

Can Deep Learning help to forecast deforestation in the Amazonian Rainforest?

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Motivation

There is a lack of methods to accurately forecast deforestation in advance



Brazilian Amazon Rainforest

From 2000 - 2020
21.3M ha
of primary forest was lost

Making it a
Net-Carbon source

Forest Conservation Projects

They aim to
mitigate
deforestation but their
impact is currently debated

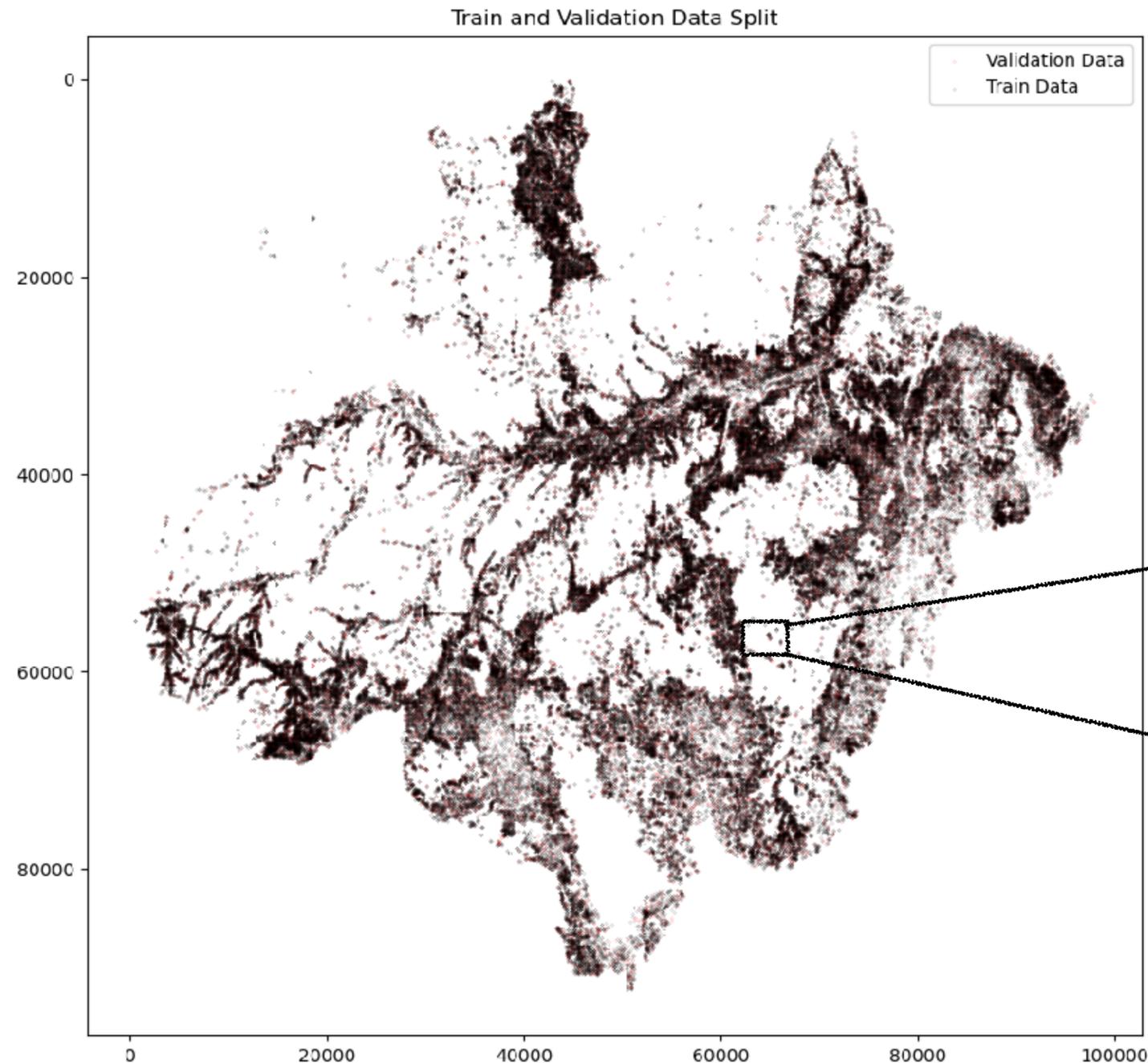
“[Deforestation] reductions were
substantially lower than claimed.”
- West 2023

Current methods merely give indicative predictions

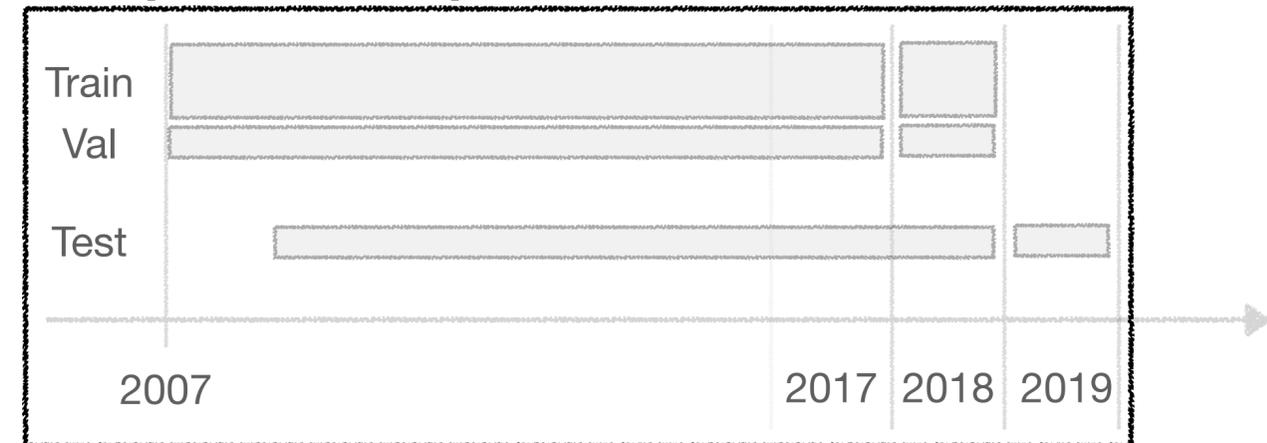
	<p>How will the deforestation rates of a given site develop in the next years? (~30T ha)</p> <p>Takahata 2022</p>	<p>How will deforestation spread spatiotemporally? (30 m/pixel -> ~ 0.1 ha)</p> <p>Ball 2022</p>
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Data preprocessing

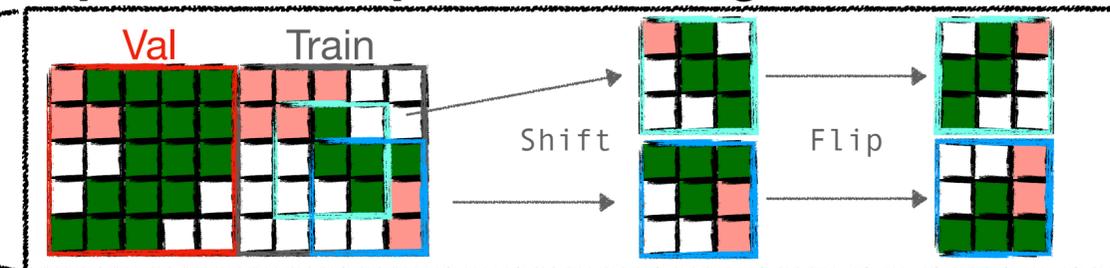
We ensure tempo-spatial independence of train and test set



Temporal data split



Spatial data split & data augmentation



Some key numbers

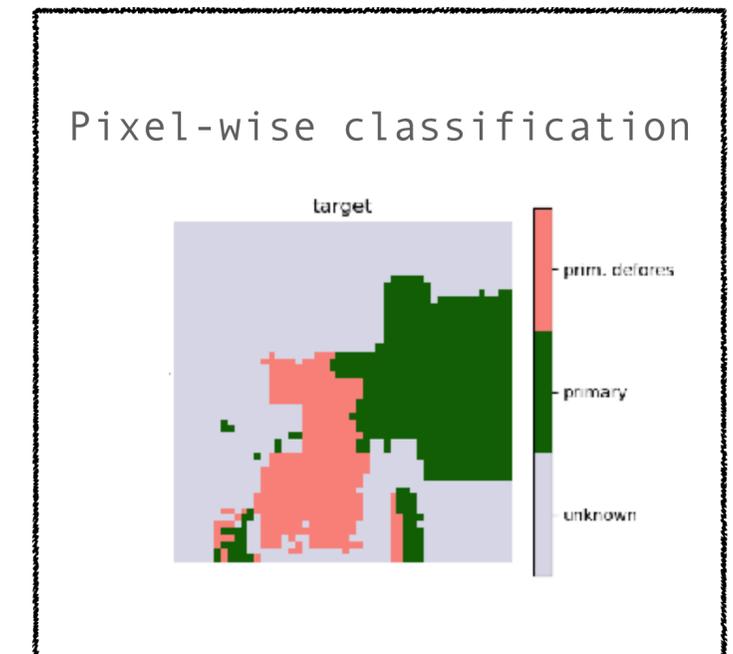
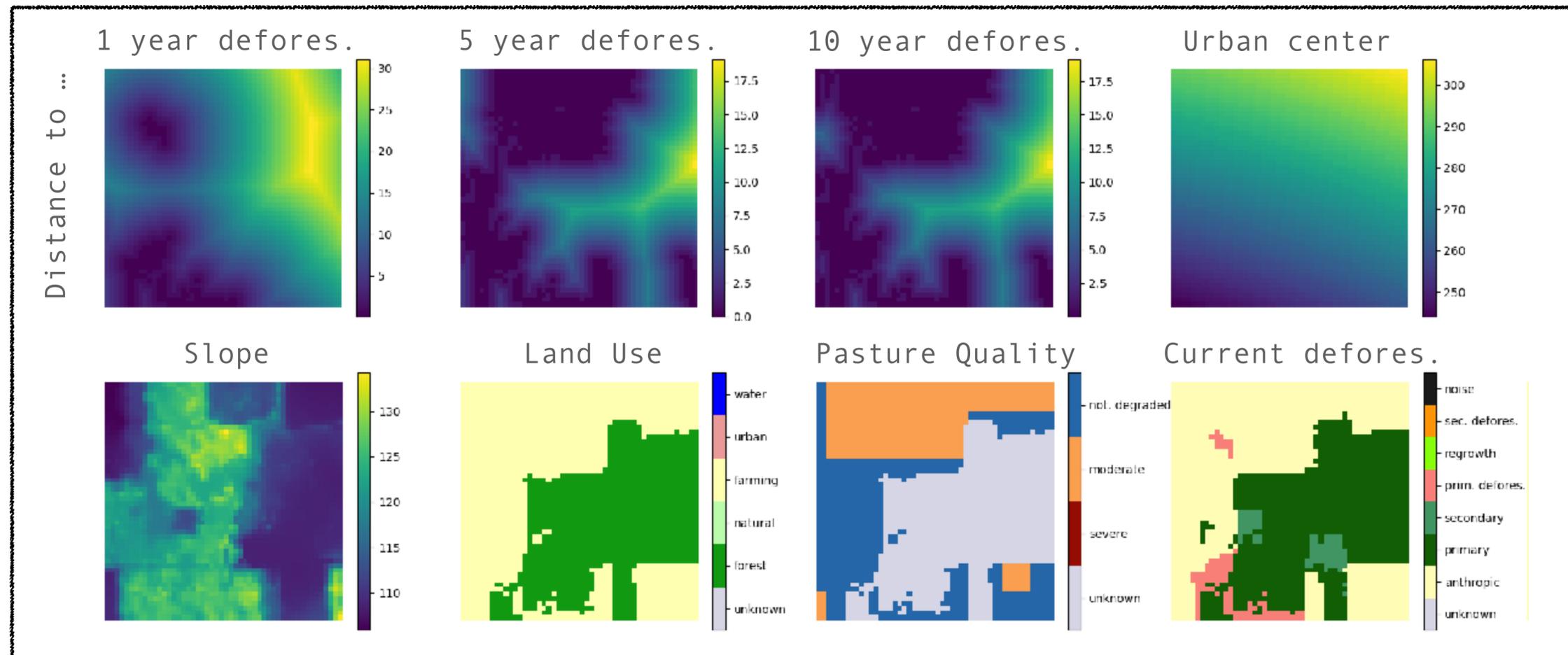
Px resolution	Model input	Train segments	Val seg.
30 m	50 px	~160T	~40T

Data preprocessing

The models input includes the major covariates for deforestation

Input

Target

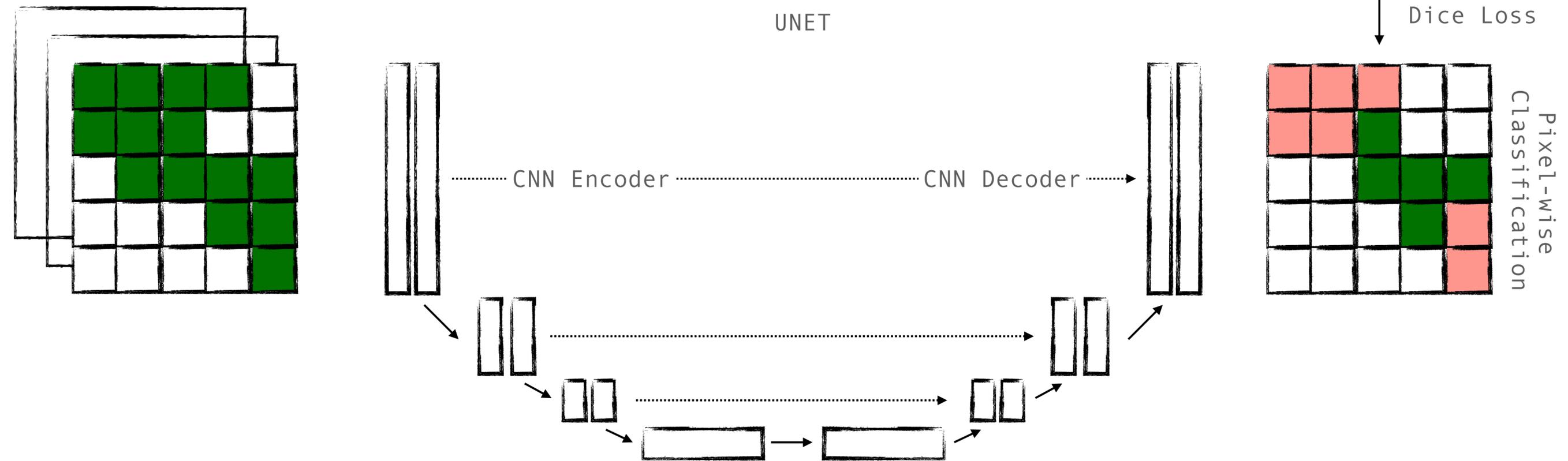


Methodology and Experiments

Pixel-wise classifications achieves poor predictive performance

Input up to 2018

Target 2019



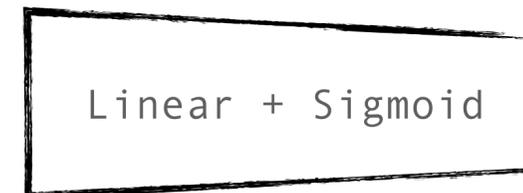
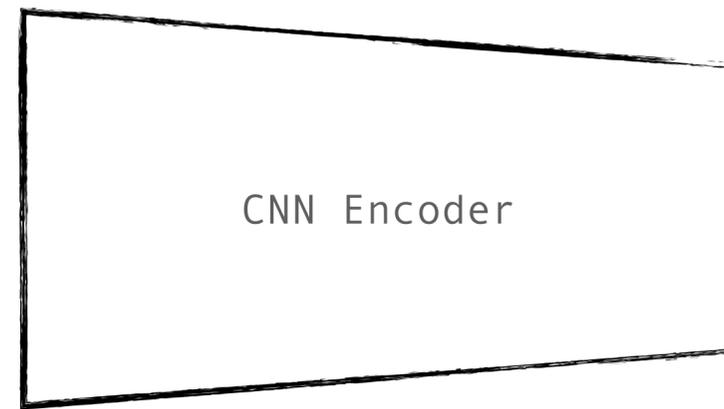
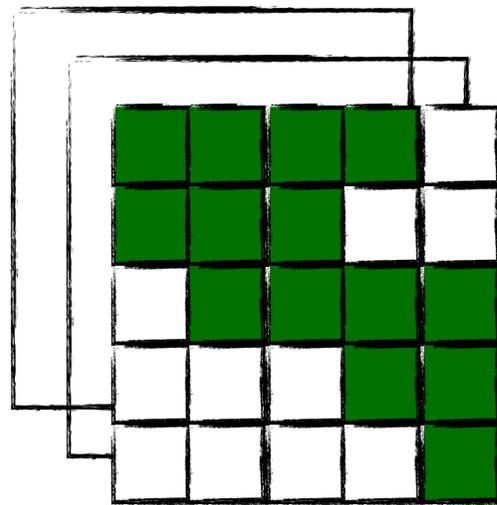
Pixel-wise classification: Predict for each forest pixel in the tile if it will be deforested

	<p>UNET <i>(ours)</i></p>	<p>Test F1: 0.263</p>		<p>2D CNN <i>(Ball 2022)</i></p>	<p>Test F1: 0.197</p>
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Methodology and Experiments

Tile-wise binary classification is a feasible task to be solved

Input up to 2018



Target 2019



BCE Loss



Tile-wise Classification

Tile-wise classification: Predict for each tile if there will be any amount of deforestation

	<p>Test F1: 0.608</p>		<p>Test F1: 0.560</p>		<p>Test F1: 0.567</p>
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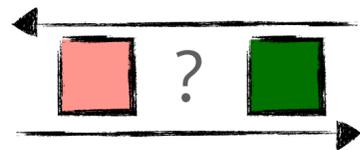
Project Overview

Can Deep Learning help to forecast deforestation in the Amazonian Rainforest?

Motivation

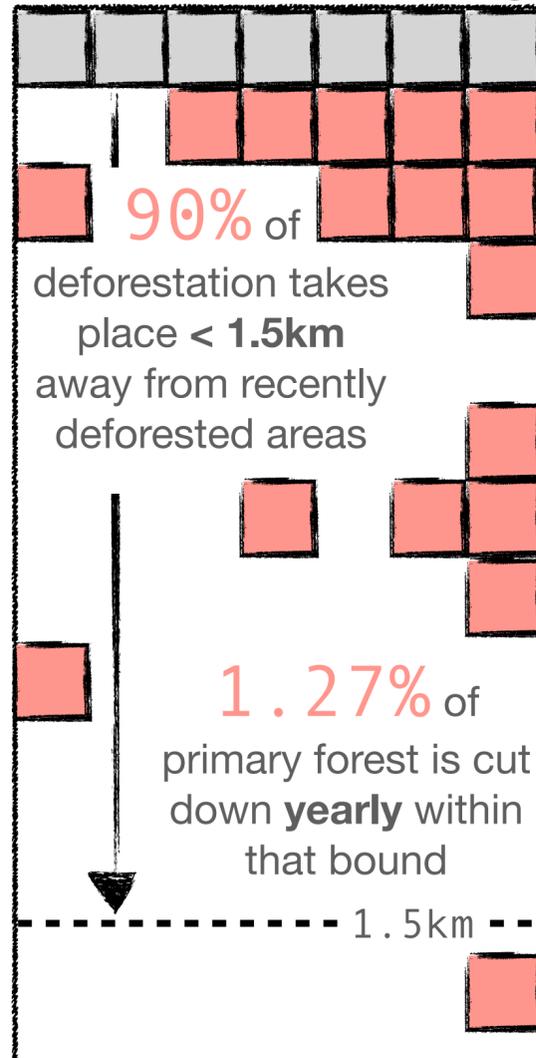
From 2000 - 2020
21.3M ha
of primary forest was lost
in the Brazilian Amazon

Conservation projects
aim to mitigate
deforestation. Their
impact is questioned
retrospectively

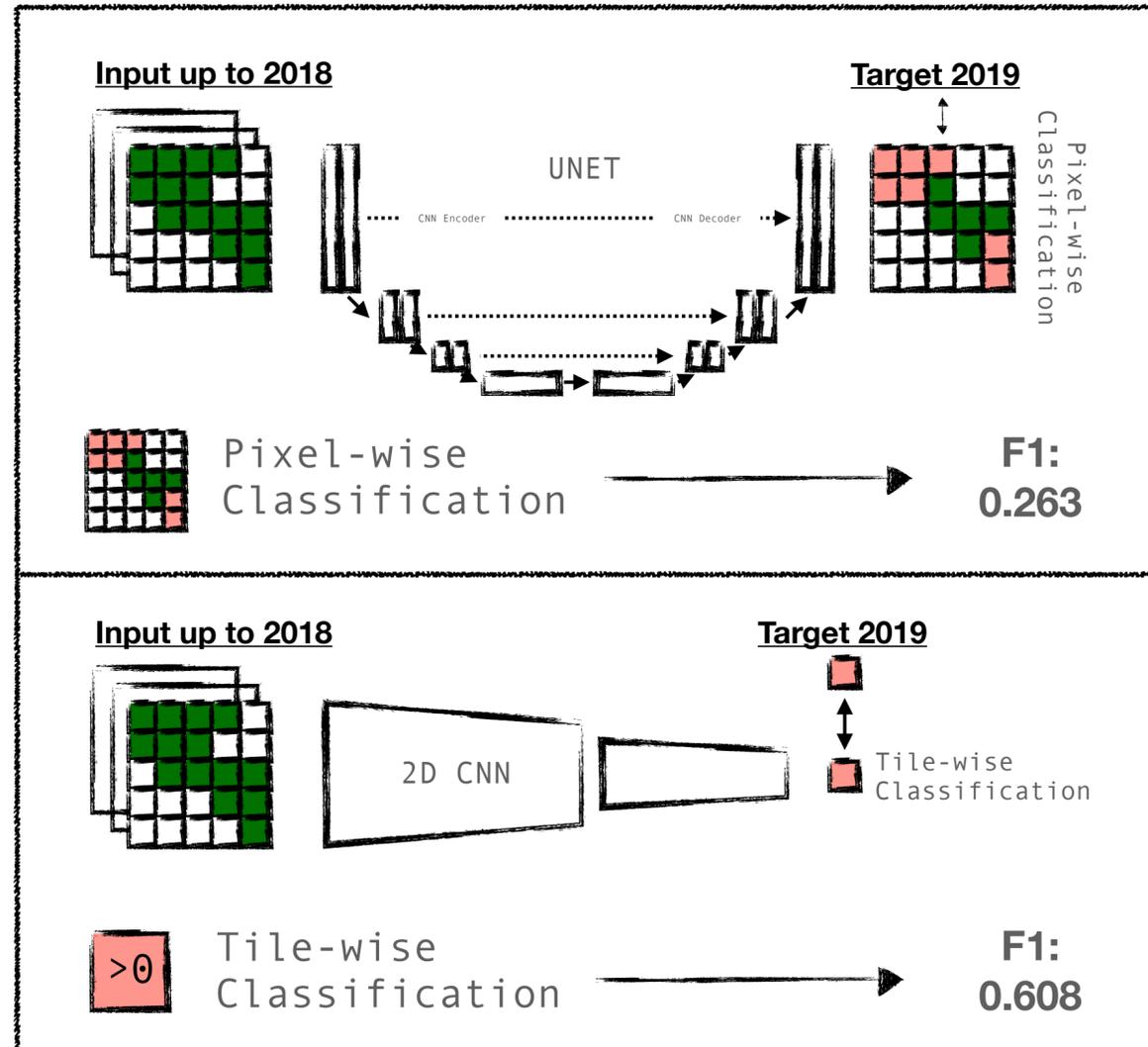


There is a lack of
methods to forecast
deforestation **in
advance**

Data Preprocessing

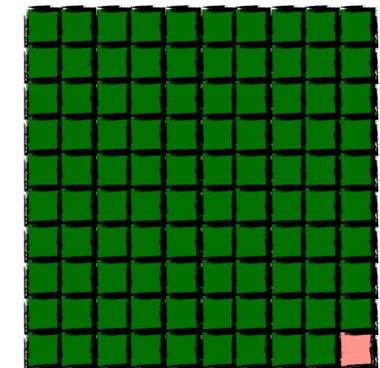


Methods & Results



Conclusion

Forecasting the **location**
of deforestation **1-year**
ahead is a difficult task. It
is subject to **noise and
class imbalance**.



We **question** whether
carbon credits from
forest conservation
projects should be
issued in advance.