

Title: Understanding Past Ecology to Protect Future Forests

Focus and aim of the project (max. 250 words):

Tropical forests are threatened by climate change, fire, and deforestation¹⁻³. The direct impacts of modern fire and deforestation are well studied⁴⁻⁷, but less is known about long-term forest recovery⁸⁻¹⁰. *Ecological legacies* refer to the impact of past disturbances on ecosystems and their persistence over a given time¹¹. Because succession in tropical systems can take 100-500 years^{12,13}, ecological legacies from past human activities may have shaped patterns of modern biodiversity and carbon storage in Amazonia through species enrichment, fire, and cultivation practices¹⁴⁻¹⁷. However, the extent and persistence of ecological legacies in Amazonia remain debated¹⁸, and is probably related to the type and timing of past disturbances¹⁹.

We aim to test these ideas in an understudied region of Amazonia (Brownsberg Nature Park, Suriname, BNP), where disturbances date back to the pre-contact and post-colonial period²⁰⁻²³ and include metabasalt mining²¹ and rubber extraction²⁰(Fig. 1). We will investigate whether the type and timing of past disturbances determine the trajectory of ecological legacies using phytoliths and charcoal retrieved from soil cores. Multivariate and magnitude-of-change analyses will be used to assess the degree to which past fire and human disturbances have changed vegetation trajectories through time¹⁰.

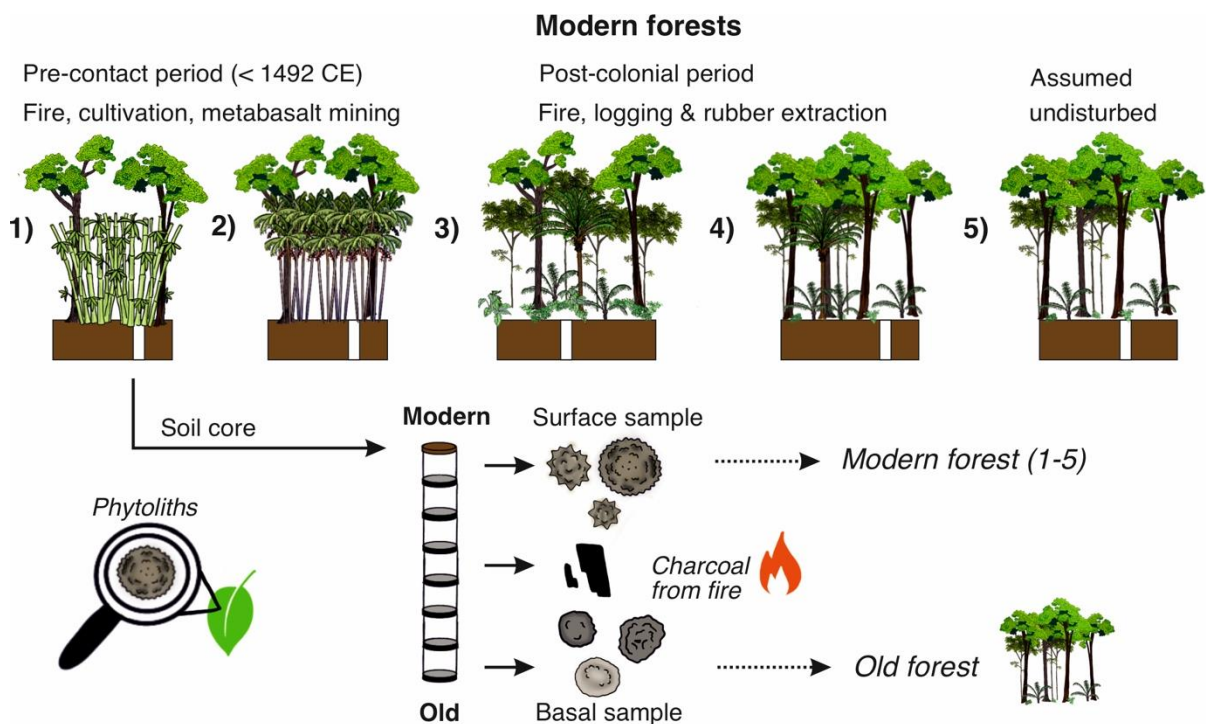


Fig. 1 Methodological overview: soil cores from five forest plots with different types and timing of past disturbances (1-5) will be analyzed for phytoliths and charcoal to reconstruct the vegetation and fire history (N = 45). Surface and basal samples from soil cores reflect modern and old forests, respectively.

Relevance given the PE&RC mission (Understanding the functioning of natural and managed ecosystems to improve the quality of life) (max. 150 words):

This research will be the first to document the human history of BNP and determine whether ecological legacies have resulted from past anthropogenic activities. By unravelling past forest management, our results will help to better inform current management and conservation attempts^{24,25}, which is crucial given the alarmingly high deforestation rates in BNP. These results will also expand our knowledge of the cultural heritage of Indigenous Surinamese people. Local communities are key for protecting tropical forests, and this research connects people and forests through their joint history.

On a broader scale, Amazonia is the most biodiverse region on earth and plays a crucial role in global carbon uptake and water cycling. Studying ecological legacies will help us understand the resilience of Amazonia's modern ecosystems and give insight into long-term forest recovery. Specifically, understanding how successional trajectories affect the carbon dynamics observed in modern ecological studies will be a great scientific contribution.

The manner in which the proposed project will strengthen the institutional collaboration, identifying the specific role of the proposed candidate(s) (postdoc/PhD), including the expected output of the project (max. 150 words):

Previous and ongoing collaborations between the research groups at UvA and WUR have been fruitful²⁶⁻²⁹, and this research will further strengthen ties between the two institutes. The integration of the long-standing history of ecology and forest management in tropical regions (WUR), and tropical paleoecology (UvA) is crucial for understanding how ecological legacies affect modern forests, and applying these data and concepts in conservation and forest management strategies.

The proposed post-doc will analyze the samples collected in BNP for charcoal and phytoliths to reconstruct the fire history and ecological legacies of the area. She will then compare these palaeoecological data with modern forest data (two plots), UAV imagery (2 plots) and satellite imagery. We will publish the results in international peer-reviewed journals, disseminate results to IUCN and policy makers, and the proposed post-doc will use this pilot study to generate a larger proposal on this subject.

Groups involved and time to be spent on the project by the Postdoc / PhD candidate(s):

Prof. Dr. Peña Claros is an expert on tropical forest management and forest recovery, and member of the Forest Ecology and Forest Management group at WUR. Dr. McMichael is an expert in palaeoecology and tropical ecology, and a member of the Department of Ecosystem and Landscape Dynamics in the Institute for Biodiversity and Ecosystem Dynamics at UvA. The proposed postdoc will spend the first six weeks doing phytolith and charcoal analyses, and the last 6 weeks on data analysis, data interpretation and writing of the manuscript. The project will be led by the postdoc in close collaboration with prof. dr. Peña Claros and dr. McMichael.

Appointment details: name of person(s) employed, employment period, chair group, the budget requested:

Name: Nina Hylkje Witteveen

Employment period: 3 months

WUR: Forest Ecology and Forest Management (FEM) – Prof. dr. Peña Claros
UvA: Ecosystem and Landscape Dynamics (ELD) – Associate Professor dr. Crystal N.H. McMichael

Budget requested:

Postdoc salary for 3 months: 11922,00 euro

Overhead 35% for 3 months: 3,576.60 euro

Total: 15,498.60 euro

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