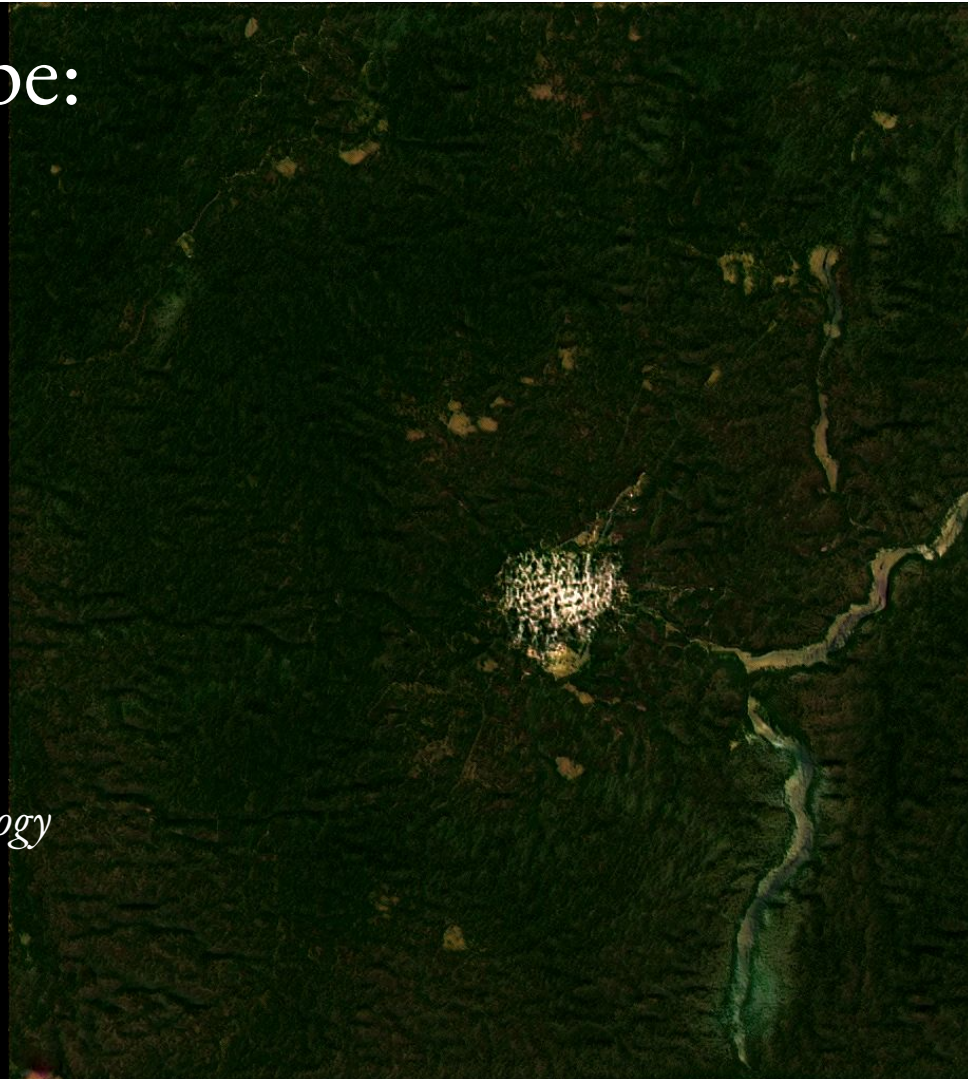
Formatting the Landscape: Spatial conditional GAN for varying population in satellite imagery



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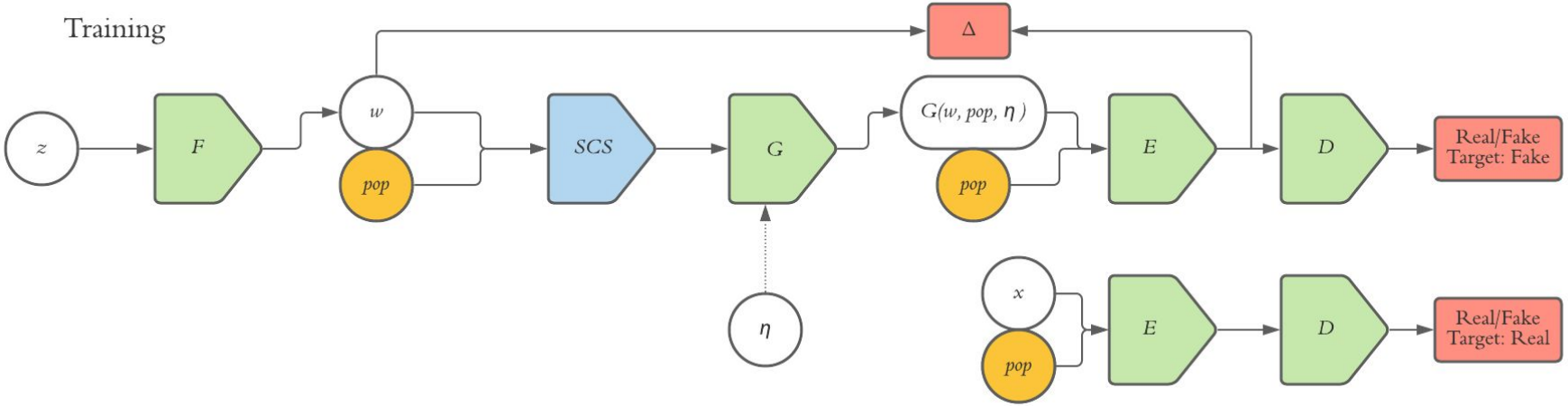
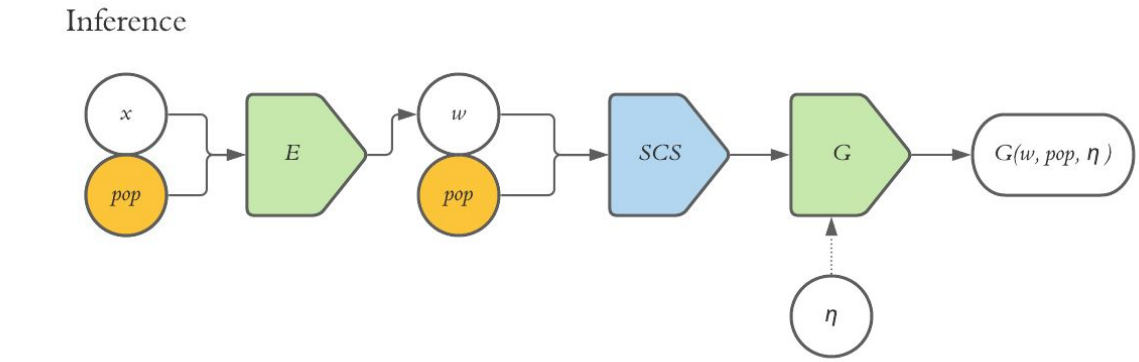
Tackling Climate Change with Machine Learning workshop
@ NeurIPS 2020

Climate induced migration will reshuffle the population landscape

How can ML methods aid in the planning pipeline?

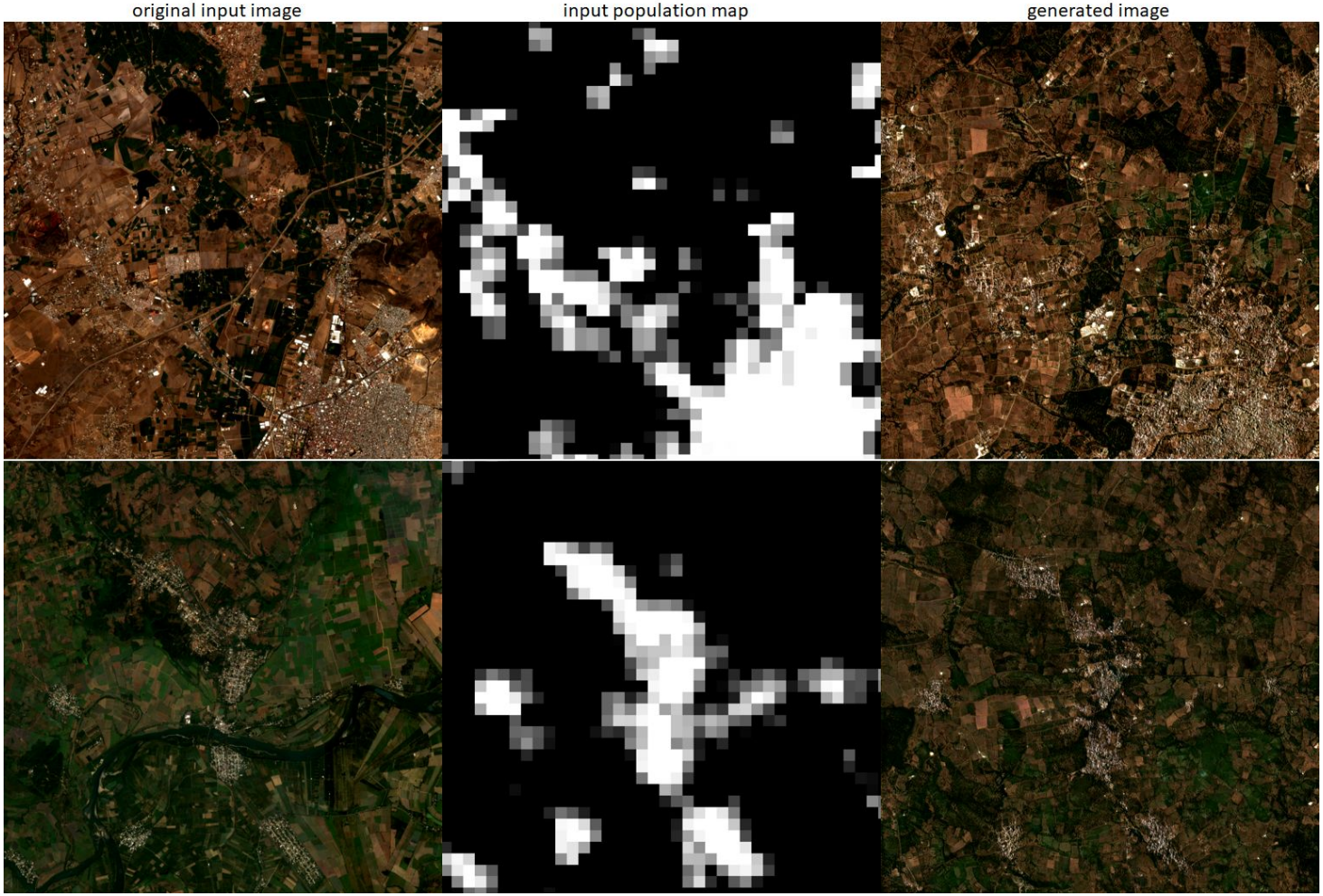
Rigaud, K. K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., ... Midgley, A. (2018). *Groundswell: Preparing for internal climate migration*. https://www.connect4climate.org/infographics/groundswell-preparing-internal-climate-migration





We create SCALAE: Extending the ALAE method by adding a ***Spatial Conditional Style* (SCS) module,** similar to SPADE (GauGAN)

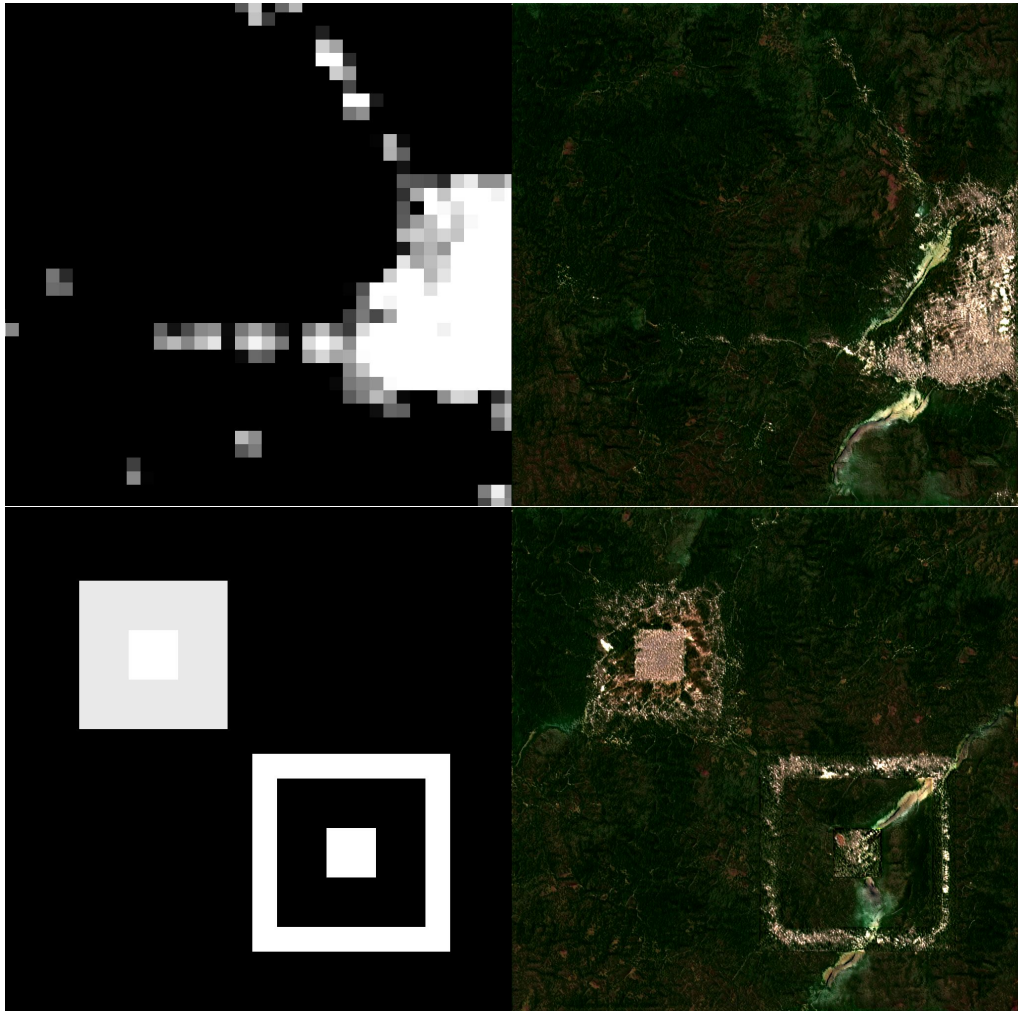
ALAE:Stanislav Pidhorskyi, Donald A. Adjeroh, and Gianfranco Doretto. “Adversarial Latent Autoencoders”. In: C (2020), pp. 14092–14101.DOI:10.1109/cvpr42600.2020.01411. arXiv:2004.04467.
SPADE: Taesung Park et al. “Semantic image synthesis with spatially-adaptive normalization”. In:Proceedings of the IEEE Computer Society Conference on Computer Vision and PatternRecognition2019-June (2019), pp. 2332–2341.ISSN: 10636919.DOI:10.1109/CVPR.2019.00244. arXiv:1903.07291.



The method allows for a reconstruction of real imagery, by encoding the real image into the latent space

We can vary the population input to generate corresponding satellite images.

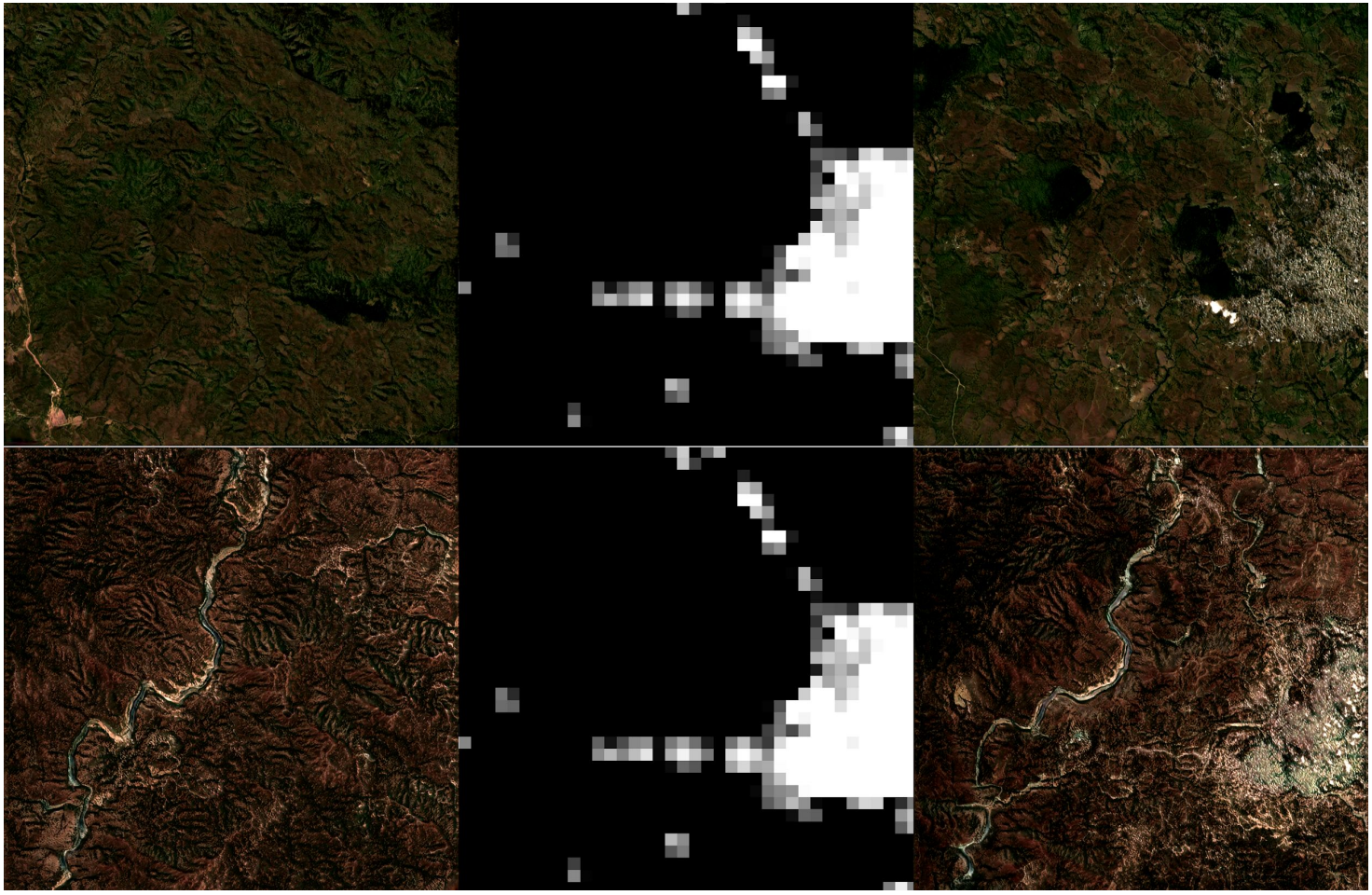
Our model is able to reproduce both realistic and artificial population maps.



generated image with zero pop

additional pop

generated image with added pop

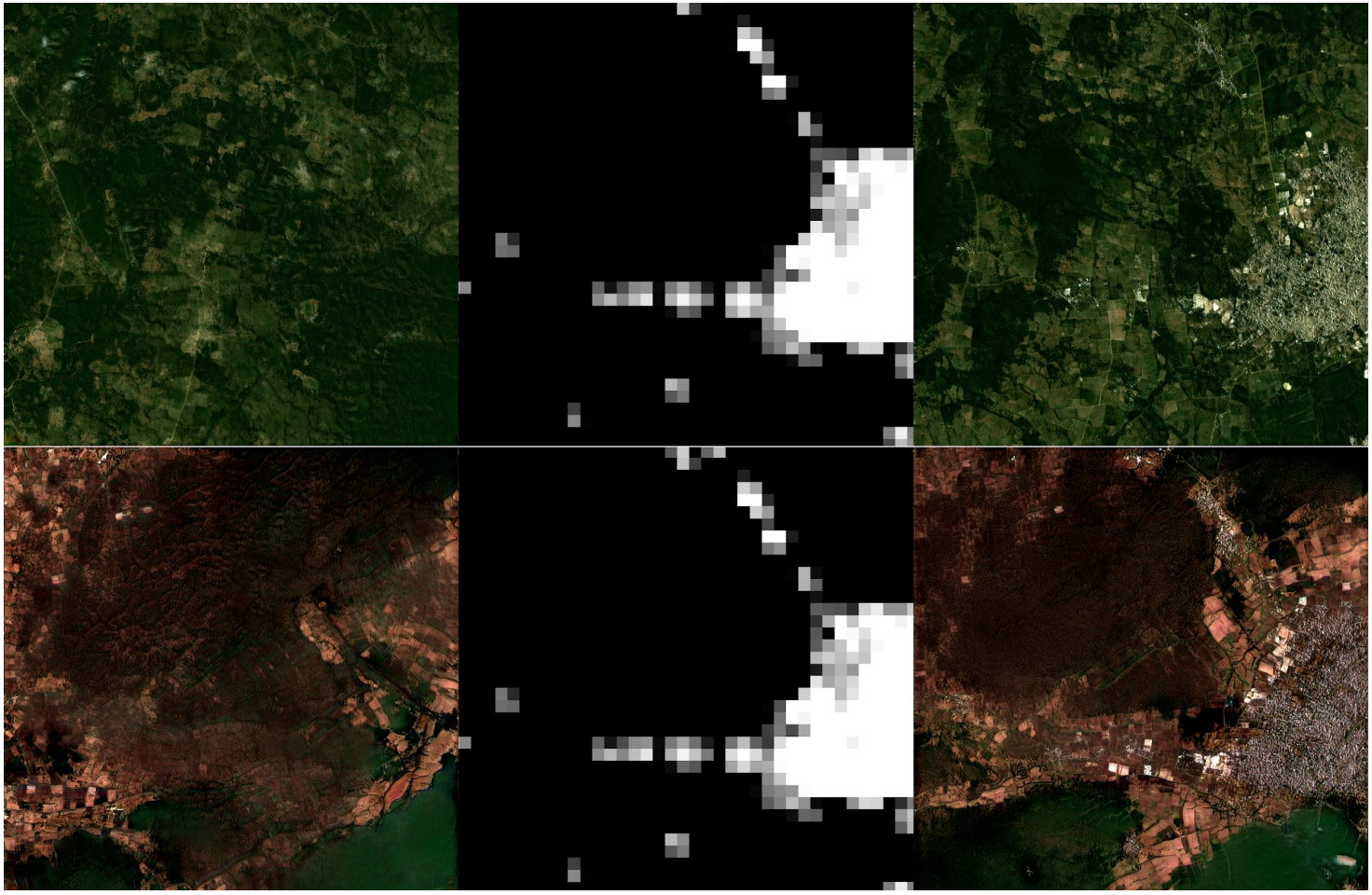


The same population map can be projected onto many different landscapes

generated image with zero pop

additional pop

generated image with added pop



The same population map can be projected onto many different landscapes

Key takeaways

- Model can successfully reconstruct satellite imagery
- Population can be manually controlled in the generated images

SCALAE can create realistic imagery from population change forecasts, directly feeding into land use and cover analyses down the pipeline, allowing users to generate imagery **flexibly, concretely, and with a means to characterize uncertainty**

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Our code: https://github.com/LendelTheGreat/SCALAE

Interactive demo: https://tinyurl.com/y2xa92t4