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Three dimensions in a tropical forest. The colonial plantation La Caroline in French Guiana

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Successful fieldwork in a tropical forest requires both a comprehensive preparatory scenario as well as a framework of everyday methods. Dense vegetation impedes navigating the terrain and interpreting the relations between the anthropogenic and natural landscapes. Additionally, the forest hampers using accurate measurement systems, such as GNSS and Total Station systems or UAV platforms. It hinders the logistics, effectively limiting the amount of equipment that can be used.

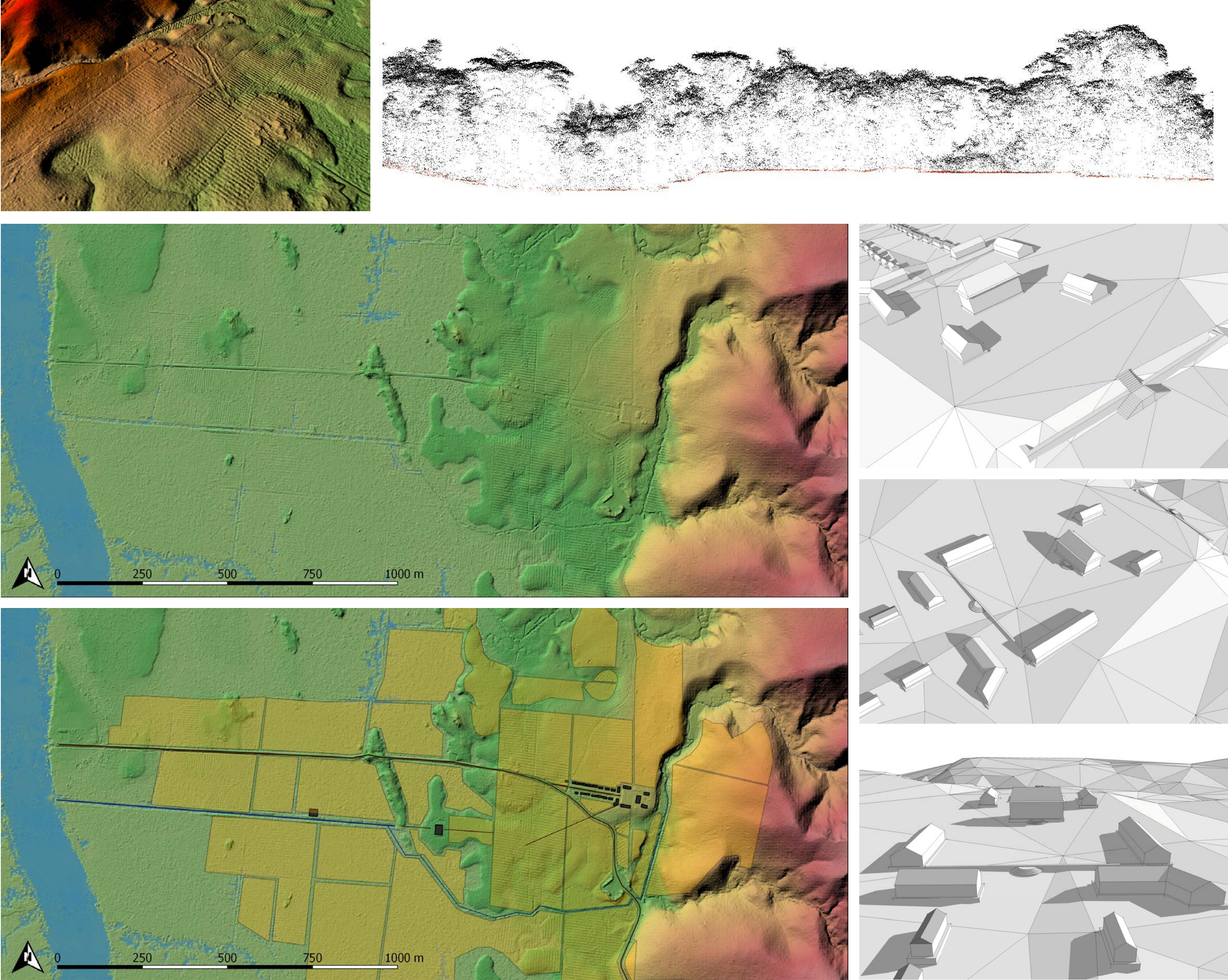
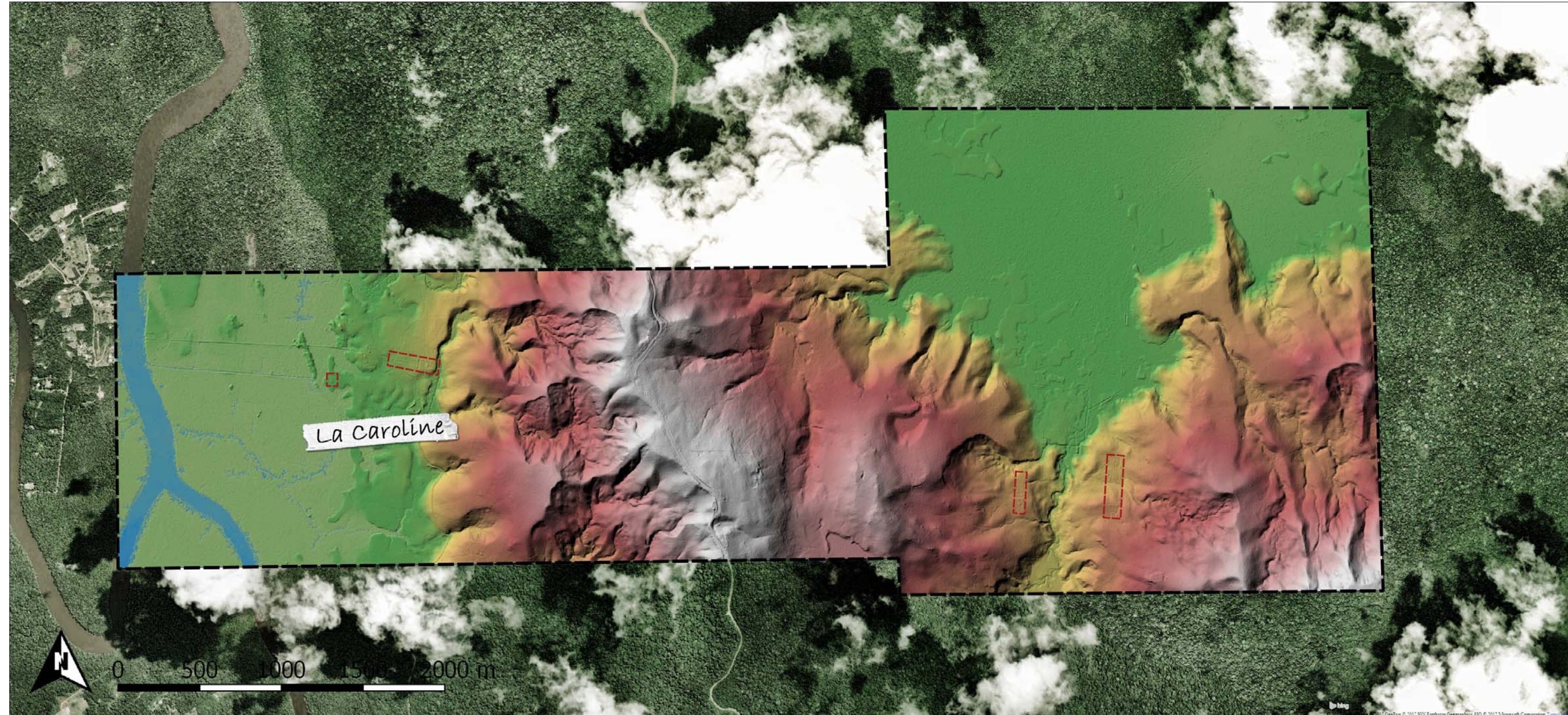
L'habitation La Caroline

Parts of the colonial plantation *La Caroline* were excavated in 2016. Located 30 km from Cayenne near the river Mahury, it was active since the end of the 18th century until the 1870's. Cloves and *rokou* were its main crops. It had a regular, somewhat iterative layout. The remains of some buildings, e.g. the *maisons de maître*, a free-standing kitchen and slave or labourer quarters are still discernible. A monumental stairway leading down to a now defunct canal and road system is also preserved. Today, the whole area is covered with a tropical forest and the building remains are hidden in thick undergrowth.



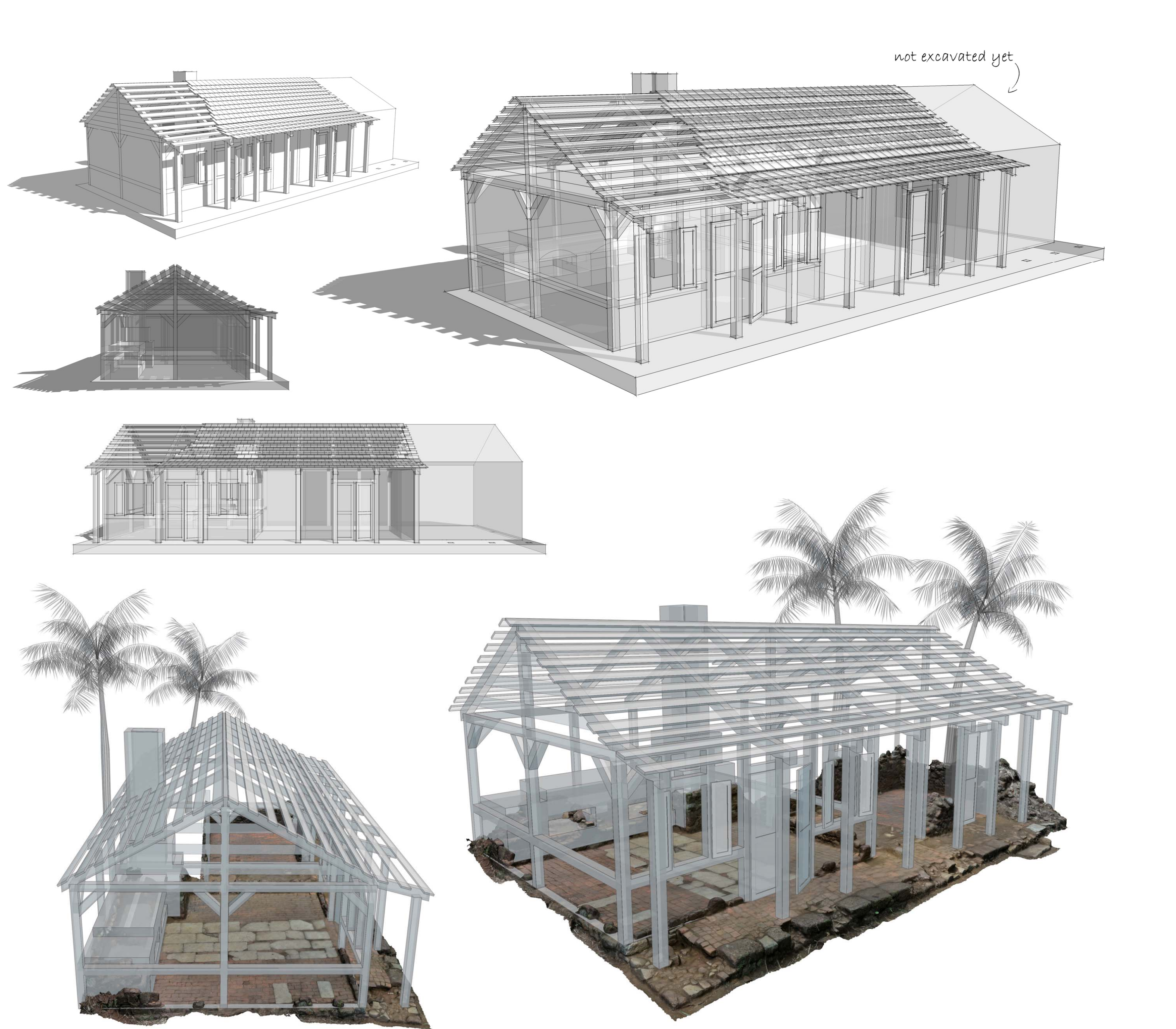
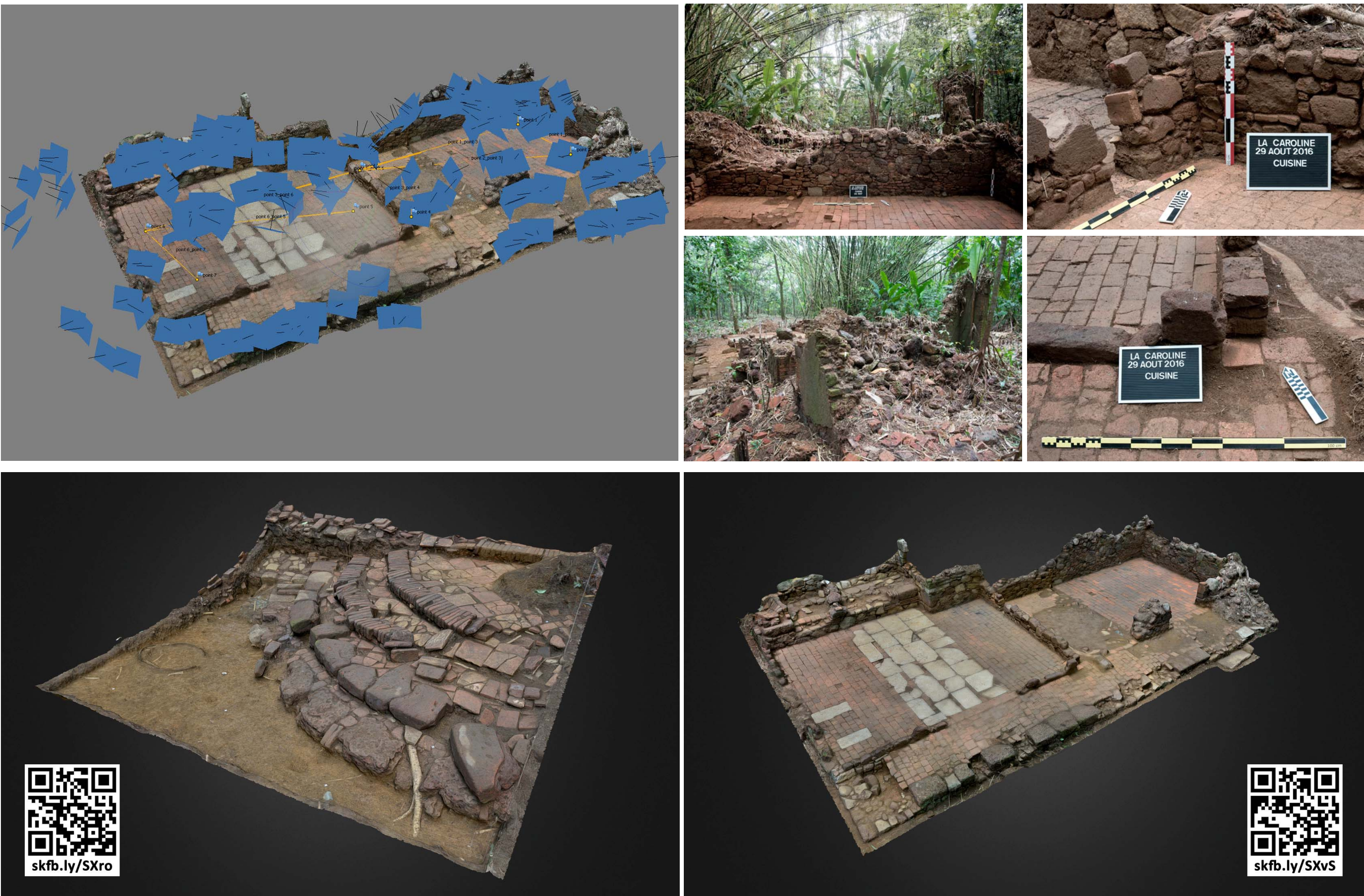
Large scale overview

Airborne Laser Scanning was conducted during the preparatory stage. This allowed to create accurate land relief and use models. The measurements were made using a RIEGL LMS-Q560. Point clouds of high density were obtained, but the thick vegetation caused the area to be irregularly covered many measurements classified as the terrain. This necessitated conducting a series of experiments aiming to find the optimal classification parameters. Eventually, an area of 17,5 km² measured. It encompassed several adjacent plantations and revealed the spatial layout of buildings, elevated fields, roads and other infrastructure.



Feature recording

Photogrammetry was utilised during the fieldwork and supplemented the traditional recording. This allowed to save time spent on documentation and provided high resolution data. Structure from motion techniques were especially useful in recording highly detailed and complex contexts such as the architectural remains. DEMs, orthophotographs and 3D models were the final result of field image-based modelling. Combined with comparative studies of similar structures, they allowed us to model, reconstruct and visualise the buildings in 2D and 3D.



Summary

Although the array of measurement methods that could have been reliably used in the dense rainforest vegetation was quite limited, they have nonetheless proven to be highly effective and yielded satisfying and valuable results.

ALS was used both for prospection and recording. It provided unique data sets imaging the otherwise inaccessible terrain. Feature photogrammetry allowed to record the features found during excavations quickly and in a high resolution, with minimal time and equipment requirements. The data became a base for models, which allowed us to notice new details during post-excavation analyses of architecture. The spatial data helped to image structures on many different scales: from the landscape, through relations of buildings, down to excavation features. Importantly enough, all data was unified in a common mapping system, easily usable in CAD or GIS environments.

Finally, the digital data provide a base for multiple scale 3D visualisations, successively uploaded online as interactive models. As such, they promulgate not only our results and the methods we used, but historical archaeology in French Guiana as well.

