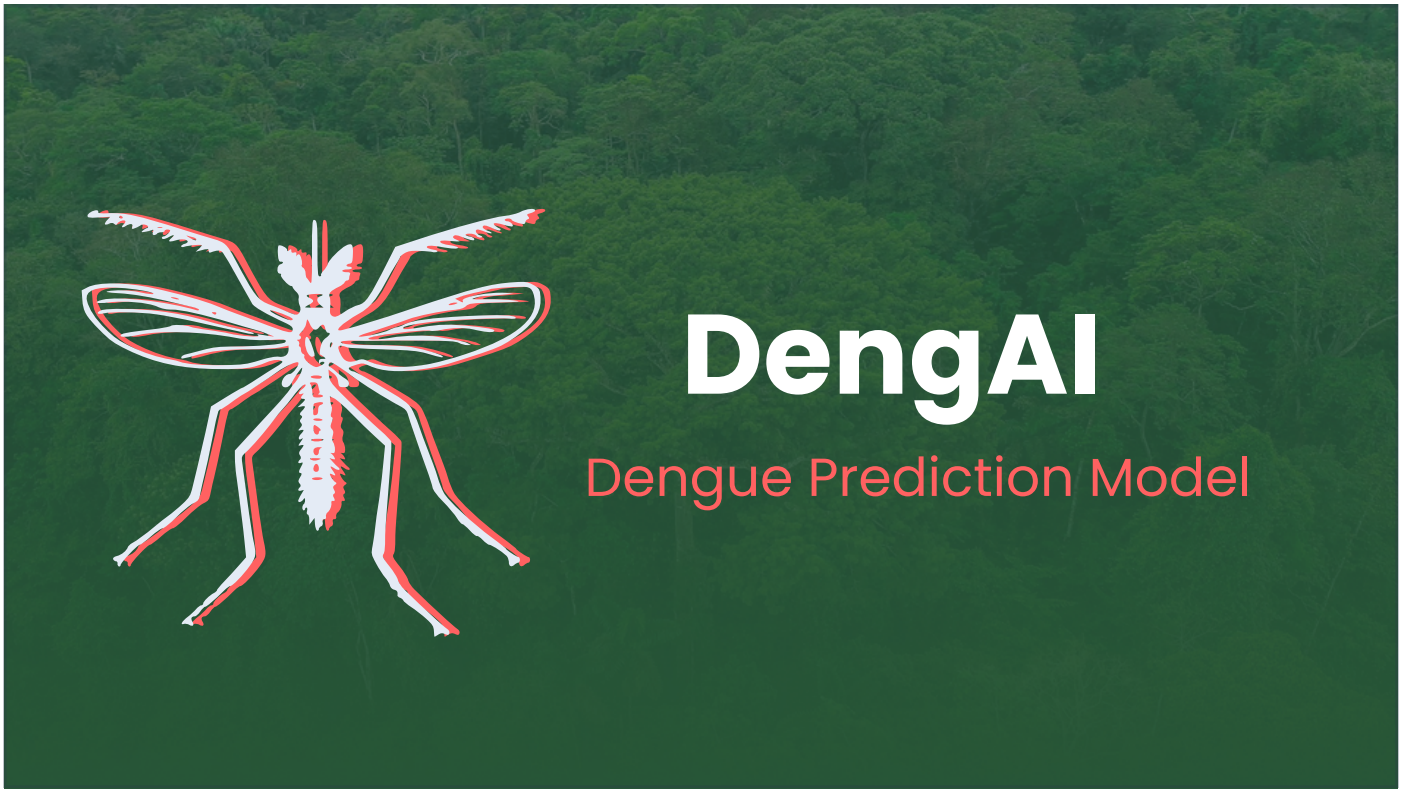



Good afternoon,
OUR team's project

focused on
Developing a

Dengue prediction model.

## Dengue is a major health threat world-wide.

**4.2 mil.**

DENGUE CASES
IN 2023

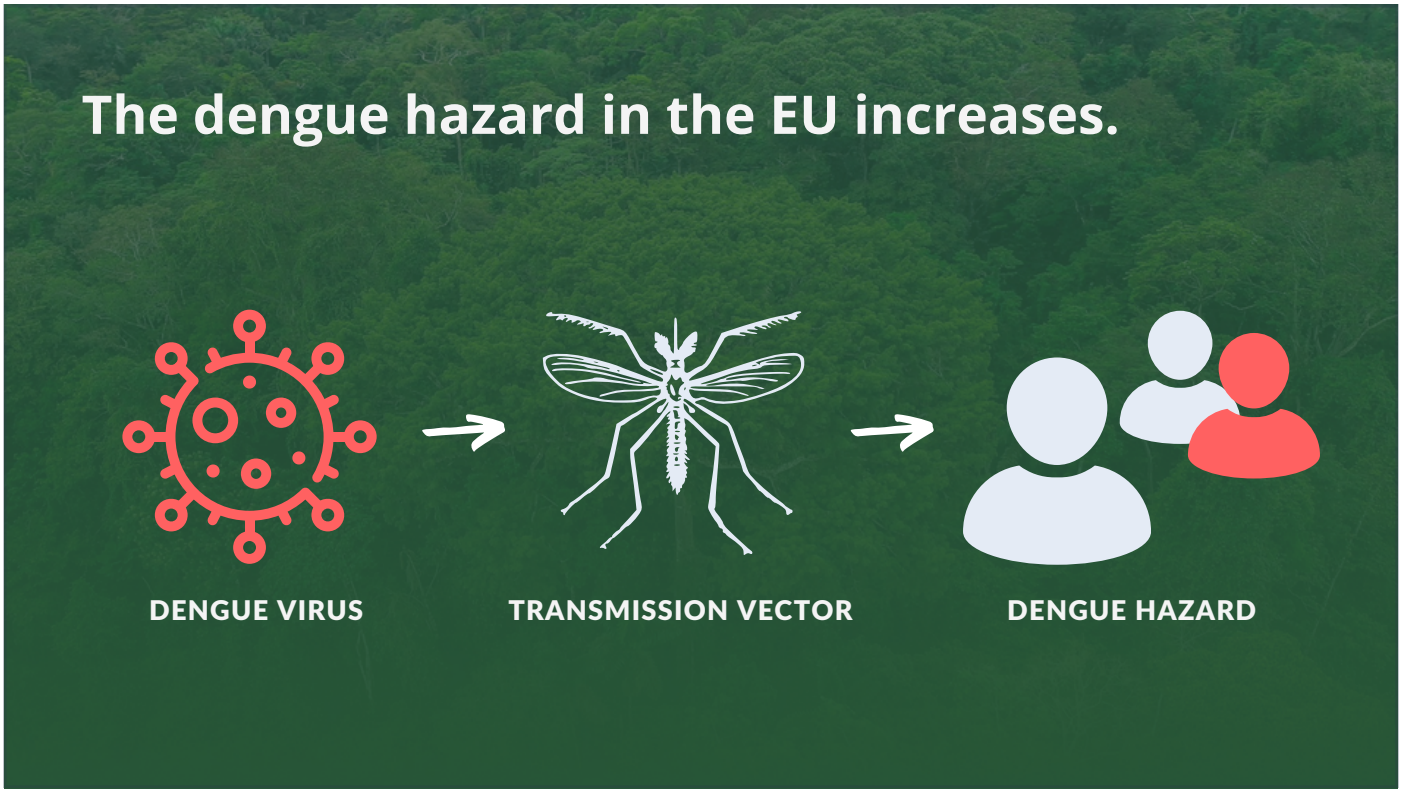

FEVER, IN SEVERE CASES
EVEN DEATH

BEST PREVENTION =
BITE PREVENTION

Dengue is one of
the most significant
mosquito-borne diseases
world-wide
with 4.2 MILLION cases
last year alone.

It can develop severe symptoms
and people even may die.

There is no specific treatment available so far.
So the best prevention is:
BITE prevention.




Dengue is commonly known as a  TROPICAL disease,

the VIRUS itself though,
has always been
brought in
by infected travellers.

but now,
- with global trade
- and climate change,
foreign species invade and BREED in Europe,

including those particular mosquitos, which TRANSMIT
the  dengue viruses.

## There are already outbreaks in the EU.


There have been already smaller outbreaks in Croatia, Italy and in France.

With both,
the virus and the mosquitos now present,

we need a WARNING system.

So. let's look, what
we need
to develope that?

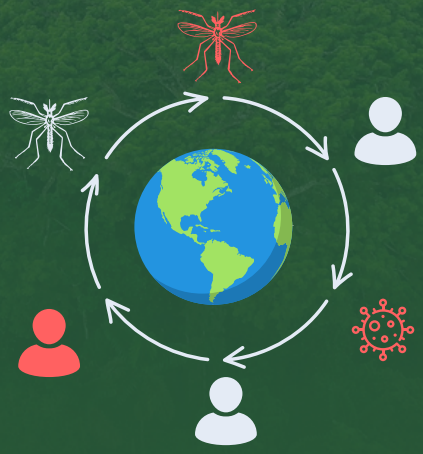
######################
(France has experienced sporadic outbreaks since 2010. In 2023, France reported 43 autochthonous  cases. (Provence, Cote d'Azure)

Italy also had several outbreaks in recent years. In 2023 82 cases (mainly Emilia-Romagna and V eneto)

In Croatia there were no outbreaks recorded in 23, but notable ones in 2019.)

(source: https://www.ecdc.europa.eu/en/all-topics-z/dengue/surveillance-and-disease-data/autocht honous-transmission-dengue-virus-eueea)

## Climate has a strong impact on the reproduction of mosquitos and Dengue virus.



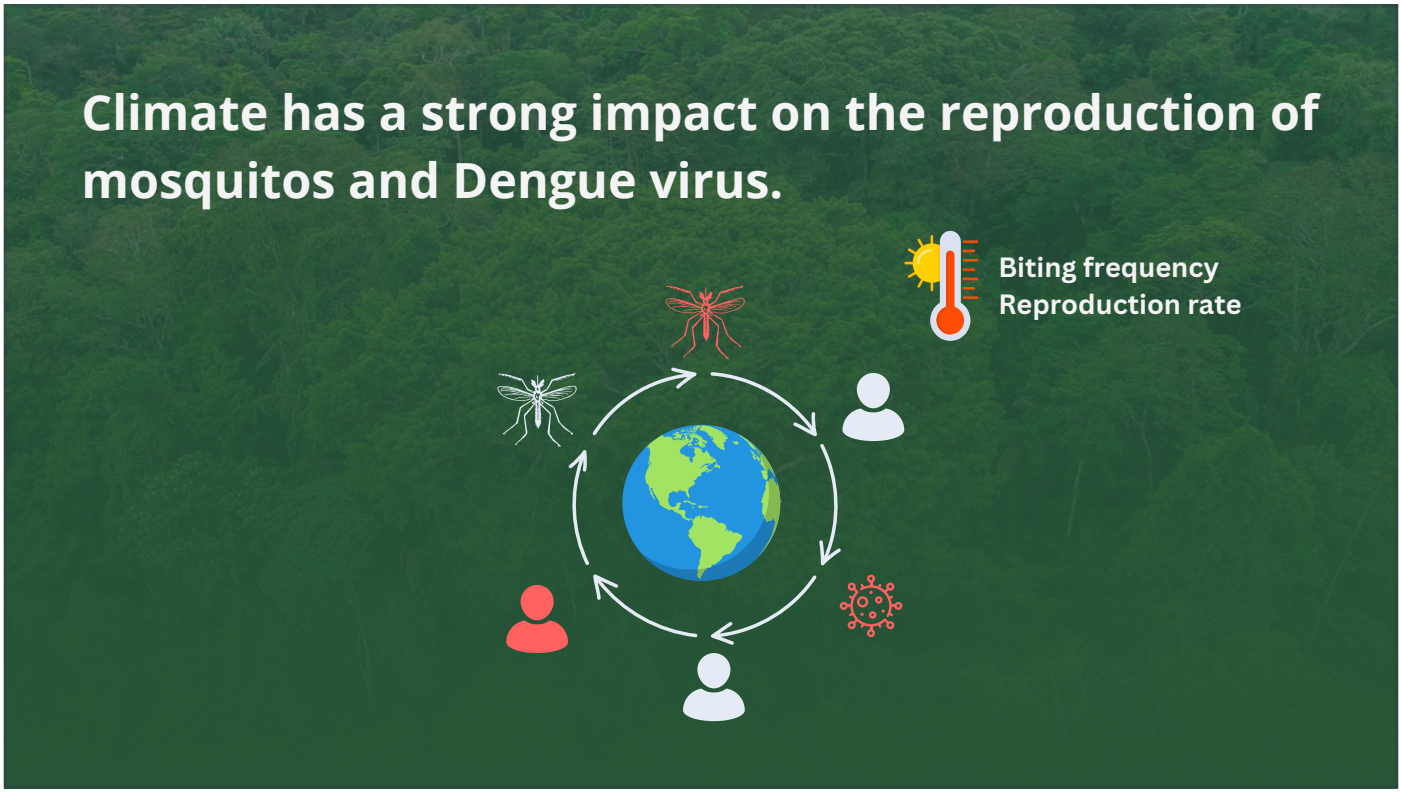
The strongest impact on the number of Dengue cases by far have climate features.

Let's take a look at the transmission cycle first: .....

Infected mosquitoes biting humans initiate the cycle.

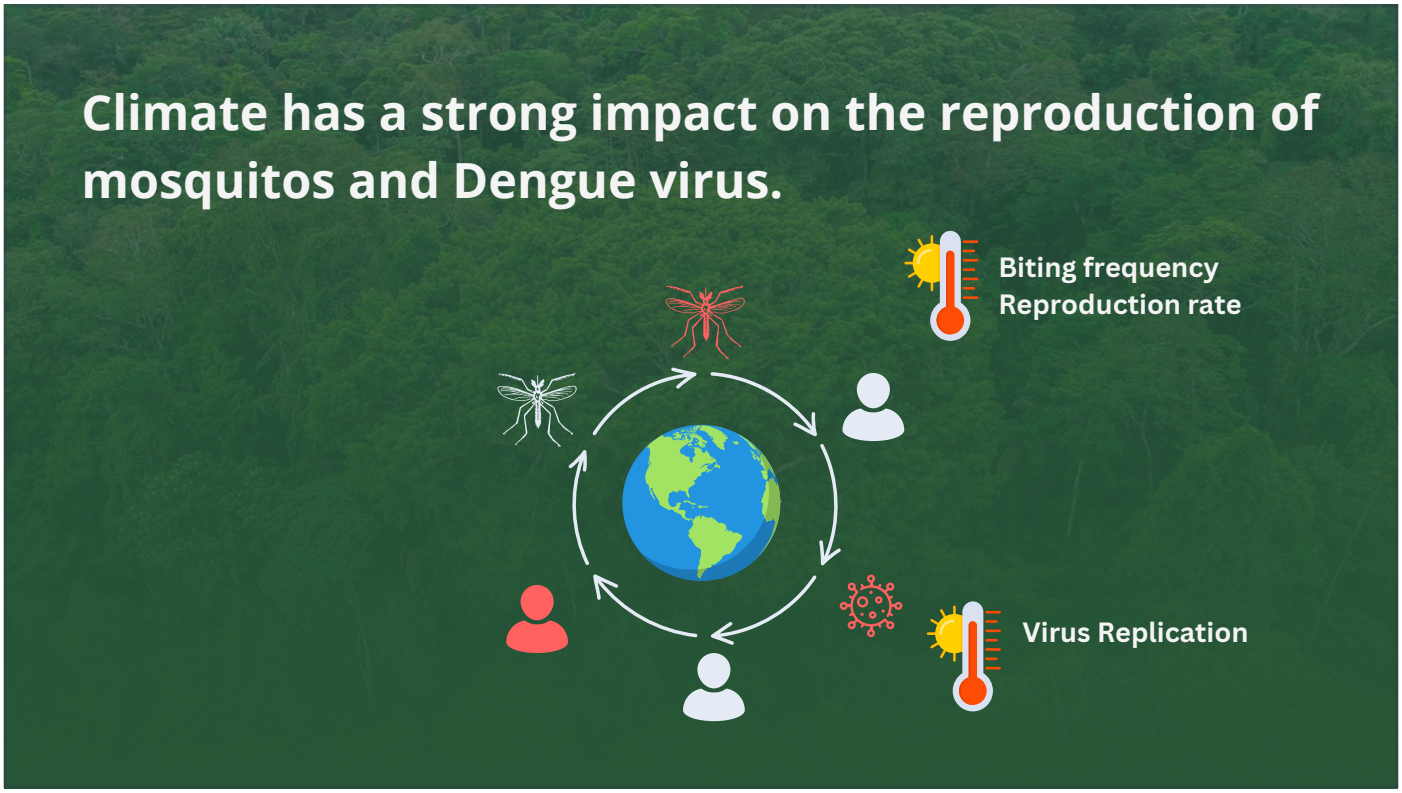
The virus replicates in the human body and when bitten by a non-infected mosquito the cycle starts again.

How is this now influenced by climate?

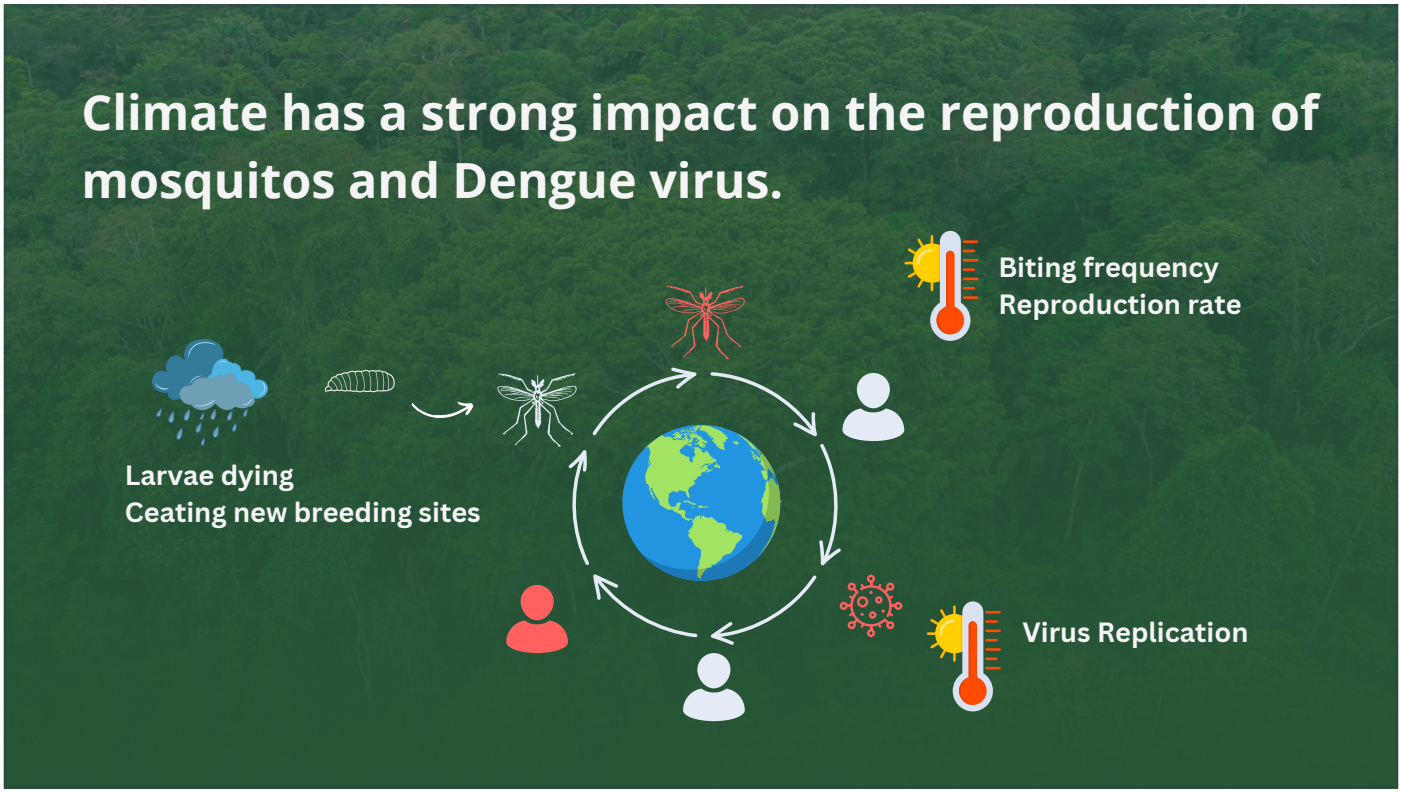



Let me give you three examples:

As temperature rises, both mosquito biting frequency and reproduction rates increase.

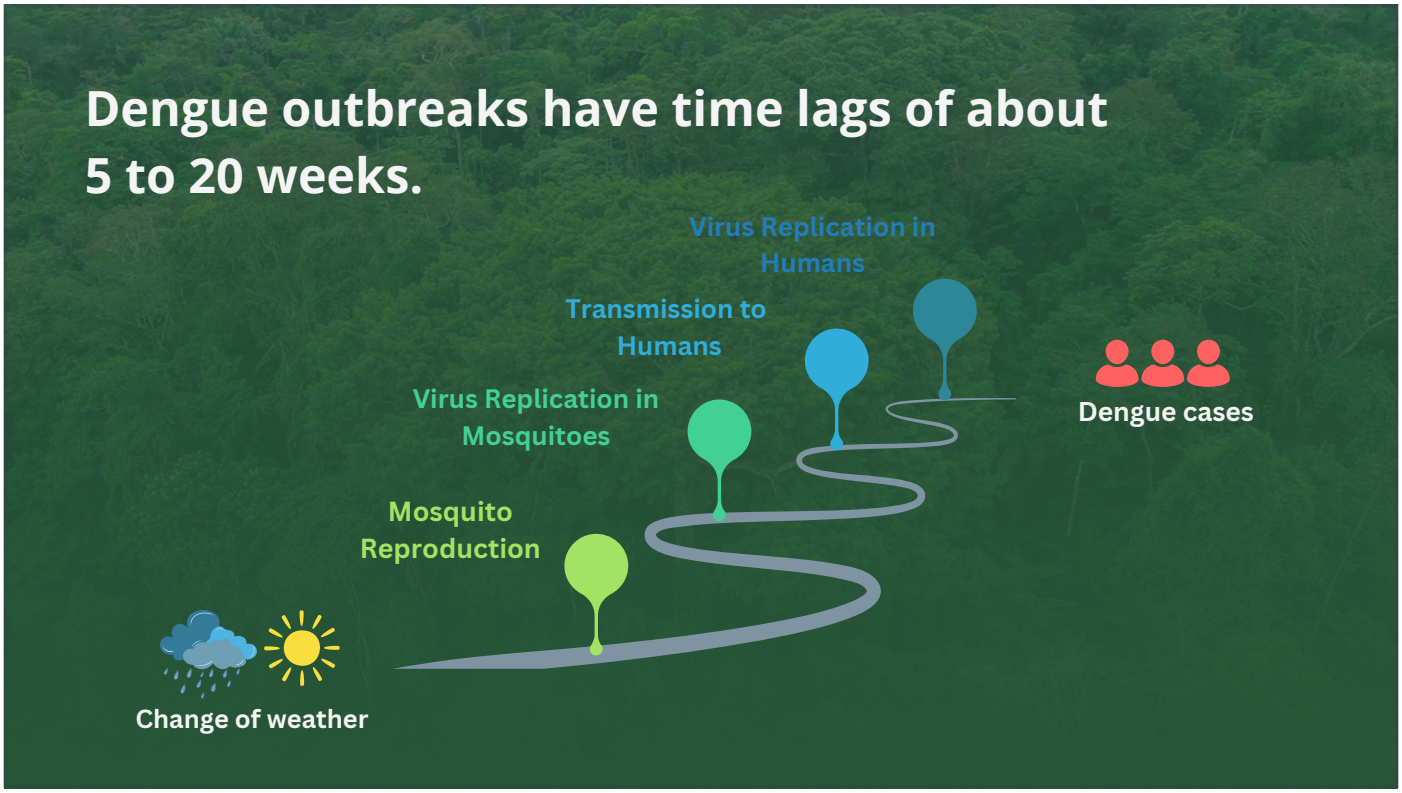



Also the replication rate of the virus increases with temperature.




Heavy rainfall can destroy the larvae, but also creates new breeding sites

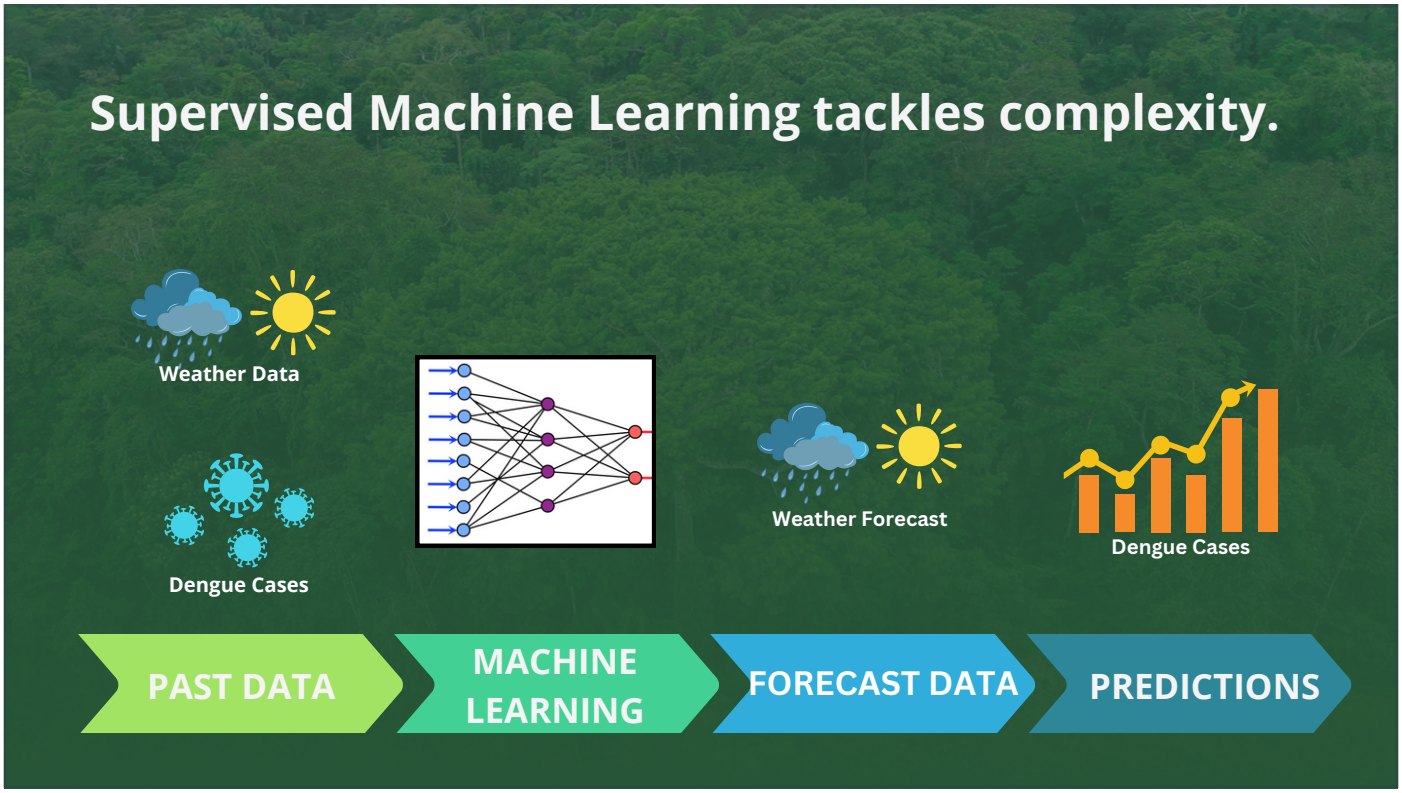
So when developing a prediction system we definitely need climate features.




But we also have to take into account the time lag between changing weather conditions and the number of Dengue cases.

This time lag can be between 5-20 weeks depending on climate.

So how to integrate all that complexity into a prediction model?




To tackle this complexity, we used Supervised Machine Learning which is a type of artificial intelligence where a model is trained to predict future events - here dengue outbreaks - by learning from historical data - in our cases weather data and the number of dengue cases.

During the training, the model starts to notice things like "When it's hot and rainy, Dengue cases tend to go up."

Once being trained, the model can make predictions based on continuously updated weather data.

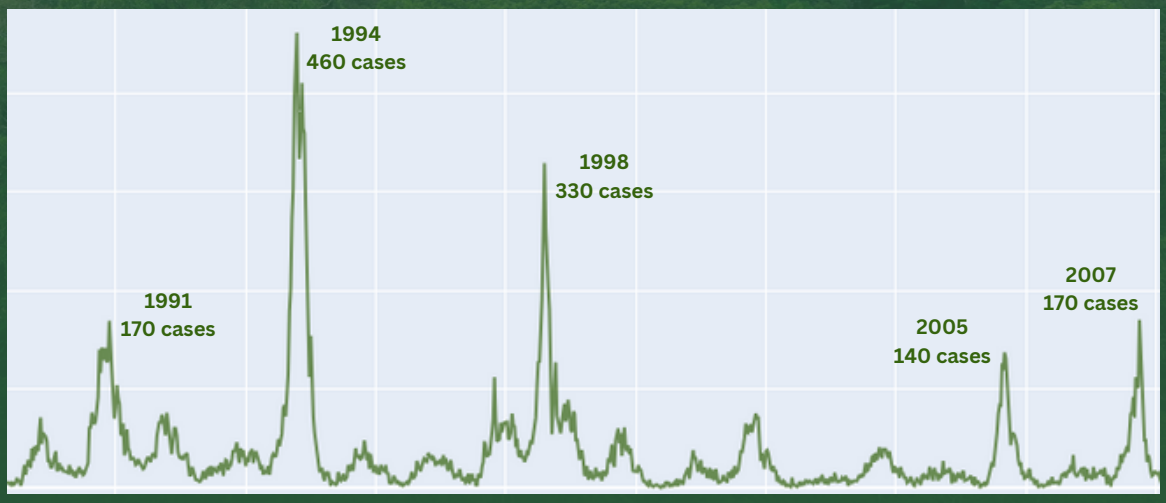
## The ML model is trained on historical data from San Juan, Puerto Rico.

1990-2008


We trained five different models using weather data and Dengue case from San Juan, the capital from 'Puerto Rico', because it has a long history of well documented Dengue Cases.

So how did our models perform?

## From 1991 to 2008 there have been five significant Dengue fever outbreaks in San Juan.

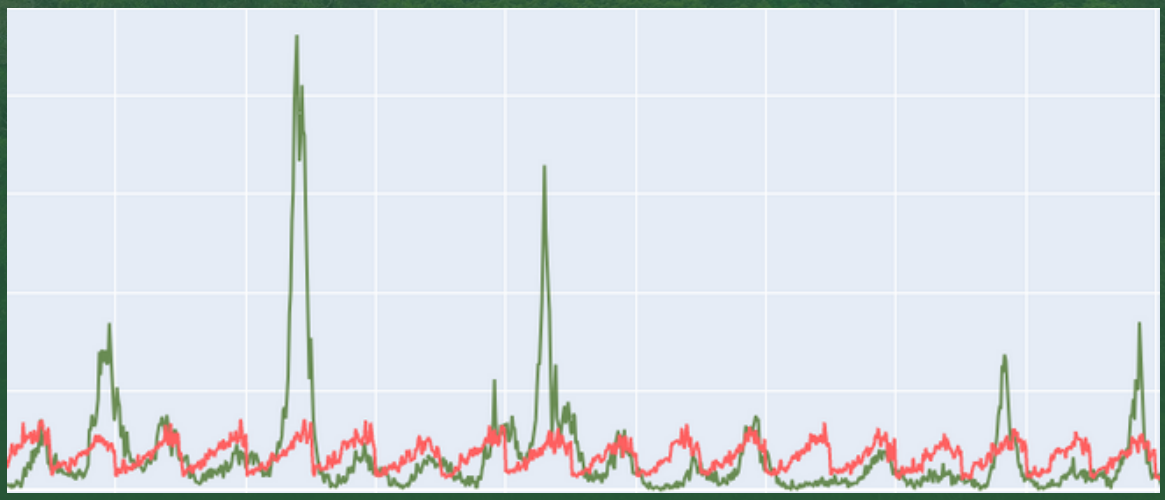



Let's first take a look at the development of the actual cases in San Juan.

From 1991 to 2008 there have been five significant Dengue fever outbreaks

So would our model have been able to predict them?

## Most of the models tested could not predict any outbreaks.



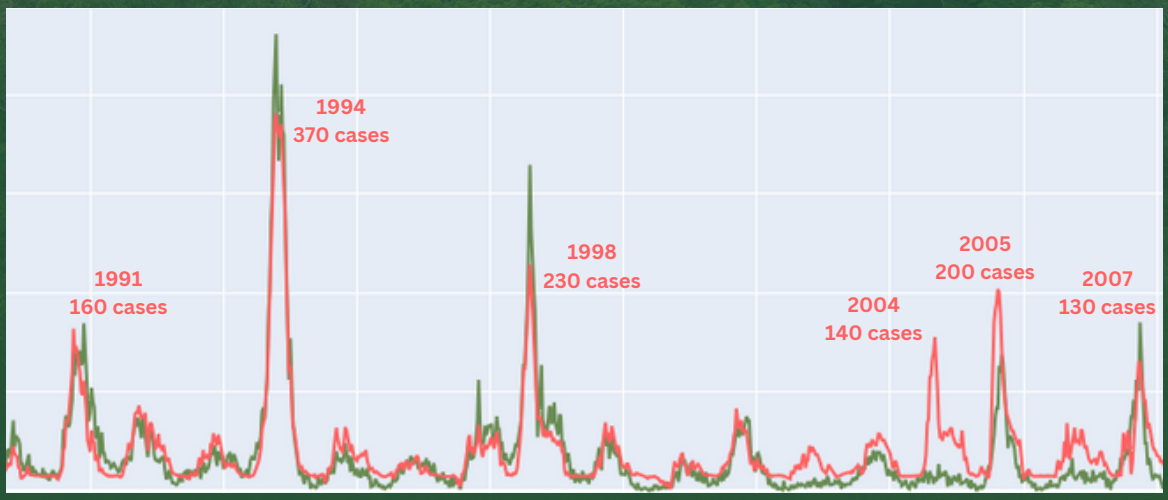
Well, not really

The red line shows the predicted number of Dengue cases from our baseline model. However the other models showed similar results.

As you can see, the model could detect seasonality but no outbreaks.

So what now? We had to find a model that is able to detect complex patterns  and time dependencies.

## Only the Neural Network was able to predict outbreaks.



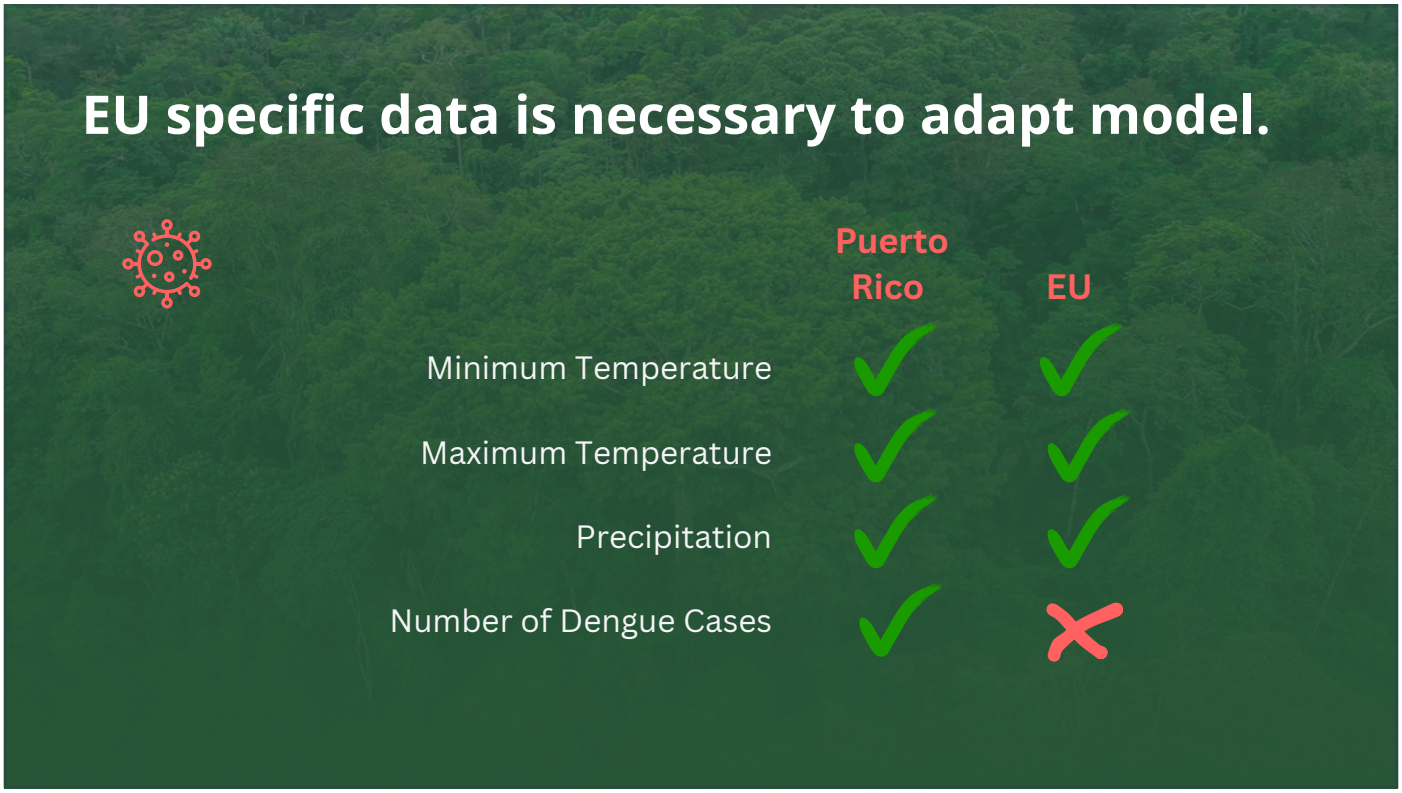

That is why we finally used a Neural Network - and it worked!

The model could predict all outbreaks.

As you can see, it predicted an outbreak in 2004 that did not happen - but better having one warning too much than one too little

So we are very proud that we finally succeded in developing a DengAI prediction system that now could be used in Puerto Rico to warn people about an upcoming outbreak.

But what about Europe?



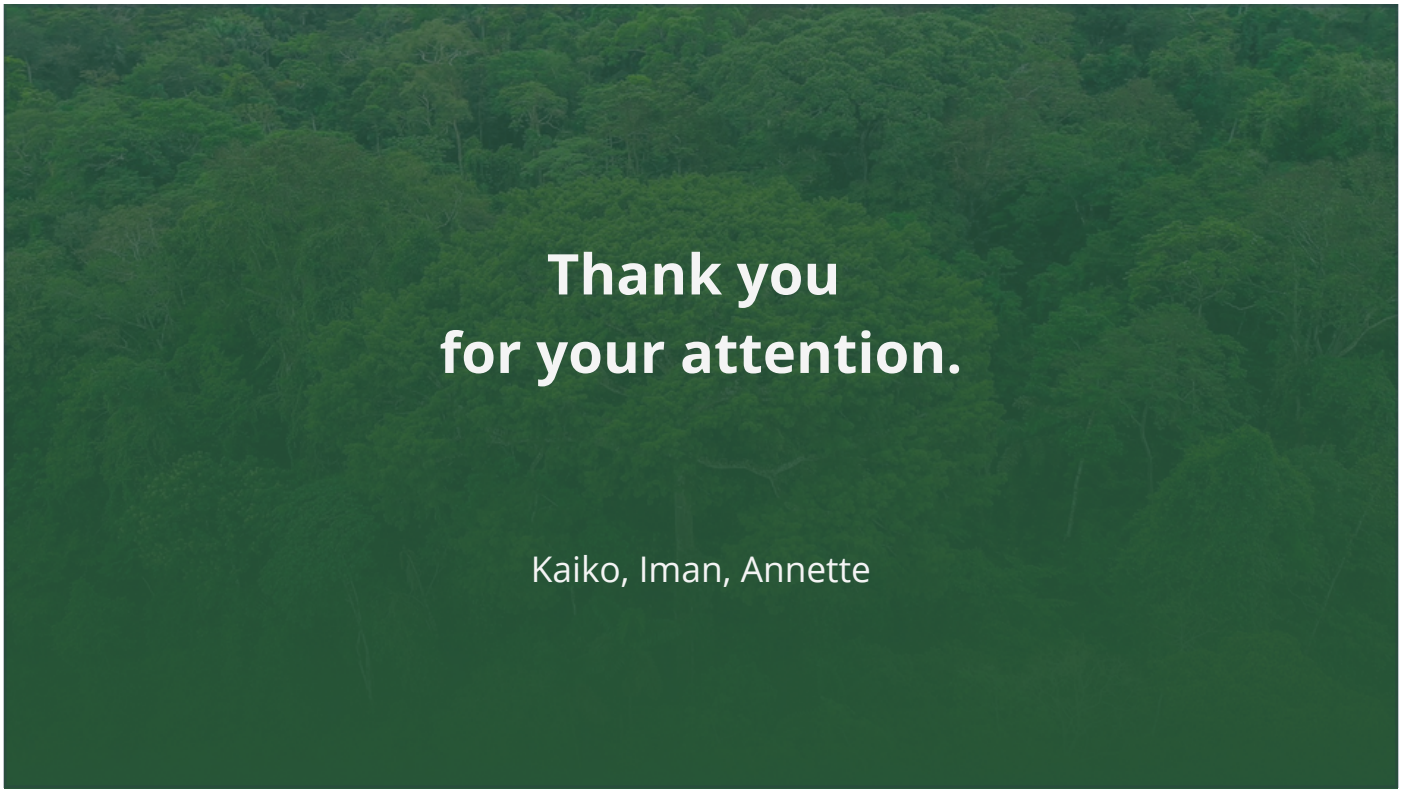

As this model was trained
on tropical data
it CAN'T simply
be applied.

For Europe, ONE necessary data is -thankfully- not available:

That is, a sufficient number of actual dengue cases,

As soon as there is,
our model THEN can warn,
in time and
AHEAD of the hazard.

So people
may have a chance
to protect themselves
from getting dengue.




We thank you
for your attention.

# Thank you
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Annette, Iman, Kaiko