Supported by

Led by

In partnership with

Restoring Abandoned ASGM Sites: A Solution to Environmental Degradation

Results of a Mission to Understand the Context of Abandoned ASGM Sites

Artisanal and Small-Scale Gold Mining in Suriname

Artisanal and Small-scale Gold Mining (ASGM) is an important source of income in the hinterland of Suriname. This area is located in the Guiana Shield, an area covered with tropical rainforests which is enriched with gold deposits. Unfortunately, the gold mining comes at a price; 90% of deforestation in the Guiana Shield can be attributed to ASGM activities, as depicted in Figure 1. The consequences of ASGM reach far beyond deforestation, causing social imbalance and impacting human health due to the use of mercury in the mining operations. Birth defects, neurological disorders, and the destruction of delicate ecosystems through land degradation and deforestation are just a few of the many tragic outcomes. Recognizing the urgency of this crisis, the TAUW Foundation has funded an innovative project aimed at restoring abandoned ASGM sites and addressing the negative effects in collaboration with the EMSAGS project: “Soil Function Restoration at Abandoned Artisanal and Small-Scale Gold Mining Sites”. The EMSAGS (Improving Environmental Management in the Mining sector of Suriname with Emphasis on Artisanal and Small-Scale Gold Mining) project has been operating since 2018, focusing on promoting environmentally friendly ASGM practices to reduce the negative impacts on people and the environment, with primary funding from the GEF.

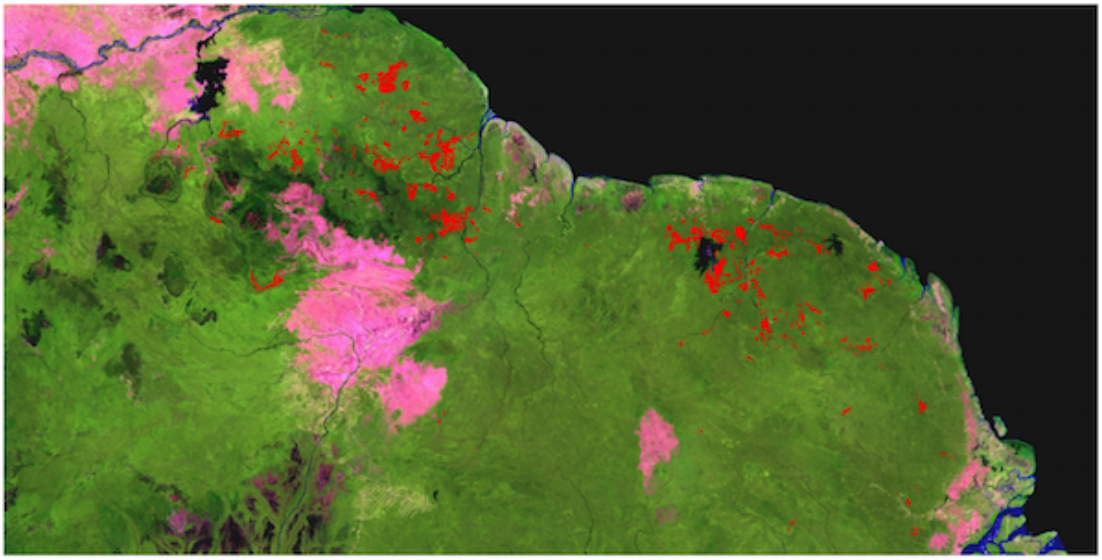

Figure 1 Deforestation in the Guiana Shield due to ASGM activities. Impacted areas are visualized in red

The removal of vegetation, topsoil and subsoil during the ASGM activities transform the once biodiverse tropical rainforest into barren wastelands, devoid of any natural regeneration. Scientific research has revealed that the absence of topsoil functions at abandoned ASGM sites is the most restricting factor for restoring them. Therefore, the project focusses on developing measures to enhance restoration of the topsoil functions. As an added benefit, these techniques reduce the migration and bioavailability of mercury contamination, a problem widely associated with ASGM. Reducing the migration and bioavailability of mercury effectively immobilizes diffuse mercury contamination. This limits the uptake of mercury by organisms, including humans, and curbs the migration of mercury into oxygen-deprived conditions, preventing the formation of methyl mercury, a very toxic form of mercury.

The Project

The project aims to empower local communities and governments in the restoration of abandoned gold mining sites. The focus lies on developing a comprehensive soil restoration guide that can be utilized by communities and government in Suriname and beyond. As a basis for this protocol, a pilot for soil restoration is being executed at a mined area near the village Compagniekreek in the Brokopondo district (Figure 2). The consortium for this project consists of TAUW bv, the EMSAGS project, Wageningen University and Research and Boudewijn Fokke Soil Consultancy.

Successful implementation of a nature- and soil restoration relies on a wide variety of components. The restoration project and protocol take into account various factors, including the physiochemical and aspects of the soil at the site, which serve as a baseline for selecting appropriate restoration measures. However, the success of the project hinges not only on the technical aspects, but also on the active involvement of the community and stakeholders, as well as capacity building.

From March 30th till April 15th 2024, our international project team travelled to Suriname for a fieldwork mission to the pilot site, several stakeholder information and discussion sessions, and the execution of capacity building activities. These activities were organized and executed in close collaboration with the local project team of the EMSAGS project.

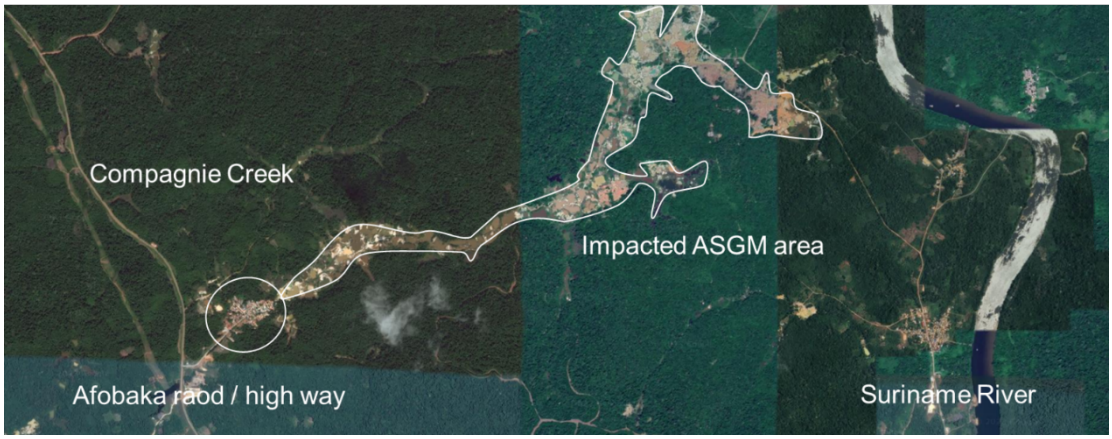

Figure 2 The pilot site near Compagniekreek that has been selected for the execution of the project

Involvement of the Local Community

The project actively engaged with the local community of Compagniekreek, facilitated by the EMSAGS project, involving them in the project. Through open dialogue and exchanging experiences, the community leaders also shared their insights on the restoration efforts of ASGM sites that had already been implemented within the community.

The EMSAGS project has placed significant emphasis on stakeholder consultation as part of its commitment to Free, Prior, and Informed Consent (FPIC), particularly involving local communities. According to the project guidelines, local communities are informed in their language and in accordance with their cultural practices. Over the years of project implementation, the EMSAGS project has gained extensive experience in the project area at Compagniekreek. The team is present in the area on a weekly basis and has built strong relationships with the communities, which greatly benefits the soil restoration project.

Community leaders highlighted several main problems associated with ASGM activities. One of the major concerns was the that the water from the creek can no longer be used as a source of drinking water due to contamination. Additionally, the deserted mines have left the soil infertile, making agriculture impossible in the area. The expansion of the village is also hindered as the mining pits created unsafe conditions and poor drainage rand frequent flooding incidents.

Capacity Building and Stakeholder Involvement

In addition to the local community of Compagniekreek, various other stakeholders in Suriname are actively involved in ensuring the sustainability of ASGM in Suriname. In the context of knowledge sharing between the Netherlands and Suriname, to build capacity, and to foster collaboration, a series of activities have been organized during the mission as part of the project. The first of these was an inception meeting, where stakeholders were provided with an overview of the project and given the opportunity to contribute their valuable insights and perspectives. Additionally, a comprehensive training program was conducted, focusing on both theoretical and practical aspects of site investigation and restoration of ASGM sites (Figure 3). This training aimed to equip local parties with the necessary skills and knowledge to effectively carry out these critical tasks.

Figure 3 A part of the group that participated in the theoretical and practical fieldwork training

Methodology of the Site Investigation

Utilizing advanced drone technology, an aerial digital elevation model was created, capturing detailed orthophoto maps of the site (see Figure 4). The Geological Mining Department of Suriname (GMD) facilitated the drone flight, while Geozicht developed the flight plan.

During the fieldwork phase, samples of soil, sediment, and surface water were collected for analysis. The sampling locations, encompassing various areas of the site such as tailings with and without vegetation, backfilled pits, and natural soils, were strategically chosen and integrated into the sampling and analysis plan as presented in Figure 4.

To investigate the site further and gather soil samples, manual boreholes were drilled to depths of up to 140 cm below ground level. The samples were described and digitally recorded, capturing vital information such as soil particle size, color, bulk density, soil compaction, soil pH, and heavy metal and nutrient content. A Handheld XRF device was employed for the analysis of heavy metals and nutrient content (Figure 5). Additionally, to validate the XRF results for heavy metal concentrations, selected soil and sediment samples were sent to the Eurofins Analytico laboratory in Barneveld, the Netherlands, for further analysis. Three surface water samples were also collected and analyzed in the field for pH and EC levels, while the laboratory analysis included heavy metal testing. The concentrations of these metals determine the need for potential measures to mitigate risks to both human health and the environment.

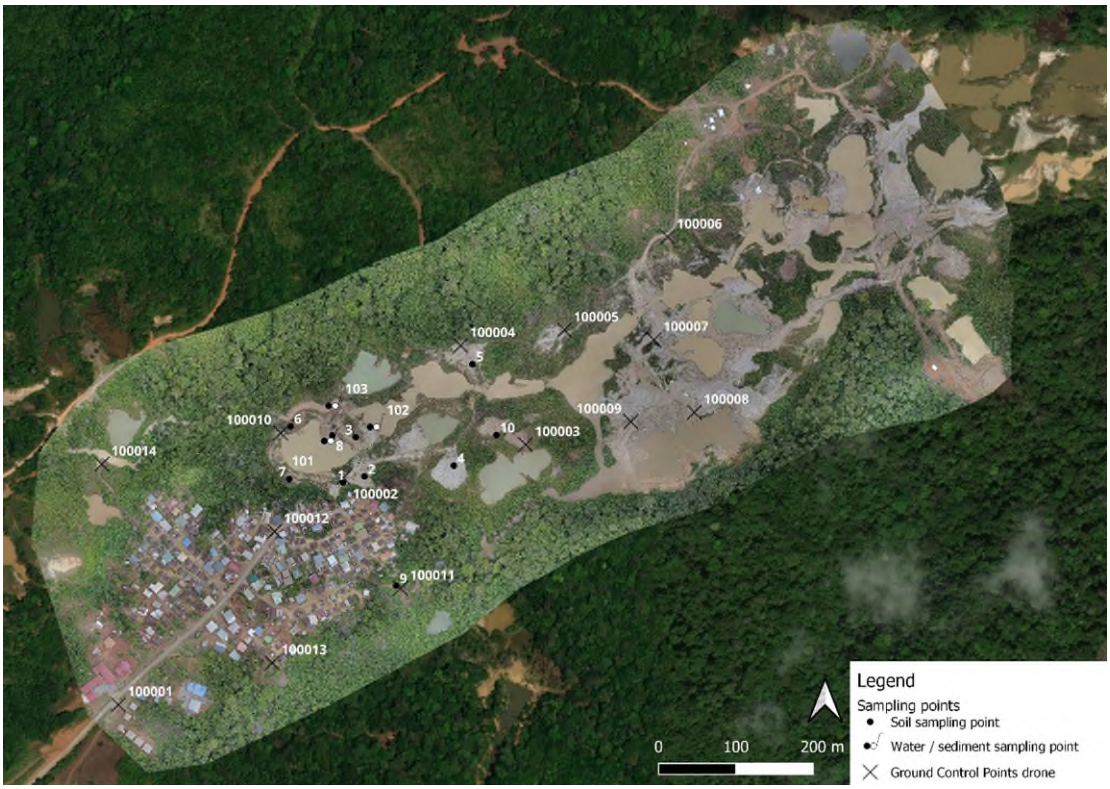

Figure 4 Orthophoto of the pilot site and its surroundings, including the sampling points for the site investigation

Results of the Site Investigation

At the pilot site multiple mining pits and overburden piles and tailings, locally known as 'bakka santi' in Sranantongo (Lingua franca), were present. These bakka santi consisted mostly of coarse materials from the subsoil, yet also bakka santi of fine clayey particles, originally topsoil, were present.

While the coarse bakka santi were bare, those composed of finer materials exhibited pioneering plant growth. Likewise, the bakka santi that showed pioneer vegetation appear to have higher organic matter content than the bare bakka santi based on their Munsel colour chart matching. Some mining pits at the site had already been backfilled, although no vegetation had taken root in these areas. Again, these pits were backfilled with coarse materials with a low organic matter content. To safeguard the village from potential flooding, the creek that runs nearby has been redirected to the south side of the mine tailings.

Extensive testing confirmed that all soil and sediment samples were deemed safe for use at the pilot site. Although slight elevations of mercury concentrations were detected in the sediment samples, these levels remained within permissible limits according to Dutch soil legislation. This means that the soil can be utilized for various purposes, including residential and agricultural areas. Notably, mercury concentrations in the water samples were found to be below the detection limit, ensuring the water's purity. However, laboratory results did reveal elevated values of copper and zinc concentrations in two samples taken from the pits, exceeding the allowable limits.

Figure 5 XRF measurements to determine the heavy metal and nutrient concentrations in the soil

Next Steps

Addressing the environmental challenges faced by the local community of Compagniekreek and its surrounding areas, and at abandoned ASGM sites in general, requires a comprehensive and collaborative approach. The successful restoration of the abandoned ASGM site hinges on the collective efforts of the project team, the local community, and other stakeholders. A crucial aspect of this effort is the long-term monitoring and maintenance of the site.

While mercury contamination is not a concern at the site, surface water in the area does show signs of contamination with copper and zinc. Moreover, the presence of several mining pits that still need to be backfilled or partially filled in adds to the complexity of the restoration process. Even the backfilled pits struggle to support new vegetation due to the lack of soil fertility. These pressing issues will be addressed in the next phase of the project, which involves the development of a comprehensive restoration plan.

The proposed approach entails identifying a limited number of land-use types and assessing the necessary soil and physiographic conditions for each type through soil restoration pilot plots. The community's input and preferences will play a crucial role in designating the desired land-use type for the pilot plots. The restoration activities will include measures to enhance soil fertility through the addition of organic matter, clay, and silt, and implementing erosion control measures.

A preliminary design will be made for a more large-scale restoration of the pilot area (see Figure 6 for an impression photo of the larger site).

If additional funding becomes available, additional restoration activities can be implemented based on this preliminary design. The restoration activities will vary depending on the specific site and may include profiling the surface to achieve the desired elevation and safe slopes, and improving drainage and water management in the area.

Figure 6 Impression photo of the pilot site at Compagniekreek

The success of the restoration efforts within the scope of this project will depend on the availability of resources and the associated costs. Additional funding is currently being explored. However, the pilot project will leverage the existing measures implemented by the community to restore ASGM mines. The traditional authority of Compagniekreek and the community members have made an oral commitment to cease any further mining activities in the area earmarked for restoration.

Acknowledgements

This project has been made possible through the generous support of the TAUW Foundation, whose primary funding has laid the groundwork for its success. The project partners, including TAUW bv, EMSAGS, Wageningen University and Research, and Boudewijn Fokke Soil Consultancy, have all played a vital role by providing not only financial and in-kind contributions, but also by sharing their extensive knowledge and expertise.

It is important to recognize that the realization of this project would not have been possible without the invaluable inputs from the stakeholders and the local community of Compagniekreek. Their active involvement and collaboration have been instrumental in shaping the project's direction and ensuring its relevance to the needs of the community.

Together, these collective efforts and contributions have paved the way for a comprehensive and impactful project that aims to address the environmental challenges associated with ASGM. The commitment and collaboration of all those involved highlight the power of collective action in tackling complex issues and creating positive change for local communities and the environment.