Site Rehabilitation of Abandoned Artisanal and Small-scale Gold mining sites at Compagniekreek

NATIONAL VALIDATION WORKHOP

Prepared for EMSAGS
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List of Abbreviation

ASGM	Artisanal and Small-scale Gold mining
CELOS	Center for Agricultural Research in Suriname
CSR	Corporate Social Responsibility
DAS	Mineral Resources Authority
EMSAGS	Environmental Management in the Mining Sector of Suriname, with Emphasis on Artisanal and Guiana/Small-Scale Gold Mining
ESG	Environmental, Social and Governance
ESIA	Environmental Social Impact Assessment
FPIC	Free, Prior and Informed Consent
GEF	Global Environment Facility
GMD	Geological Mining Department
MTEC	Mining Training and Extension Center
NIMOS	National Institute for Environment and Development in Suriname
NMA	National Environmental Authority
PES	Payment for Ecosystem Services
PMU	Project Management Unit
SOP	Standard Operating Procedures
UNDP	United Nations Development Programme

Executive Summary

The National Validation Workshop focused on the rehabilitation of abandoned artisanal and small-scale gold mining sites in Suriname, specifically at Compagniekreek and is an output of the EMSAGS project, which aims to improve environmental management within Suriname's Small-scale Gold mining sector and to promote environmentally responsible mining technologies. The rehabilitation activity aims to address the environmental and social impacts of mining by restoring land, improving water management, and developing practical guidelines for soil restoration and post-mining land use. In Suriname, gold mining involves open-pit excavation, where soil is processed to extract gold, leading to significant soil erosion and sediment displacement into nearby creeks and rivers. This process changes the landscape, causing material loss and accumulation in different areas.

To understand the pre-mining environment, researchers analyzed geological data and soil maps to reconstruct the original landscape, identifying soil characteristics like clay content and carbon levels. This reconstruction serves as a baseline for soil restoration and its capacity to hold moisture and nutrients, enabling vegetation to grow and supporting the entire ecosystem.

Various experimental treatments were applied to degraded land, including adding topsoil, clay, and humus. The most effective treatment involved adding 10 cm of topsoil without tillage, which improved organic matter and vegetation cover. Based on these findings, a protocol and guidelines were developed for restoring small-scale abandoned sites, applicable in Suriname and other countries. These guidelines include steps like baseline measurements, developing restoration plans, implementation protocols, safety measures, monitoring and adaptive management, and governance and alignment of financing.

The lead impremente of the activity is TAUW BV. The practical execution of earthworks at Compagniekreek was done by Haukes NV, while the agroforestry system as an alternative was done by CELOS on the rehabilitated plot of land. The agroforestry plot covered an area of 3,000 square meters (m^2). The concept of the half-moons shaped beds was in order to keep as much organic matter as possible on the plot.

Stakeholder engagement, including community consultations and engagement with national stakeholders has been of key importance in this activity, alongside the technical side of the project is also needed. That is why discussions were held with the captain to request permission to carry out the technical activities. Subsequently, meetings were held with the community in their own area to talk about rehabilitation, without them feeling compelled to participate. Sessions with held with national organizations engaged in management of the small-scale mining sector. This national validation workshop is part of the intended stakeholder engagement.

In Compagniekreek, approximately one hectare of land has been restored and the water management system has been improved, generating valuable knowledge and capacity building for future rehabilitation efforts in other depleted mining areas of Suriname. The primary purpose of the research is stated to be for government policy, with data to be transferred to implementing partners like the Ministry of Natural Resources and the National Environmental Authority, for developing guidelines for soil and degraded area restoration.

Introduction

On August 13th 2026 EMSAGS organized a National Validation Workshop regarding the project *"Site Rehabilitation of Abandoned Artisanal and Small-scale Gold mining sites at Compagniekreek"*. The central question that is becoming increasingly important when discussing sustainable gold mining is what happens to an area after mining operations have ended. It is not just about what is happening during mining, but also about what is left behind and, above all, what can be rebuilt afterward.

The workshop focused on soil restoration, earthmoving, agroforestry, and collaboration with local communities, as well as the lessons that can be applied from Compagniekreek to other post-mining areas in Suriname. The agenda was as follows:

- Walk-in and registration
- Opening and welcome
- Presentations:
  - Soil function Restoration after Small-scale Gold mining: Case study at Compagniekreek – *Marcel Hoosbeek*
  - General Introduction to the Redevelopment project at the ASGM site at Compagniekreek – *Jasper Wisman*
  - Execution of earthmoving works by Haukes NV – *Ashwin Jhinkoe*
  - Participatory site Rehabilitation Pilot at Compagniekreek – *Anwar Helstone*
  - The importance of community engagement: The case Compagniekreek – *Simone Weewee*
  - Validation of Guidelines – *Jasper Wisman*
  - Discussion long-term vision ASGM sites & future projects - *Jasper Wisman*
- Closing remarks – *Preciosa Simons*

Opening remarks

*By **Ms. Fanisha Salamat,** Facilitator*

Ms. Salamat warmly welcomed everyone on behalf of EMSAGS and partners. The workshop started with welcome speeches of which Ms. Sandra Bihari was the first to officially open the meeting, followed by Ms. Ilona van der Kroef and Ms. Preciosa Simons.

***Sandra Bihari* – Project coordinator EMSAGS**

Ms. Bihari welcomed everyone especially the director of Mining at the Ministry of Natural Resources, the captain and representatives of the community of Compagniekreek, the director of CELOS, the CEO of Haukes N.V., the representatives of the National Environmental Authority (NMA), colleagues and project partners of CELOS and the representatives of all organizations present both physical and online.

Also, Ms. Bihari mentioned that the results are being validated as part of the EMSAGS project, which focuses on soil and the rehabilitation of depleted mining areas in Suriname. This collaboration started in 2023 with both Surinamese and Dutch organizations with the project *"Restoration of Soil Functionalities and Abandoned ASGM Sites in Suriname,"* with the focus on research, knowledge development, and knowledge exchange regarding the rehabilitation of depleted mining areas; it has been a long-term process of nearly three years. This led to the follow-up project in 2025, *"Soil Rehabilitation of Abandoned ASGM Sites at Compagniekreek,"* whereby the knowledge gained was applied in practice. These activities were carried out at the EMSAGS project sites in Compagniekreek, in the Brokopondo district. The rehabilitation of post-mining areas in Suriname is an important issue and has therefore been fully integrated as an activity within the EMSAGS project.

Also, Ms. Bihari indicated that the EMSAGS project aims to improve environmental management within Suriname's Small-scale Gold mining sector and to promote environmentally responsible technologies. Within the EMSAGS project, environmentally responsible mining is not limited to what happens during the mining process itself but the entire life-of-mine cycle is taken into account: from exploration and extraction to processing and ultimately rehabilitation. A lot of work is being done on processing and setting up demonstration sites, but the project also focused on the entire mining cycle. When mining operations are terminated, open pit-mines, disturbed soil, tailings, and stagnant water often remain. This has consequences for biodiversity, forests, ecosystem services, and local communities. It is also important to keep in mind that there are not enough specific guidelines for the rehabilitation of these areas and for the transition to the post-closure phase of the mines.

In Compagniekreek, approximately one hectare of land has been restored and the water management system has been improved. TAUW BV and its partners tested various soil improvement methods on established test fields; in collaboration with CELOS, it was investigated which methods are most effective. These experiences and results were then used to develop practical guidelines for soil restoration that should be applicable to other depleted mining areas in Suriname as well. For EMSAGS, it is not just about realizing the restoration of one hectare of land

at Compagniekreek, but rather the investment in knowledge and capacity that has been gained can be applied to other areas. The involvement of the Compagniekreek community has been of great importance, because it is not just about the soil; it is about the livelihoods of local communities and the question of how they can repurpose the mined-out areas in their region. The hope is that the knowledge gained will be incorporated into policy, future mining activities and the way in which Suriname approaches mine closure and rehabilitation; not only in large-scale gold mining, but also specifically in the small-scale gold mining sector.

On behalf of the Project Management Unit (PMU) of the EMSAGS project, Ms. Bihari expressed sincere thanks to organizations, partners and individuals who have worked intensively on this process over the past three years:

1. Captain Pina and the community of Compagniekreek for being involved in this project throughout the entire process, granting permission and cooperation.
2. TAUW BV, the lead project partner, for the project implementation, technical expertise, guidance and many years of collaboration: Ilona van der Kroef (team leader), Ellen Verboom and Jasper Wisman.
3. The Wageningen University and Research
4. Boudewijn Fokke Sol Consultancy
5. CELOS, for its significant contribution to soil research, the test fields and monitoring.
6. Haukes NV, which was responsible for carrying out the earthwork at the Compagniekreek site and which also provided support for the project as part of its CSR efforts
7. The government agencies, experts, and other partners who have contributed to this project, particularly to the refinement of the guidelines.
8. EMSAGS project partners: the Ministry of Natural Resources, the National Environmental Authority (NMA), the UNDP and the GEF.

Lastly, Ms. Bihari mentioned that this project has shown that soil restoration and mine rehabilitation are possible when knowledge, technical expertise, government policy and local engagement come together. The hope is that everything that has been accomplished over the past three years, the guidelines, the experience, and the capacity-building efforts at institutions such as CELOS, will be incorporated in other areas and used for future policy development.

***Ilona van der Kroef* – Team leader**

Ms. van der Kroef indicated that she is involved on behalf of TAUW BV as a team leader on the consulting side. *"Today is an important moment that marks the end, but hopefully also the beginning of a process that started more than three years ago",* Ms. van der Kroef cited. It has long been known from previous projects that the problems arising around small-scale gold mine sites worldwide have an impact not only on the people living near these sites, but also on the wider environment. Every year, ± 1,400 metric tons of mercury end up in the environment due to small-scale gold mining activities which makes these activities the most significant source of mercury contamination worldwide; this highlights the urgency and necessity of making this sector sustainable. This sector is receiving significant attention within international partnerships and conferences such as UNEP & Partnership, the Minamata Convention and within EMSAGS. At the same time the problem is not limited to mercury. The local impact is often significant with hundreds

of hectares of degraded land at an average site. Ms. van der Kroef mentioned that this urgent problem was already known three years ago. That is why NIMOS (NMA) was approached to explore opportunities for collaboration: to bring this problem to light, investigate it further and jointly demonstrate and present solutions. This suggestion was received with great enthusiasm and the collaboration between the TAUW Foundation and EMSAGS got started.

Also, Ms. van der Kroef indicated to be genuinely very grateful that the process has been started and hoped that the workshop will contribute to finding a solution to this major problem. *"It may be a major challenge, but every step brings us a little closer",* Ms. van der Kroef cited and was therefore very curious about the input of the participants in order to have an interactive session. Finally, Ms. van der Kroef thanked everyone who made this project possible in particular project partner Boudewijn Fokke Sol Consultancy, CELOS, Wageningen University and Haukes NV, but also the involved stakeholders, the Ministry of Natural Resources, the National Environment Authority, the UNDP, Global Environment Facility, the EMSAGS and the community of Compagniekreek.

***Preciosa Simons* – Director of Mining at the Ministry of Natural Resources**
Ms. Simons extended a warm welcome to everyone, especially representatives from various ministries, the NMA and the entire PMU team of the EMSAGS project. Also, Ms. Simons thanked the UNDP, GEF, NMA as well as TAUW BV for their support throughout the project, and also expressed appreciation towards the local community of Compagniekreek and to all involved stakeholders.

Ms. Simons noted that the importance of rehabilitation is being increasingly recognized: Environmental, Social and Governance (ESG) is taken into account at both various large companies and small-scale gold mining. Gold is important, but it is very important to know what is left behind once the gold has been extracted. The actual benchmark of a responsible mining policy is not only the extraction itself, but also how the landscape and nature of Suriname are treated as well as the communities in the immediate vicinity. Going back in history, gold mining began at Compagniekreek. *"Having this rehabilitation initiative take place at Compagniekreek as part of this project is simply a perfect match"*, Ms. Simons cited. The rehabilitation of abandoned small-scale gold mining sites should not just be a technical exercise. It also involves environmental protection, food production, biodiversity, and the collaboration with the community in the surrounding area.

Also, Ms. Simons indicated that although there is an awareness of the need to transition to more responsible mining, it must also be realistic to recognize that everything won't happen overnight. It is just the beginning of an initiative that needs to be built upon into policy. Although nature restores itself, it is important to lend a helping hand since deforestation was facilitated for mining purposes; both the government and the private sector bear responsibility in this regard as well. Ms. Simons noted that the assistance from international partners is appreciated because capacity and technical expertise is needed to carry out work; only by working together individual initiatives can be transformed into a structured approach.

Ms. Simons indicated that the validation workshop is to identify what is going well, what is not working and what can be done better starting tomorrow and to put it to use. The experience learned at Compagniekreek should contribute to a broader, practical, and sustainable approach to the rehabilitation of other abandoned mining sites in Suriname. Also, Ms. Simons pointed out that however soil conditions are not the same everywhere in Suriname, it does not mean that there isn't a guideline that could be applicable in Suriname; rehabilitation is not just about restoring the land, it is also about restoring opportunities.

Finally, Ms. Simons wished everyone a very fruitful, open, and inspiring workshop, and declared the National Validation Workshop for the Rehabilitation of the Abandoned Artisanal Small-scale Gold mining sites at Compagniekreek open.

Presentations

Soil function Restoration after Small-scale Gold mining: Case study at Compagniekreek

*By **Marcel Hoosbeek – Department Soil Chemistry at Wageningen University, The Netherlands***

Mr. Hoosbeek indicated that mining, particularly Small-scale Gold mining, has side effects: it affects environmental health, safety (abandoned landscape with potentially dangerous situations (mine and water pits)), and the frequent loss of agricultural land in nearby villages. Also, Mr. Hoosbeek noted that both locally and internationally satellite imagery is used to capture images of landscapes ravaged by small-scale mining. This has been done in nearly every part of the world, resulting in a list that includes Suriname. Mr. Hoosbeek presented a diagram of mining activities by the large companies and small-scale mining whereby it appears that mining activities are quite a major problem worldwide.

ASGM practices

Mr. Hoosbeek mentioned that the processes involved in mining were examined: it is an open pit situation at a high part of the landscape where there is often forest. At the bottom of the terraces is where the gold particles are found as well as at the top of the eroded rocks. Under high pressure, the soil is blasted into a slurry. The slurry, the dissolved soil, is then guided through a sluice box, where mats are used to collect the gold particles. All soil particles flow through the landscape toward the creek. The coarse particles are captured in the soil, while the finer particles flow through the silt and clay in the river or creek, as well as the small pieces of organic matter that are part of the soil.

Geology

To understand what existed before gold mining took place, the geology was examined to see what background concentrations are present in the landscape. To this end, soil maps for the Compagniekreek were retrieved. Using these soil maps, a landscape was reconstructed as it likely appeared at the Compagniekreek; the creek itself is a flat riverbed, followed by several terraces, a lower slope, and then the higher part where the forest is located.

Soil profiles

For each landscape area, representative soil profiles were found that indicate the presence of clay in the soil; carbon stock, soil pH and soil saturation are all indicators that these were actually good soils for small-scale agriculture. The landscape reconstruction and the available information gave insight into the situation prior to mining and offered ideas about where to move forward and what exactly the goal is for the restoration.

Initial field work

Mr. Hoosbeek presented one of the drawings that was made during fieldwork that included the area where the houses are located, a number of pits and holes where mining apparently took

place, as well as areas where deforestation has occurred. This raised the question: *"to what extent is mercury pollution a problem in the area?"*

Restoration of ASGM site

The fieldwork was divided into three (3) main themes:

1. *Physical landscape*. A large part of the soil has been eroded, changing the shape of the landscape; how can this be reshaped

- There is coarse soil material lying everywhere on the land. What can be done with it? Can the pits be filled again, and what level of landscape restoration can be achieved?
- It is not possible to lower the entire landscape or the section being treated, because soil material has eroded and ended up in the creek. There is also a choice to lower certain areas, but this will still require transitioning to a different type of landscape.

2. *Environmental health*. There is mercury contamination. A lot of mercury has been used*; where does it end up?*

- During gold mining, mercury is added to the process, forming an amalgam. That amalgam attracts the mercury and the gold and concentrates into a mixture. That mixture containing the amalgam is then heated again, causing the mercury to evaporate. As a result, there is a massive mercury emission near the gold mining site. There have also been other projects in which mercury evaporates are captured in simple condenser-like setups; however, most of the mercury still ends up in the environment.
- Research has also been conducted in the past, by Eric Arets in 2006, who also measured mercury levels at various sites where mining took place; however, the concentrations were lower than expected, whereas higher concentrations had been expected. Research has also been conducted to determine the background levels in the Guyana shield, the geological region of which Suriname is a part, and to identify the mercury levels occurring in the landscape.
- Salomon Kroonenberg, who worked at the AdeKUS, measured mercury concentrations in various types of soil in Suriname several years ago and found background levels ranging from 0.2 to 0.8 micrograms of mercury per gram of dry soil.
- According to Eric Arets, some of that mercury in the area has also undergone a transformation; the soil contains small particles and organic matter, and perhaps that mercury is being carried along with the flow. This was also measured directly using field equipment at the Compagniekreek, but it turned out that the mercury concentrations in the field remained below the detection limit. To be sure, soil samples were also taken, which yielded results between 0.05 and 0.12 micrograms of mercury per gram of dry soil; the values were all within the natural range in soils which was quite surprising. The hypotheses here are that:
    - it is possible that the mercury vapor has spread throughout the entire area, including the surrounding forest, resulting in a massive dilution. That doesn't mean the problem is solved, because the mercury then ends up in the ecosystem; the mercury begins to accumulate in organisms and eventually, it may end up in the fish, with consequences for humans.

- some of the mercury could be bound by fine soil particles; particularly clay particles and organic matter which can also absorb metal ions, causing small particles to be deposited in the Surinamese river and end up in the ocean.

3. *Soil restoration*. How can the available resources be used to ensure that the soil can be used again and that vegetation can grow:
   - determine the primary material and what was left behind near the gold mine.
   - examine the landscape: at what elevations is the relief
   - the climate
   - the organisms are also important for soil restoration. This includes both the vegetation that will form and the microorganisms that must be able to come back to life; this means getting that entire ecosystem going again.

Soil components

What is in the soil? Clay, silt, and sand. Mr. Hoosbeek indicated that the clay and silt have disappeared, as well as the organic matter and needs to be added back. Only by mixing all these components together can the soil return to a healthy state; where there is enough structure, an ecosystem will form again. When looking at soil restoration, there is a lot of sand. But where does the clay and organic matter come from to bring those levels back up? *Why is this important?* Because soil with good structure can retain moisture. Mr. Hoosbeek presented a picture that indicated the volume of water the soil can hold, and the negative suction tension in the soil. Soil can hold very little water and will dry out very quickly during a dry period. But if there is a good mixture of clay and other fine particles, the soil can retain moisture for the vegetation much longer. Soil pores are also of great importance because water can easily pass through them. Also, gas exchange, oxygen and CO_2, is important for a healthy, living soil.

Mr. Hoosbeek noted that the challenge in soil restoration is to restore a good soil structure with the capacity to retain moisture for a dry period, as well as a charged surface consisting of clay particles and organic matter to hold plant nutrients. Soil is essentially a storehouse of plant nutrients to enable plants to grow. And as organic matter is decomposed by soil microbes, nutrients (such as ammonium, nitrate and phosphate) are released and absorbed by the plants so that plants can start to grow again.

Where does organic matter come from? The food processing industry (by-products of agricultural production), forest litter or other forms of organic matter This is important for the sediment left behind after gold mining. By adding organic matter to the soil and through photosynthesis (driven by energy), a good soil structure is achieved that ensures that the soil can retain water and release plant nutrients for growth.

Clay particles are very small charged particles that have a negatively charged surface and can retain ions, which are important for plant nutrients. Just like organic matter, which is pH-dependent, these particles can retain nutrients that can later become available to plants. It is therefore important that clay and organic matter are present in sufficient quantities in the soil. A

small soil particle holds all kinds of plant nutrients; a small root can then absorb those nutrients. This is how an ecosystem begins to thrive again.

Nitrogen and phosphate cycling

When organic matter is decomposed by microbes, soil organisms, ammonium and nitrate are released; this is important for plant growth. When establishing a new ecosystem as part of soil restoration, it is important to use plants that can also absorb nitrogen from the atmosphere on their own. In this case, less organic matter is needed to start with, but nitrogen can be obtained in that ecosystem in a different way; the roots contain small root tubers, and inside the tubers, nitrogen from the atmosphere is absorbed and stored in that ecosystem.

Phosphate must primarily come from the erosion of rocks, a process that releases orthophosphate. The intention is that it should not be stored in tropical soils; it should not accumulate in iron oxides. This is the situation in younger soils, where rocks contain various forms of organic phosphate. In Suriname, where the soils are older, organic phosphate is the primary source of phosphate for plant growth. This is why organic matter is important for soil restoration in this type of soil.

Vegetation recovery

Vegetation recovery is part of soil restoration:

- a part of the surface must be available
- there must be a suitable topsoil
- reintroduction of seedbank; either natural vegetation must be allowed to grow or replanting local trees; the vegetation must be reintroduced.

Restoration pathways

Mr. Hoosbeek indicated that no mercury contamination was found at Compagniekreek, which is a bit suspicious given that the problem has not been resolved. The fieldwork in the area was conducted based on literature. As a result of the considerations regarding clay and organic matter, pits were filled and a number of treatments were explained:

1. zero treatment: no tillage; only very coarse sand.
2. 10 cm of topsoil mixed into the top 30 cm of that material.
3. 10 cm of topsoil without tillage
4. 5 cm of topsoil added mixed into the top 30 cm of that material
5. 3 cm clay and 1 cm humus mixed into the top 30 cm of that material: a mixture of clay was brought in from elsewhere; it can be quite difficult to find loose clay and humus.

Pilot plots soil restoration

1. The nitrogen-fixing leguminous plant (*Okray Pesi*), did quite well on some of the plots; it provided good ground cover. This is a type of plant intended to be worked back into the soil after the growing season; no fertilizer is needed which makes it a very suitable plant for revitalizing the soil.
2. The cassava has been planted, but the crops had some problems; there has been some pest damage.

Results

Finally, Mr. Hoosbeek presented the following results:

- The 10 cm of topsoil without tillage on the surface produced the most organic matter after plowing from the first crop.
- A simple statistical model was also applied, with treatment as a fixed factor. This was also a block design, meaning four replicates, randomly designed. The study examined vegetation cover and the number of cassava plants, but focused primarily on organic matter, which was measurable.
- The treatment involving the addition of 10 cm of topsoil, without tillage, was the easiest and gave the best results. The advantage of topsoil is that it contains a seed bank, whereby some soil structure remains intact containing a lot of organic matter. If the topsoil is not turned under, its water-holding capacity, especially in the deeper layers of the soil, may prove detrimental later in the season; this likely became a problem during cassava cultivation as well.
- Adding topsoil as a treatment method, means that topsoil has to come from somewhere. That means damage is being caused somewhere else in a forest or on another farmland. So, in reality, this can only be done if there is certainty that the source of the topsoil won't simply shift the problem elsewhere. Otherwise, there will still be a need to use loose clay and loose humus.

Questions and comments

Name	Questions/Comments	Answers/Comments
Ravindre Patandin (ILACO Suriname NV)	ILACO also happened to have done research in a mine tailing, and very low mercury levels were found in the sediment as well; so, it may not be surprising, but it's true that the question of 'why' remains unanswered.	**Marcel Hoosbeek** It's good to hear that mercury levels have also been found in the same range. This is an issue that needs further investigation: where is all that mercury going, because it is definitely being used.
	The biggest problem is not mercury, but actually the issue of sediment transport; the entire disturbance of the subsoil (the erosion, the deposition). Why then would such an expensive 10 cm topsoil would be extracted from elsewhere and solutions sought to regenerate or rehabilitate it, while cassava started growing even when nothing was done; the soil could be leveled perhaps so that no water remains standing. But at a minimum, if mercury is not the problem, why isn't that being done; no other expensive solutions are needed.	**Marcel Hoosbeek** It is necessary to add clay and organic matter to this very coarse sand, which remains after gold mining, during soil restoration, because it is impossible for plants to grow again in the coarse sand. Mr. Boudewijn has put together a photo report series showing all the plots, which clearly demonstrates that on the control plots, where nothing was added, almost nothing grows; the vegetation is much sparser. So fine-grained material is definitely needed, preferably some clay, but especially organic matter, to get the nutrient cycle going again. It is indeed a problem to source topsoil from elsewhere, and it can also be dangerous. Or it must be obtained from somewhere else in a

Name	Questions/Comments	Answers/Comments
		different way, which can indeed be expensive. But in that very coarse sand, it seemed truly impossible to get vegetation to grow there again.
Joshua Prentice (Basel Convention Regional Center for the Caribbean)	Was this site abandoned before the project began, and if so, how many years was the site abandoned?	**Marcel Hoosbeek** The first time in the field, the mining was still kind in operation, just a few hundred meters downstream (± 0.5 km). So, it was one- or two-years that the miners just moved to the next site; basically, out of the area where the research was being done.
	Was there any testing of mercury content in water samples from the nearby water courses? And if so, what were the results? The reason for asking this is because mercury is a compound or element that can move very quickly, and it would be likable to understand the transportation of mercury from this site.	**Marcel Hoosbeek** Mercury is adsorbed by clay and organic matter and in that way, it is transported by the river; by flowing water. No water samples were taken; only sampled soils and the sediments. But it would be interesting to see what kind of concentrations are taken up by the water.
	Would it then be a best practice for a project like this to take place immediately upon closure of a site to prevent mercury runoff?	**Marcel Hoosbeek** It would be nice to remove the topsoil before making a slurry, before the mining, to take the topsoil aside and keep it for later soil restoration again; and also limit the amount of clay and fine particles that go into the river. It would of course be very nice to keep the part of the soil on site and take it pits or something so it can be reused again after the mining stopped. In practice, people only buy a big pump to destroy the soil and they don't care about anything else. But it would be nice to keep everything on site.
Max Huisden (SAFE Globally)	Limiting runoff is important not only for the growth of topsoil, but also because the runoff often ends up in the water; the water turbidity is a major problem for biodiversity.	
	Mucuna pruriens is a legume, a vine that can grow to 5+ meters in length. A few years ago, Kudzu was introduced and had a high protein content, but it became an invasive species in Suriname. At that time, all the trees and crops were overgrown by Kudzu. Mucuna pruriens has several varieties and is not only poisonous but also has the potential to become an invasive species. It	**Marcel Hoosbeek** The process behind choosing this crop isn't entirely known, but this information is useful. **Ilona van der Kroef** Further research has been conducted, and specific attention was paid to select a

Name	Questions/Comments	Answers/Comments
	is a vine that grows very aggressively, and its seeds contain very high levels of L-dopa which is toxic to both animals and humans. Which variety of Mucuna pruriens was used?	species that does not exhibit invasive behavior. **Fokke Boudewijn** The seeds of this green manure crop were harvested locally. There were bushes in Nieuw-Ganzee. The seeds were collected locally, in part with the aim of using something that was already accepted and present in the area. So, the seeds don't come from elsewhere; the seeds really do come from the region.
Iwan Samoender (NMA)	The NMA has also studied the Mucuna crop rotation and other agricultural crops in the interior, on abandoned land resulting from slash-and-burn practices. Efforts have been made to rehabilitate the land through projects in which Mucuna was harvested and incorporated into the soil to enrich it with nitrogen. Restoration means to return the vegetation to its former state. Was the initial approach for agricultural areas to first increase soil fertility and then restore the original vegetation?	**Marcel Hoosbeek** The first crops that were chosen were intended to somewhat restore the soil structure and revitalize the soil, so that the crops would return to their original state.
	Bringing in topsoil from somewhere else is expensive. Have there been any considerations regarding organic fertilizers e.g. in granular form to promote low production, so that sufficient organic material is obtained for both Mucuna and cassava, to be worked into the soil over time? It will likely be a long process, but over time, the same effect should be achievable.	**Marcel Hoosbeek** As for organic matter, when granules are added, there's often less structure, whereas coarse organic fertilizer like cow manure and barnyard manure would be ideal. It all depends on what is available in the area and this is limited to the topsoil; it is not ideal because of the risk of damaging the topsoil somewhere and it is expensive. Initially, waste streams from the agricultural industry were sought, such as from oil palm, but those were no longer available nearby. **Ilona van der Kroef** Both options have been tested. And since the costs are so high, the possibilities for what can be done within the area were explored, given that the areas in question easily cover 100 hectares of damaged terrain. If external material is added, this will also entail high costs in terms of the

Name	Questions/Comments	Answers/Comments
		number of truck trips required. So, the possibilities were examined for how to reactivate the soil within such an area. If a small portion of the area is damaged and that can be used to restore a very large area, then that is actually very efficient. That is certainly a factor that was also taken into account.

General Introduction to the Redevelopment project at the ASGM site at Compagniekreek

*By **Jasper Wisman – Technical engineer (TAUW)***

As a short introduction, Mr. Wisman mentioned that 20 million people worldwide depend on Small-scale Gold mining, that as of 2018, cumulative deforestation had exceeded 200,000 hectares and that mercury is a major problem at the mining sites throughout the entire Guiana shield. Also, Mr. Wisman indicated that large amounts of clay, organic matter and silt were washed away by mining. Many sites have been abandoned for years, leaving little clay, silt, and organic material available; this resulted in little recovery in the mine tailings and sandy areas.

Project video

Mr. Wisman presented a project video which was focused on restoring abandoned mine tailing sites, particularly the soil functions impacted by mining activities done at Compagniekreek. Validation sessions were held with the local community by CELOS and TAUW BV, as part of the EMSAGS program that focused on rehabilitating a former gold mining site. The team collaborated with the local community at Compagniekreek to align restoration goals in order to minimize the impacts on human health and the ecosystem. Based on this restoration pilot a protocol was developed to guide the restoration of similar sites in Suriname and other countries. The initiative aims to promote the CELOS agroforestry system as an alternative to agriculture, enhancing local livelihoods. Both residents and traditional leaders at Compagniekreek have shown strong support, being a model for other gold mining areas and demonstrating that there are alternatives to gold mining.

Mr. Wisman proceeded the presentation with the project objective: site redevelopment, developing guidelines and providing capacity-building training, using Compagniekreek as a demonstration project; this project has been ongoing from 2023 to the current date. The approach focused on a combination of scientific research, fieldwork and practical implementation. Also, Mr. Wisman indicated that it is unknown when the gold mining began at Compagniekreek, but around the year 2000, the miners started in the west of the creek and worked eastward to follow the gold.

Soil restoration trial

A soil remediation trial has been performed. The intention was to work on the redevelopment of the site, applying the knowledge gained from the soil restoration trial. The preliminary design involved, and the tendering process took up the entire year 2025, while in 2026, work was done

on the redevelopment of the site. It is important that all gathered information and knowledge is also incorporated into the guidelines for the restoration of former ASGM sites which is a very important end product. The physical implementation and the lessons learned were based on science, but also greatly supplemented by practical lessons learned during the execution of this project.

Best practices for soil restoration at post- ASGM sites

These guidelines are also intended for anyone who wishes to restore ASGM sites and include a non-technical communication tool to make it easier to share this information with communities or experts without a technical background. The lessons learned from the two different projects at Compagniekreek are also included in these guidelines. The main steps that must be taken according to the guidelines are:

- baseline measurements
- develop a restoration plan including a decision framework
- implementation protocols and safety
- soil restoration
- monitoring, evaluation, and adaptive management
- governance and alignment of financing.

What has been done at the Compagniekreek?

Five different treatments were applied:

- in the first one, nothing specific was actually done other than planting cassava and applying fertilizer. Due to pest damage and drought, the cassava's growth was consequently disappointing. There was also very little vegetation cover, very few surviving cassava plants, and no increase in organic matter during the two years of testing.
- application of 10 cm of topsoil incorporated into the top 30 cm of that material - the vegetated surface is quite high and the cassava plants are growing well. However, there is no significant increase in organic matter over time.
- adding 10 cm of topsoil without tillage - this seems to have the highest success rate, because the organic material really increases over time.
- adding 5 cm of topsoil and incorporating it into the soil results in mediocre outcomes.
- bringing in clay from another location does produce decent results in terms of vegetated area and cassava plants, but the organic matter remains behind. This is also the most expensive solution, because it requires importing materials from elsewhere.

As a result, it was decided to simply add a top layer of local material without mixing it into the soil. The project objectives of the redevelopment project, the rehabilitation of the site, are:

- site safety
- village expansion
- improving water quality
- improving soil restoration

This was all based on the wishes and discussions of the community as well.

The design

- after the excavation work, the area was covered with local material, resulting in a higher concentration of clay and silt.
- the agroforestry system was implemented.
- the village expansion was made possible and a riverbank was added; since the slope was quite steep it has been flattened.
- a flat plane was made to ensure that if a lot of water flows towards the site, it can flow over it and does not reach the village. At the same time, this was also a very important area for soil extraction, as it contained more clay and silt, which was used on the agroforestry plot. The pit was connected to the creek, functioning as a large sedimentation basin, allowing the silt to settle.

Mr. Wisman noted that during **the baseline study** many soil and water samples were taken to determine in advance where organic material was present, and also to be able to compare the results afterward. Also, aerial photos were taken which was very important to see what has been done. Other activities that were carried out were:

- the pit was attached to the creek; the pit has been breached to create an outlet so that water can actually flow through it.
- a sediment dam was also constructed to slow down the waterflow, allowing more sediment to remain behind and settle.
- a section of the area was flattened so that the material could be reused, but also to prevent water from flowing toward the community should the water level rise.
- village expansion: less fertile soil has been added and the surface has been leveled.
- a small soccer field was built, and an entrance to the pit was created.
- agroforestry system: soil was added and the area was actively planted and also fertilized.

Mr. Wisman also indicated that not everything went equally well. Within this project, a tree was cut down and landed on the dam which requires repair work. However, it is also noticeable that the section that was leveled is still eroding quite a bit. Therefore, constant monitoring is important to keep an eye on what is happening on the site so that action can be taken.

Results

De results of the goals are:

- *site safety*: the edges of the pit have been flattened, but more erosion is taking place than expected. Therefore, the area should be re-profiled and grass should be planted as well.
- *village expansion*: ± 3,800 m² of land has been prepared for the villagers to use as desired.
- *improving water quality*: a sediment dam has been constructed and a pit has been opened so that it can function as a sedimentation basin. However, the dam has sustained some damage due to the tree falling, and it may still need to be relocated to optimize sediment retention.
- *improving soil restoration*: ± 3,000 m² of agroforestry area has been cultivated. Samples have shown that the percentage of organic matter in this area has also doubled in a short period of time. This is due to the combination of the soil that was added, as well as the application of green manure and chicken manure.

Also, constant dialogue with the community remained.

Questions and comments

Name	Questions/Comments	Answers/Comments
Sharon Westerlow – Pinas (Ministry of Regional Development)	The project has shown that it is possible to rehabilitate a plot of land that was previously used for mining operations and repurpose it for agricultural activities. To what extent is sustainability integrated into the project? To what extent will the villagers be able to continue on their own after the project ends and the collaboration may have come to an end?	**Jasper Wisman** The plan is for CELOS to remain present in the project for a longer period and to continue with the agroforestry plots. This is to ensure that the project remains sustainable; ownership must remain in place. It is therefore important that the villagers continue to be supported by CELOS, but also that it actually benefits the local community.

Execution of earthmoving works by Haukes N.V.

*By **Ashwin Jhinkoe – Project Manager at Haukes N.V.***

Mr. Jhinkoe indicated that Haukes NV was approached by CELOS to execute the project. Haukes NV has extensive mining experience, but no experience with ASGM projects. However, it would benefit the community, hence the input to participate in the tender process for this project; this project has been a collaboration between CELOS and Haukes NV. The impact area is much larger than just the gold mining area that needs to be rehabilitated. However, since this was a test site, the decision was made to limit the project to this area and the possibility of constructing a sedimentation basin was also considered. This proved somewhat difficult, because the water flowed toward the Suriname River without any sedimentation taking place. Also, Mr. Jhinkoe indicates that an attempt was made to make improvements to the current water flow due to the execution of the earthworks.

Scope of work

The scope of the study was to set up an agroforest system, a civil housing and a sedimentation basin, as well as rehandling material from the area to ensure both costs and outcomes were in line with the scope.

Project metrics

- Haukes NV had to construct access roads of 100 - 150 meters to gain access to the project. This had to be done because the area consists of compacted material, which is not stable throughout; working with excavators and trucks can be dangerous if a good, stable road is not constructed first. This cost quite a lot of the budget.
- In addition, ±1600 m^3 of earthwork had to be done.
- A sedimentation basin had to be constructed.
- Earthwork for civil housing, ±1,000 m^2 meters.
- Haukes NV had only two weeks to complete the entire project, because the budget did not allow for a longer timeframe. Haukes NV went a little beyond the scope of the project out of a

sense of the Corporate Social Responsibility (CSR) and expanded the agroforestry plot, within the time frame and budget, in order to give a little back to the community; This was in collaboration and consultation with TAUW BV and Mr. Boudewijn.

After execution

- Building a sedimentation trap; this was initially outside the scope. An overflow had to be constructed so that all the water entering the sedimentation basin could settle and only flow out at a certain water level.
- Earthmoving was also carried out, where a few issues were noticeable:
  - It is a compacted area where there is a great amount of segregation; there is a lot of coarse-grained material and very little sediment. All the clay material had been washed away and had to be brought back, which made earthwork operations difficult; everything that was built was washed away. It was then decided to make the slopes less steep, and even then, erosion occurred during the first rains; despite the fact that all the slopes were lined with silt that was already present in the sedimentation basin, it was still washed away.
  - A sedimentation trap and an overflow was built to prevent too much water from flowing into the basin, otherwise the sediment won't settle. But it also had to ensure that, at certain water levels, it does not flood the village. It was observed that the sedimentation trap did retain some organic material, but the sediment itself was not retained.

As a recommendation, Mr. Jhinkoe suggested making the sedimentation traps slightly wider in the future using geotextile, and building an overflow to slow down the water before it enters the basin.

Lastly, Mr. Jhinkoe thanked the community for their commitment and appreciation in carrying out the project. In order to keep costs down it was requested, in collaboration with CELOS and TAUW BV, that the community also help with the security of Haukes' machines. Mr. Jhinkoe also gave thanks to CELOS for executing the project and TAUW BV for the good cooperation and trust in Haukes NV, as well as Mr. Boudewijn and Mr. Wisman for the critical guidance during the project.

Questions and comments

Name	Questions/Comments	Answers/Comments
Donovan Bogor (NMA)	A lot has been invested in the project that has been set up. Has consideration also been given to the hydrology that is now developing as a result of this earthwork, given that this could affect the integrity of the work that has been planned? It would be unfortunate if the hydrology were not taken into account in the event of heavy rainfall.	**Ashwin Jhinkoe** Yes, that has been looked into as well. Contaminated water keeps flowing in, and even though the miners are gone, there are still activities taking place both upstream and downstream, which is disrupting the area. For example, small dikes are being built where no dike should be built, and water is being diverted to places where it shouldn't be. The hydrology should be considered within a broader context; what is happening upstream and downstream should be examined so that a specific line can be set, and from there, address the sedimentation issue.
	This will then be considered as a recommendation when the guidelines are released, namely that hydrology must also be taken into account along with its impacts on such rehabilitation projects.	**Ashwin Jhinkoe** The area of influence is very small. **Jasper Wisman** It is a good point to include hydrology. Along the way, a number of drainage ditches were identified and cleaned, making it easier for the water accumulating south of the village expansion to reach the creek. In this way, an attempt was made to implement improvements, thanks to Haukes NV. **Ilona van der Kroef** It would be ideal to restore the hydrology of such an area and also to fully map it, including the water balance and the fluctuations in runoff that occur in the area. This has been partially examined, but within the scope of the current project, it has not been possible to obtain a complete picture. In the long term, and as specifically noted in the guideline, the hydrological restoration of such an area is an important part of the area's overall restoration, including the restoration of the soil.

Participatory Site Rehabilitation at Compagniekreek

*By **Anwar Helstone – Head of Agricultural Production Department at CELOS***

Mr. Helstone indicated that the first phase, concerning soil restoration, had been fully carried out by TAUW BV and the other partners, and presented the agroforestry concept that CELOS has implemented on the rehabilitated plot of land.

What were the assignments in collaboration with TAUW BV?

- Community engagement. CELOS has been active in the EMSAGS program since 2024 focusing on alternative livelihood and has built a relationship with the community of Compagniekreek.
- Training sessions – these were done in the M-tec building in Brokopondo and afterwards at the Compagniekreek site itself.
- Setting up the agroforestry plots on the rehabilitated land.
- Daily and monthly monitoring at the site; observing all civil engineering work that has been done and maintaining contact with TAUW BV.

CELOS vision on agroforestry

CELOS has been active in agroforestry in Suriname for 20 years and focuses primarily on the rehabilitation of old agricultural plots, better known as shifting cultivation systems. The vision is to offer an alternative for livelihoods, but agroforestry can:

- contribute to soil improvement.
- promote resilience in the context of climate change, as well as resilience to economic developments.
- be important for biodiversity and agroecology, which must be preserved to ensure sustainable development.

In 2024, agroforestry was started with the community of Compagniekreek.

Reshape of the Compagniekreek landscape

How did CELOS receive the assignment?

- From May 2024 – May 2025, CELOS has been allowed to introduce the agroforestry system at Compagniekreek on agricultural land. Since the Compagniekreek was a new community, the start-up was not going very smoothly; the partners had to get used to working together, and for Celos, that took a year.
- Once the project was completed, a connection with the community at Compagniekreek had indeed been formed; this led to generating results when carrying out activities. *How was this connection achieved?* After the project ended in 2025, CELOS embraced the community by involving them in other CELOS agroforestry programs and training sessions, and through WhatsApp whereby information is constantly shared in an alternative way. CELOS also remained actively involved in the long term with agroforestry in the Brownsweg area, where the small agricultural plots are located between gold fields.

The agroforestry plot that CELOS was allowed to reshape covers an area of 3,000 m^2. This was designed based on:

- CELOS's experience with agroforestry.
- studies that TAUW BV has already conducted in the area.
- a number of studies that have been carried out by other stakeholders in the EMSAGS program.
- other studies that CELOS have conducted.

An important species included in the agroforestry system is Açai, because one of the reports from the EMSAGS program indicated that it was an endangered species. Since the local community harvest açai, the trees are cut down during harvesting; this means that after a single harvest, there will be no trees left. Therefore, for agroforestry, this was already a starting point for CELOS to develop a design.

Agroforestry layout

The concept of the half-moons was selected during the literature review based on practices in the Sahel. Since the soil is known to be relatively nutrient-poor, a system was needed to improve the soil fertility; this has been incorporated into the agroforestry model. This model is divided into two parts.

- Model 1: half-moon shapes. This is quite intensive. Each half-moon shape has a diameter of 5 meters.
- Model 2: using palm species; this is an extensive approach. In this section, coconut palms were used, with Palepoe (*Bacteris gasipaes*) planted among them. Minimal intervention was required for this model: the coconut palms were planted, and then maintained.

The concept behind the half-moon shaped beds is to keep as much organic matter as possible on the plot. The site is on a slight slope, and aerial photos have shown that runoff occurs every rainfall. The idea is to use these half-moon shaped plots to build up organic matter. Five banana plants have been planted in each half-moon shape, and in the center, we have an Açai plant in a 5-by-5 planting pattern. *Why were banana plants chosen?* Bananas are plants that actually retain moisture and are ideal for long-term, extensive use. Bananas also produce sufficient biomass, which is returned to the soil to support the soil formation process.

In each bed a slope has been created and organic material has been added in the form of chicken manure; biomass has also been collected from nearby trees, which were chopped up to provide the bed with a layer of mulch to help the process. Mr. Helstone also mentioned that there is a variety of other crops in the beds, including legumes such as Mucuna pruriens, yard pea "djarpesi" and corn. The idea was to cover the ground within a short period of time. Also, cassava has been planted between each tree, since cassava is a crop that can grow even in nutrient-poor soil.

The implemented CELOS Agroforestry system

- The goal for the first two years is to ensure sufficient vegetation growth, with the output not intended for human consumption. The intention is to achieve growth of a variety of crops, but not for human consumption. The plan is that before the banana tree enters its flowering phase, it will be cut down, shredded, and then placed on the ground to provide sufficient biomass. The same will be done for cassava. Before the cassava reaches 1 meter in height, it will also

be cut down, shredded, and placed on the ground to enrich the soil through a layer of mulch. And as for all the other legume crops that have been planted, the idea is that before they enter the flowering phase, they will simply be mowed down so that all that organic material goes into the soil. The goal is essentially to revitalize the soil.

- After the second year, the monitoring will begin (water quality, air quality) and assess whether the crops will have any impact on human health.
- After year four, the acai must start producing; a non-local variety was used, namely Açai BRS Pará.

A schematic visualization

The main goal in the first two years is an ecosystem recovery, achieving full soil coverage, and biomass production. Starting in year two, the focus shifts to food production; root crops such as cassava and bananas. After the fourth year the focus will be on a mature system with açai production as the primary crop. In the long term, this will need to have an impact on livelihoods, so that the community becomes economically stronger, and that this system can serve as an alternative for the community alongside gold mining.

One of the challenges in the system is that damage was already noticeable during the sprouting of cassava and banana. In the first test plot planted with cassava, growth got off to a slow start. It is important to take insects into account, as there were problems with termites and presumably, wood lice.

A total of 84 açai trees have been planted in the system; also, Moringa, and Inga trees are being used as fast-growing species. mixed in. The woody species have not yet been planted because the planting material is not yet ready. The plan is to plant *Cedre*, *Pakoeli* and *Teak* in the system as fast-growing varieties.

Mr. Helstone mentioned that growth was observed in the process following soil excavation. In addition to the first crop, the following activities were carried out:

- monitoring,
- soil management,
- backfilling/replanting,
- insect control, and
- irrigation.

Challenges and opportunities

- Over the past 6 months, growth has indeed been observed.
- Monitoring insects on the plantings; effective pest management
- A living lab was created for science-based learning and experimentation

Finally, Mr. Helstone indicated that CELOS does not have the capacity to sustain the developed agroforestry landscape without stakeholder collaboration, and that the following needs to be taken into account:

- Biomass monitoring

- Soil monitoring
- Air quality monitoring
- Water quality monitoring
- Continue to ensure community participation throughout the project's development and implementation
- Regular measurements of crop and tree species growth performances.

Questions and comments

Name	Questions/Comments	Answers/Comments
Iwan Samoender (NMA)	Does CELOS also use mycorrhizal fungi since some crops are growing slowly? On such farms, mycorrhizal is propagated and inoculated into depleted soils to promote this process. In Brazil, for land restoration and reclamation, researchers are looking into a specific species of mycorrhizal; a fungus that expands the plant's root system to extract nutrients from the soil as effectively and efficiently as possible.	**Anwar Helstone** Unfortunately, not; a living lab has been created with the stakeholders. However, as an outcome of TAUW's collaboration with Wageningen University in the EMSAGS program, possibilities for exploring this symbiosis are currently being investigated. It is important to examine the local microorganisms that are present; introducing microorganisms from outside carries the risk of invasions. This is on the agenda with partners.

The importance of community engagement - The Case: Compagniekreek

*By **Simone Weewee - Consultant***

The captain of Compagniekreek and representatives of the local community shared their experiences regarding collaboration with CELOS, TAUW BV and Haukes NV:

- Captain Pina of the Compagniekreek expressed his thanks and appreciation to EMSAGS, CELOS, Haukes NV, and all the other organizations that have carried out activities at Compagniekreek. The collaboration was viewed as positive. Compagniekreek was launched as a pilot project to rehabilitate the area where gold mining activities took place. *"Soil restoration is needed: planting needs to be done and ways to restore the soil's fertility must be explored*", Mr. Pina cites. Finally, the captain indicated that the support from CELOS is important in order to continue the project in a sustainable manner.
- Ms. Edith Misiedjan also expressed her gratitude and appreciation for the collaboration with EMSAGS, CELOS, and TAUW BV, and mentioned that through this collaboration, the local community has been trained on how to plant and how to deal with mercury. A dike was built, with which the community was initially satisfied. However, heavy rain has caused damage to it, whereby the open pit is posing a danger to the village children who play soccer; whenever the football lands in the water, all the children run into the water to take the ball. Lastly, Ms. Misiedjan requested support from CELOS, TAUW BV, EMSAGS, Grassalco, Newmont Suriname, and Haukes NV to renovate the area near the football field so that the children are not at risk.

Ms. Weewee proceeded with the presentation and appreciated that CELOS has also considered the human aspect alongside the technical side of the project: how it is explained to people what it is about and to embrace the project. Ms. Weewee indicated to have been working with the community of the Compagniekreek to inform them about all the technical aspects and mentioned that the community is a straightforward group that expresses its opinion when it is not satisfied. First, discussions were held with the captain to request permission to carry out the technical activities. Subsequently, meetings were held with community representatives in their own area to talk about rehabilitation, without them feeling compelled to participate.

Haukes NV also approached Ms. Weewee to discuss how the community could help to ensure that the machines were protected, that work is carried out safely, and that no accidents occur. This needed to be communicated to the community by inspiring them to embrace the project and get involved.

Introduction to the activities: why the rehabilitation of abandoned mining sites is important
Ms. Weewee indicated that the community will only cooperate once they have confidence in the project. It took a year to gain the trust of the Compagniekreek community; one does not simply enter an area to carry out a project, otherwise the project will fall apart when leaving because no one will take it over:

- *Human*
  - local knowledge is needed from the start so that the community can describe the situation to the stakeholders, for example, information about where the creek was located before the well was filled in.
  - rehabilitation is not just about land restoration. It is also about
    - *restoring trust*: many projects have been carried out in Suriname, mainly in the interior, that have not been completed, which has damaged trust. How must the community move forward if there are no resources or a budget to complete the project in a sustainable manner? The community cannot be abandoned halfway through the projects.
    - *safety:* the open pit forms a danger to the children. The community asked for the old soccer field to be restored; this will also require funding.
    - *access to sustainable reuse*, with special, undeniable attention to the local community. That area needs to be reused, but who will do it? The community must continue to do so even after CELOS, TAUW BV, EMSAGS and Haukes NV have left with the machines.

- *Water*: local knowledge is needed to know where a strong current is, why and where the creek has been relocated. The community had no confidence in change, that is why the community needs to be made excited by discussing what the community itself wants in order to embrace the project. Some of the questions asked include: can the community use the water again, and how safe is it? Can the community bathe and swim in the water, and can dishes and clothes safely be washed.

- *Land use*; also requires local knowledge.
  - Sustainable reuse of the land. The knowledge of the community is also needed to indicate where, for example, termites and insects occur; the community can provide an idea of which crops will or will not grow on a particular type of soil.

From introduction to validation session
After the introduction and regaining the community's trust, there have been a number of validation moments:

- In December 2025, information sessions started with the captain and the community of Compagniekreek
- In January 2026, various online and in-person sessions took place. There is also a WhatsApp group with the community to stay in touch if any issues arise.
- In February 2026, a session was held at the M-Tec building in Brokopondo. The community was mobilized to attend, but also to participate. A site visit took place, along with preparations regarding Haukes' work. The community was instructed on how to behave when the machines pass by and what to look out for; regarding security purposes someone from the community was involved to keep watch.
- From March through May 2026, Haukes carried out the work. The community was mobilized to ensure safety; not only for the machinery but also for the community to ensure not get too close while the work was being performed.
- From June through July 2026, a validation session was held to assess where the project had started, what its current status is and how the community has experienced everything so far. Haukes also gave the community the opportunity to suggest what could be done.
- In August 2026, the community was mobilized to participate in the validation workshop. *What are the next steps?* Even after Hauke's machines have left and the project with EMSAGS has ended, there is still a process that needs to continue. The community must take over and carry it forward, but still need that motivation.

Finally, Ms. Weewee ended the presentation with the quote: *"A technically restored site is not automatically socially successful"*

Validation of guidelines

*By **Jasper Wisman – Technical Engineer (TAUW)***

Mr. Wisman points out that several projects have been carried out, but that it is important for them to be reproducible so that the larger problem can be addressed.

Since large areas of land have been deforested, which resulted in the loss of fertile soil, guidelines have been developed and implemented to restore these areas. The guidelines focus on the challenge of:

- soil degradation - loss of soil functions
- mercury risk - this is not as significant at Compagniekreek

- loss of biodiversity - all the trees are gone; there is no biodiversity left
- disrupted water cycle
- limited resources

The basic principles on which the guidelines are based are:
- science – university studies among the local knowledge
- active participation with the community
- pragmatic – the guidelines need to be practical, feasible, and cost-effective.

The ultimately goal is to use these principles to:
- restore soil functions
- restore nutrient cycles
- improve water regulation
- enhance biodiversity and habitats.
- carbon sequestration, which has a positive effect on climate change.
- immobilization of contaminants, particularly mercury, so that it does not wash away and end up in bio-organisms, but remains bound.

This requires an integrated approach divided into six main steps:
- baseline measurements - understanding the current situation, gathering data, mapping the landscape together with the local community to know where the old pits are located that might have filled in again, and where the creek used to flow
- developing a restoration plan along with a decision-making framework. The decision-making framework is included with the guidelines, so that a plan can be created as well as defining what the goal can be. Rehabilitation does not necessarily mean restoring something to its original state; it is a choice about what should be done with it
- implementation and safety - safety both for the people working on the project and for the local population; during and after the project is completed.
- the execution of the soil restoration
- monitoring, evaluation, and adaptive management - monitoring is necessary in order to respond to unexpected issues; a plan to be implemented cannot succeed without being adaptive.
- governance and alignment of financing - aspects that run throughout the entire project.

In addition to the important case studies from Compagniekreek, also a few international case studies were viewed from Ghana, Indonesia, and Peru, where, for example, mercury was sometimes a major problem or where land rights were different. These lessons are also briefly summarized in the guidelines, so that the local knowledge of Compagniekreek can be combined with international experience. These guidelines should contribute to:
- the restoration of soil functions
- a safe living environment
- nature conservation
- stronger livelihoods for the local community, and

- resilient communities.

Theoretical framework

- Inputs:
    - initiative - someone has to take the initiative,
    - funding resources
    - partnership with the community.
    - local knowledge and materials
    - expertise - from people who have more experience.
- Activities:
    - conduct a thorough baseline assessment.
    - develop a solid plan for what needs to be done.
    - carry out soil restoration and integrate it into the community's livelihoods
- Outputs:
    - restored soil
    - restored soil functions,
    - to do something in nature or on agricultural land depends on the soil
- Outcomes:
    - increased food production or more natural areas
    - reduced health risks – such as immobilizing mercury
    - improved livelihoods – if crops can be harvested, then the community will also benefit financially.
- Impacts:
    - create more sustainable communities and environmental restoration at the ASGM site

Some practical steps listed in the guidelines

- *Community-driven work*. Some important questions to ask the community include: *What problems have actually been caused by the mine? What does the community actually want in return? What functions are important to them?* Decisions must be made in consultation with the local community. To that end, it is also important to use the FPIC framework (*Free, Prior, Informed, Consent*).
    - *Free*: consulting and communicating with the community should be done in a free and open manner. Allow the community the freedom to participate.; no coercion or manipulation.
    - *Prior*: it has to happen beforehand. What often happens during community consultations is that the plan has already been developed, and then presented to the community; this is considered as sufficient community involvement. But that's really more for show than it is actually effective; the community must be able to have a real influence on the plan.
    - *Informed*: the community need to be well-informed in their own language
    - *Consent*: reach a mutual agreement

- *Baseline assessment*
    - Participatory mapping is done together with the community: where were things located in the past, where are the mine tailings, and where could topsoil be sourced from? This also includes drainage patterns (hydrology)

- Technical soil sampling - analyzing the soil: *what kind and how much of organic matter is present, what is the nutrient status, and what is the level of contamination, both in the soil and in the water?* The soil sampling should be carried out as follows:
    - for filling the samples there must be no air inside; this in order to prevent the volatilization of substances e.g. mercury.
    - the samples need to be stored refrigerated
    - the samples need to be analyzed by a reputable laboratory for heavy metals, organic matter, and texture.
- Water sampling – what is the influence of water quality

This resulted in a map showing landscape elements and a spatial overview of soil and water quality and pollution.

- *Developing a recovery plan and a decision-making framework*
    - Contamination – for the Compagniekreek little contamination was encountered
    - Physical hazards - the edges of the pit were flattened.
    - Improving soil health - the topsoil has been modified and plants were added; various crops were used, as well as chicken manure.
    - The desired end goal does not have to be restoring the soil to what it once was. It also can involve nature conservation, agriculture and livelihoods or allowing the village to expand.
    - Constant monitoring and adjustment - the physical hazards must continue to be monitored constantly, and if hazards do indeed arise, then something needs to be done about them.

- *Developing a soil remediation plan*
    - *Soil balance*. Since it is expensive and difficult to bring in soil from elsewhere it is preferable to work with the soil that is already available and move it around. It is also important to estimate in advance how many square meters of usable soil are available and how deep it can be excavated; the difference between topsoil and less fertile soil. For the Compagniekreek the surface area of various components was examined: the average change in height, how much material was removed and how much material was placed back. A bulking factor was used since when soil is excavated, it becomes more voluminous. In this manner, a closed soil balance was achieved. Also, a conscious decision was made not to have trucks driving around in order to avoid extracting soil from the surrounding area; the costs were higher and there was a danger for trucks that had to drive past.
    - *Integration of livelihoods*:
        - Agroforestry and aquaculture could be an option; a pond filled with water where fish could be raised; this is not common in Compagniekreek
        - Nature restoration: creating small “islands” of vegetation so that it can continue to grow from there

- *Implemented workplan*
  - Making use of Standard Operating Procedures (SOPs): step-by-step instructions for field workers on what needs to be done
  - Health, Safety and Environment: what is being done to ensure safety requirements that nothing goes wrong for the environment as well as the workers
  - Involvement of local workers (capacity building)

The work plan must be flexible:
  - the seasons must be taken into account; rainy seasons make it more difficult to work with large equipment
  - be prepared for the unexpected.
  - allow room for deviations from the plan; there must be flexibility in scheduling, budget, and equipment. There is not always room for this due to deadline constraints

- *Soil restoration and vegetation development*
  - a process spanning several years; it is not realistic to expect the forest to be fully restored within 1 to 2 years, because the soil must recover, organisms must grow, and succession of plants, which means it will take years before any results are noticeable.

- *Monitoring, evaluation and adaptive management*
  - The more measurements are taken, the better; and the more is known, the easier it is to understand the effectiveness of what has been implemented:
    - increase or decrease of erosion
    - the survival rate of the seedlings; plant damage caused by herbivores, resulting in the death of various plants and the need for replanting; this is only possible if the plant population is constantly monitored
    - measuring organic matter to see the progress; a distinction can be made between the different strategies that have been tested on the plots.
  - This should result in adaptive management.
    - if something falls below a certain threshold, it should be possible to replant or make adjustments.
    - it is important to know that restoration is not a straight line; adjustments are necessary and must be planned for.

- *Governance and alignment of financing*
  - Everything that is done must be enshrined in regulations, compliance with national laws and the Minamata treaty. It must also be clear to know what the roles are by using the RACI- matrix; who is responsible, who is accountable, who must become the consultant, who must provide information and who must be informed. If this is clarified in advance, there will be a better understanding of what to expect.
  - Finance: there are various sources:
    - GEF program
    - Carbon Credits: carbon that is sequestered in the soil; there are markets where it can be traded. Carbon-poor soils from mine tailings and sand contain no carbon at all, but

if these soils are improved, this will have a positive effect on climate change, and credits can be earned for this.

- PES: Payment for Ecosystem Services

Long-term management must be secured through income for the land (e.g. sale of crops so that the local community benefits and preserves it).

Finally, Mr. Wisman indicated that the final phase of finalizing these guidelines is near, which will then be shared, and hopes that practitioners will also make use of these guidelines. Also, Mr. Wisman mentioned that with new expertise and case studies improvements will be possible, which is open to receiving.

Questions and comments

Name	Questions/Comments	Answers/Comments
Donovan Bogor (NMA)	These guidelines represent a milestone for Suriname. Which entity or agency should endorse these guidelines? Who is responsible for ownership and endorsement?	
Winston Wielson (Newmont Suriname)	As part of the community engagement, were there also discussions with small-scale miners? Was this target group also involved?	**Simone Weewee** No discussions have taken place with the gold prospectors. They are not currently active in the area.
	During a field trip to the area, the observation was made that the area where the project was carried out was flooding. Although the area has been elevated to some extent, is it still a risk? A sedimentation pond has been constructed to store sediment, which will eventually fill up. If water continues to flow, where will it flow to? Is there a risk that another flood will occur?	**Jasper Wisman** The flat plane was also taken into account; it has been lowered so that if more water does indeed arrive than expected, the water would always flow toward the east and continue down the creek. This has been lowered by approximately two meters, meaning it is always lower than the area that could potentially be developed and lower than the area where agroforestry is carried out. The water flowing out of the creek can always continue its path to the east. **Ilona van der Kroef** It is true that the sedimentation pond is slowly filling up with sediment. But that's also one of its main purposes: to provide new fine material that can be used to restore the other area. However, it will need to be emptied at certain times.

Name	Questions/Comments	Answers/Comments
	Since there is a sedimentation pond where sediment is stored, there is a possibility that gold will accumulate there. For example, if a “batée” (gold pan) is operated after 1 or 2 years, is there a certain risk that mining will resume there?	**Simone Weewee** This has also been discussed with the community: how will the area be monitored to prevent the rehabilitated area from being used again as a gold mining site. Both the community and the captain have indicated that they indeed no longer want that to happen, because they have seen the negative consequences it has caused. Two years ago, or during the COVID pandemic, small-scale gold miners tried their hand at gold mining and invested a great deal, but found nothing, so the activities were stopped. It’s unknown if they will return, but the community and the captain will make sure that doesn’t happen again.
Ravindre Patandin (ILACO Suriname NV)	Aquaculture was discussed. It was indicated that mercury accumulation might occur in the sediment and water. So, if aquaculture is practiced, it will encourage the breeding and use of fish there, even though most studies have indicated otherwise. Is that correct?	**Jasper Wisman** That’s a good point, which is why the baseline study, which assesses the quality of the sediment, is also important. If there is indeed mercury present as mercury naturally accumulates in the fat of fish, then that’s not an option. That’s why it is important to know the sites, both physically and chemically, before making these kinds of decisions.
Jerry Rasdan (Conservation International Suriname)	So much work has been done, and so much money and time have been invested. EMSAGS will be winding down in December. Will Compagniekreek, as a village, receive all the data and the results of all the studies that have been conducted, so that if, for example, there are other projects in the future, they can actually continue using that data?	**Jasper Wisman** The lessons learned are shared in the guidelines. The data is reported to EMSAGS, but CELOS will remain active in the area for a while longer and has access to the data as well. **Sandra Bihari (EMSAGS)** This study and research are primarily intended to inform government policy. Guidelines have been formulated based on thorough research conducted by reputable organizations; these guidelines are primarily intended for the Ministry of Natural Resources and the National Environmental Authority in establishing guidelines for the restoration of soil and demined areas.

Name	Questions/Comments	Answers/Comments
		EMSAGS is ending as a project, but the executing partners are the Ministry of Natural Resources and the National Environmental Authority. All the data will be transferred to the implementing partners, and that data will then be used to provide insights to the government. The EMSAGS project is not an independent project carried out on its own. It is a project initiated and carried out under government leadership; therefore, it is a government-led research project. All data is intended to support government policy, and it will also be up to the government to determine how further monitoring of this should be conducted.
Jerry Rasdan (Conservation International Suriname)	Would it be an idea, for example, to also implement an integrated biodiversity resource management system, so that the monitoring sessions can track changes over the years and the results can be seen as well?	**Jasper Wisman** It is indeed a good suggestion to set something up for this purpose. It certainly helps to have a responsible party in charge; how can this be continued in the long term?

Discussion on the Long-Term Vision for ASGM Site Restoration

*By**, Jasper Wisman - Technical Engineer (TAUW)***

A Mentimeter questionnaire was set up for this purpose, allowing participants to use a QR-code to provide their input on the proposed statements and participate in this discussion. Below the results of the participants are summarized.

Strategic Roadmap for the Restoration of Abandoned ASGM Sites in Suriname

There are several activities that can be carried out to move the project forward:

- *a national assessment and risk-based prioritization - in other countries, it can be seen that work is sometimes done in a very project-based manner, and that there isn't always a very clear national overview of where the problem actually lies or where the risks are highest.*
- *an international and private financing strategy – a lot of money is needed to solve these kinds of problems. Is this something that's very important?*
- *integration into existing policies and governance - the Surinamese government is already working on this, but are there other steps that could be taken in this regard?*
- *capacity building and scaling up through best practices - this means building the capacity of local populations, but also more broadly within the community, so that it actually becomes easier to carry out these kinds of projects.*

What is the most important action Suriname can take right now? And who should play a key role in this?

- Incorporation into policy and permit conditions
- Mapping out areas; this must be done by the Ministry of Natural Resources
- FPIC
- Inventory and prioritization. Without doing this, it is unclear who is responsible and how much budget is reserved
- Inventory of depleted gold mining areas
- Commitment from the government. This is a role reserved for the Ministry of Natural Resources, the NMA, and District Commissioners
- Incorporating the Action Plan into the National Development Plan 2050
- Capacity building within the government and enforcement agencies, as well as the local community
- Conduct a national inventory and incorporate the guidelines into policy as soon as they are finalized
- Incorporation into mining policy, because projects that are carried out separately and in mixed order have no chance of success
- Enforcement of laws related to illegal gold mining is important
- Capacity building combined with legal enshrinement and licensing. This must be done by the Ministry of Natural Resources
- Identifying the key locations where rehabilitation should take place, as well as vulnerable areas and biodiversity hotspots. This is a matter for the government, NGOs, and local communities
- Suriname can already tighten its policy on depleted gold mining areas through legislation. The Ministry of Natural Resources should play a key role in this.
- Good Legislation. This is a role for the government and institutions
- The community also needs to be educated, especially the gold miners. This is the responsibility of the government and the relevant ministries.
- The government must strengthen its agencies and renew its laws
- Implementation of legislation. This has not yet been fully implemented. As a result, there can be better monitoring and enforcement of policy.
- The Geological Mining Department, the Mining Authority, must publicly disclose the mining concessions. Spatial planning policy must be established when decisions are made regarding where rehabilitation can take place.
- The NMA must conduct an inventory in collaboration with the Ministry of Natural Resources
- Policy and governance. The central government is the most important stakeholder in collaboration with communities and other stakeholders
- Regulation of the gold sector and enforcement of mandatory rehabilitation in gold mining. This is a role for the Ministry of Natural Resources, Regulation and Organization of the Gold Sector, and the NMA
- Phasing out mining and focusing on green and sustainable development
- Good communication with the community and ensuring that everyone is involved; it is about sustainable development for everyone, including residents of the interior

- Inventory of ASGM areas. This is a role for the NMA
- A shortcoming of this project is that it excludes the other method of small-scale mining, namely using cyanide or the Jin Chan gold dressing agent
- Appointing the right people to ensure that rules and laws are followed in order to end corruption. This is the role for the Ministry of Natural Resources
- The government, including the relevant ministries and agencies, the private sector, science and the local population must take joint responsibility
- Reorganizing gold mining operations using the proper procedures and resources. This is the role for the government, ministry of Natural Resources, ministry of Regional Development and the closely involved community
- Education on traditional authority regarding how the Mining Act takes effect.

Questions and comments

Name	Questions/Comments	Answers/Comments
Jasper Wisman	Inventory of ASGM areas. Can this be explained in more detail?	**Preciosa Simons (Director of Mining)** To this day, the laws and regulations governing mining remain in effect; it is Mining Decree E58 of 1986. There is, however, a draft revised version, and the President's Office is currently reviewing it. But the Mining Act stipulates that mining areas must be rehabilitated. So, the question which ministry it should fall under is the Ministry of Natural Resources: mining policy, the responsibilities, and descriptions of the various departments.
Ilona van der Kroef	Who, specifically, should be responsible for getting this off the ground? Is there a particular ministry that should take the lead on this? (*referring to inventory of ASGM areas*)	
Jasper Wisman	That is a very clear answer. Are there already ongoing matters in this area regarding the inventory?	**Preciosa Simons** The EMSAGS project, one of the Ministry of Natural Resources implementing departments, is doing something; that is crystal clear!

Local government authority

- *In Ghana, for example, the community is only willing to invest if it can reap the benefits itself.*
- *Involving the local community and the local government by allowing them to benefit from mining; sometimes there are also problems where local authorities lack the resources to prevent mining.*

How can it be ensured that the (local) governing authority gains more control over the land and that the land is protected from the gold mining industry?

- Education is essential; recognition of the land rights of indigenous and tribal peoples
- Free, Prior, Informed and Consent must also be included in the draft mining law.
- Local communities do not have land rights. So, they won't be able to enforce much.

- Support the revised legislation. It is not just important for policymakers, but also for the society; if Suriname does not support this legislation, there will be no progress.
- Effective cooperation between involved parties and ongoing consultation
- Be involved in every aspect and use their perspectives to formulate policies for better sustainable development; this can be done by applying FPIC
- Define land rights and the authority of local governments in legislation, and strengthen enforcement of the mining decree. After 40 years, it is time to implement this more emphatically.
- Good regulations between the community and the relevant ministry; what responsibility does such a village have?
- Give local communities a clear voice in the development of plans.
- By identifying what the situation is regarding the issue of land rights
- Digital overview of all granted concessions, including all mining data. Control and monitoring by the Geological Mining Department ("GMD") or Mineral Authority ("DAS")
- Regulate the ASGM sector so that, at the start of ASGM activities (planning), local authorities and traditional leaders determine how and where mining takes place.
- This is going to be difficult. Because men who may also be head of households need to be able to earn money locally. This is going to cause a lot of friction.
- Resolve land rights issues so that local communities are granted more say. Diversification of gold mining to provide livelihoods for local communities.

Questions and comments

Name	Questions/Comments	Answers/Comments
Jasper Wisman	What is happening now with regard to the recognition of the land rights of indigenous and tribal peoples?	**Erwin Kamil (Cooperation SSMP)** The law protecting the residential and living areas of tribal and indigenous peoples has been approved but has not yet been promulgated. Therefore, it cannot be implemented.

Ongoing initiatives

What initiatives are currently underway to bring about change? These include initiatives by the national government or local governments, as well as international organizations and the private sector. ***What kinds of initiatives are these parties taking?***

- The prospective Suriname Mineral Resources Authority ("DAS") must inspect and monitor small-scale gold mining
- Launch of digital registration for small-scale miners. This must be done by the government.
- Monitoring of fauna recovery after rehabilitation
- The indigenous peoples have submitted ten laws to the National Assembly to bring changes on all relevant issues.
- TROPENBOS Suriname - Upper Suriname Project; UNDP Suriname - initiatives involving local village communities
- Indigenous peoples have developed their own FPIC protocol; hopefully, the Tribal people will follow as soon as possible.

- A number of local communities do not want gold mining operations in their area because of the devastation caused in other areas.
- International organizations including IUCN NL, which helps generate funding, in collaboration with local research NGOs for biodiversity monitoring following the rehabilitation of depleted mining areas.

Questions and comments

Name	Questions/Comments	Answers/Comments
Jasper Wisman	The prospective Mineral Authority of Suriname is to control and monitor small-scale gold mining. Has this just been established or is it in the process of being established at this very moment?	**Zamorah Jasadirana (GMD)** Work has been underway for several years to establish this authority with the intention of ultimately achieving better monitoring in the field of mining; however, it is more about legislation and regulations. Everything regarding the Mineral Authority has essentially been put in place, but the legislation and regulations are not being approved or are still under review and remain under review. As long as there are no laws and regulations, enforcement cannot take place and work cannot be carried out as desired.

Mr. Wisman indicated that enforcement is indeed based on existing laws and regulations, and that with these kinds of restoration projects in some countries where there are more laws and regulations, for example in Australia, funds must be set aside at the very beginning of a mining project to ensure that rehabilitation actually takes place; the law forms the foundation for all other initiatives.

Finally, Mr. Wisman ended the discussion and thanked everyone for their participation and presence. Also, a special word of thanks was given to Haukes NV, CELOS, EMSAGS and captain Pina and the community of Compagniekreek.

Questions and comments

Name	Questions/Comments	Answers/Comments
Ravindre Patandin (ILACO Suriname NV)	There are laws and regulations, but it is as if they can't be used to ensure compliance. Why? Because it's easier to hide behind them rather than look for the specific phrases and words within them to make use of them, while the other side of the table has long since figured it all out and knows exactly what should and shouldn't be done. These days, an ESIA is required for almost everything, and most of those mining areas have absolutely no ESIA. There is a law that needs to be enforced. Why isn't it happening? People shouldn't hide behind laws and regulations; the focus should be on what is possible and what is available. There is a law from 1986; that is 40 years ago. In the 1970s, small-scale mining was smaller and grew explosively in the 1990s and 2000s. If that is known, why, 40 years later, is there still a need to conduct an inventory to determine where the priorities lie? There is legislation for ESIA, and yet these things aren't happening. The ESIA requires monitoring to be conducted and data to be collected as a result. Mining operations must have a closure plan; the budget and other details must be provided in advance.	**Donovan Bogor (NMA)** There are indeed plenty of regulations. Another challenge is not only identifying the violation, but also investigating and prosecuting these criminal offenses. Environmental crimes are a new type of crimes; these are not the conventional crimes known as capital crimes or economic crimes. The environmental crimes require an expert reconstruction of the offense. Because if that isn't done and such a case is brought before a criminal court or the Public Prosecutor's Office, and the case file isn't strong, it will pose a problem. So, enforcement is important, but capacity must also be improved in investigation and prosecution.

Closing remarks

*By **Preciosa Simons - Director of Mining at the Ministry of Natural Resources***

Ms. Simons mentioned that for the Ministry of Natural Resources, and in a broader sense for Suriname as a whole, the workshop provided a very promising start in terms of how rehabilitation could work and what the possibilities are. Soil conditions are not the same everywhere, and geologically speaking, gold will not be found everywhere either. But having an indication of how to proceed is ideal. The fact that guidelines have been derived from this is already a very good start. Also, Ms. Simons indicated that small-scale gold miners must be made aware of the need to leave the environment in very good condition. *"It is important to work together to raise awareness, but also to promote economic development and sustainability; the balance between economic development and the conditions necessary for life must always be attainable to humans and animals"*, Ms. Simons cited. The goal is for other communities to be informed as well and provide their cooperation. This is very important because rehabilitation is becoming increasingly important; the area is being restored to a condition as close as possible to what it was. The NMA discussed environmental crimes, but when people operate using a trial-and-error, hit-and-run, or slash-and-burn approach, it becomes very difficult to hold them accountable.

Lastly, Ms. Simons gave thanks to the project coordinator of the EMSAGS project, the NMA as a partner, TAUW BV, and the local community of Compagniekreek.

Ms. Salamat thanked all the speakers, experts, partners, and participants for attending the validation workshop and wished everyone a pleasant day.

APPENDICES

Appendix 1. Meeting Agenda

Site Rehabilitation of Abandoned Artisanal and Small-scale Gold mining sites at Compagniekreek

NATIONALE VALIDATIE WORKSHOP

PROGRAMMA

Tijd	Onderwerp	Presentatoren
08:00 – 08:30	**Registratie en ontbijt**	
08:30 – 09:00	**Opening en Welkomstwoord**	Sandra Bihari, project coordinator EMSAGS Ilona van der Kroef, TAUW (Online spreker) Preciosa Simons, Directeur Mijnbouw, Min. NH
09:00 – 09:30	**Algemene Introductie Bodemherstel ASGM Sites Suriname**	Marcel Hoosbeek, Wageningen Universiteit (Online spreker)
09:30 – 10:00	**Algemene Introductie "Site Rehabilitation of Abandoned Artisanal and Small-scale Gold mining sites at Compagniekreek" (Project video)**	Jasper Wisman (TAUW) (Online spreker)
10:00 – 10:15	**Uitvoering van de grondverzet werkzaamheden**	Ashwin Jhinkoe (Haukes NV)
10:15 – 11:00	**Aanleg en onderhoud agroforestry plots**	Anwar Helstone (CELOS)
11:00 – 11:15	**Groepsfoto/ Pauze**	
11:15 – 11:30	**Samenwerking met de lokale gemeenschap & stakeholders**	Simone Weewee & Landbouwer Gemeenschap
11:30 – 12:00	**Validatie Best practices/ Guidelines for Soil Restoration at post ASGM sites**	Jasper Wisman (TAUW) (Online spreker)
12:00 – 12:30	**Discussie Langtermijn Visie ASGM sites & Toekomstige projecten**	Jasper Wisman (TAUW) (Online spreker)
12:30 – 13:00	**Sluiting**	Preciosa Simons, Directeur Mijnbouw, Min. NH
13:00 – 14:00	**Lunch**	

Appendix 2. List of participants

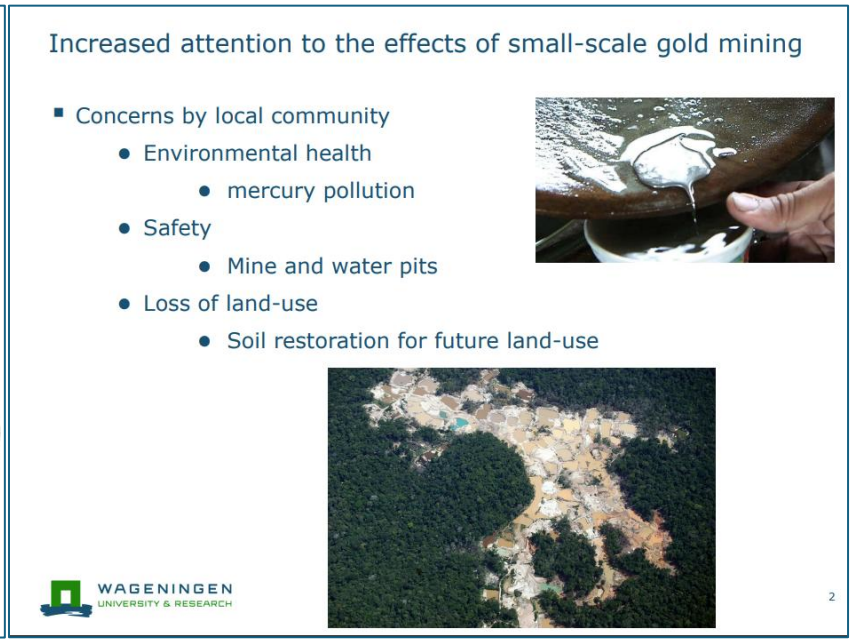
Last name	First name	Organization	Position/role/Comments
Alfaisi	Fabiëne	Stinasu	RvC member
Aloema-Tokoe	Josien	Organization of Indigenous Peoples in Suriname	Chairman
Azib	Héla	Universiteit van Oxford, on behalf of Tropenbos Suriname	Student
Bihari	Sandra	EMSAGS	Project Coordinator
Binda	Sharoma	NZCS/CMO	Lab manager
Bogor	Donovan	National Environmental Authority	Special Advisor
Brave	Iwan	Journalist	Journalist
Breinburg	Marcel	Photographer of Ministry of Natural Resources	
Chandoe	Bhartie	US Embassy Suriname	Economic/ESTH Assistant
Chickoer	Kishen	CELOS	Agroforestry field coordinator
Danoe-Alimoenadi	Marjory	National Environmental Authority (NMA)	Sr. EIA Officer
Debisarun	Kawiesh	Ministry of Oil, Gas and Environment	Policy maker
Doest	Luciano	Mulokot	
Dompig	Priscilla	Conservation International Suriname	M&E Coordinator
Druiventak	Anthony	S3D	Director
Emanuels	Raymondo	Bauxite Institute Suriname	Team Leader (Department Control & Monitoring)
Fernand	Minouschka	EMSAGS	Finance Officer
Gemeente Celos	Amamba	CELOS	
Haukes	Jeroen	Haukes NV	Core Operations Officer
Helderberg	Ellesca	Ministry of Natural Resources	Communication officer
Helstone	Anwar	CELOS	Head of Agricultural Production Department
Huisden	Max	SAFE Globally	Chair
Jairam	Soedeshchand	CELOS	Director
Jasadirana	Zamorah	GMD	Policy maker
Jbara	Tedy	Cariminco NV, CanaSur Gold/SHMR	Director/vice-chair
Jhinkoe	Ashwin	Haukes NV	Engineer
Kadosoe	Vanessa	NeoWild	Secretary/researcher

Last name	First name	Organization	Position/role/Comments
Kalka	Ratan	Suriname Business Development Center (SBC)	Manager Business Support Services
Kamil	Erwin	Cooperation SSMP UA	Chair
Captain + 6 villagers of the Compagniekreek community			
Majana	Novella	EITI Suriname	National Coordinator
Munusami	Videsha	Suriname Standards Bureau	Standards Officer
Ngu Chin Tjon	Ansmarie	CELOS	Head of Chemical Laboratory
Ouboter	Paul	NeoWild	Director/researcher
Pansa	Rianne	Volcanic Resources Suriname N.V.	Ass. Operations Manager
Patandin	Ravindre	ILACO Suriname NV	Director
Raafenberg	Michiel Glenn	Rosebel Gold Mines N.V.	Sr. Associate Legal & Corporate Affairs
Rasdan	Jerry	Conservation International Suriname	GIS and senior coordinator
Saman	Rachel	CELOS	Research associate
Samoender	Iwan	NMA	Deputy director MEA and VV
Sanné	Lindsey	Ministry of Natural Resources/GMD	Acting head of the Geological and Mining Services/ Policy advisor Ministry of Natural Resources
Sewsahai	Ashvin	National Environmental Authority	Deputy director, Directorate of Supervision and Enforcement
Simons	Preciosa	Ministry of Natural Resources	Director of the Directorate of Mining
Soetodrono	Emmy	EMSAGS	Project Monitoring & Evaluation
Somopawiro	Rene Ali	Foundation for Forest Management and Production Control (“Stichting Bosbeheer en Bostoezicht”)	Director of Research and Development
Sosrojoedo	Eric	EMSAGS Project Management Unit	Logistics Officer
Tujeehut	Maurice	Planet GOLD	Project Manager
Weewee	Simone		Consultant

Last name	First name	Organization	Position/role/Comments
Westerlow	Sharon	Ministry of Regional Development	Policy adviser
Wielson	Winston	Newmont Suriname	Lead ASM – External and Government Relations
Wortel	Verginia	CELOS	Head of Forest Management Department
Kuipers	Ank	Freelance Journalist	
Emanuelson	Vanessa	Radio 10	
		ATV	
Neuve	Patrick	Apintie TV	
Prentice	Joshua	BCRC-SCRC Caribbean	Research Officer (***online attendee***)
Hoosbeek	Marcel	Wageningen University	Associate professor (***online attendee***)
Verboom	Ellen	TAUW BV	Consultant Contaminated Sites and Nature Based Solutions (***online attendee***)
Praamstra	Tobias	TAUW BV	Consultant Soil, Groundwater and Sustainability
Van der Kroef	Ilona		Team Leader (***online attendee***)
Wisman	Jasper	TAUW BV	Technical Engineer (***online attendee***)
Fokke	Boudewijn	Boudewijn Fokke Sol Consultancy	*(**online attendee**)*

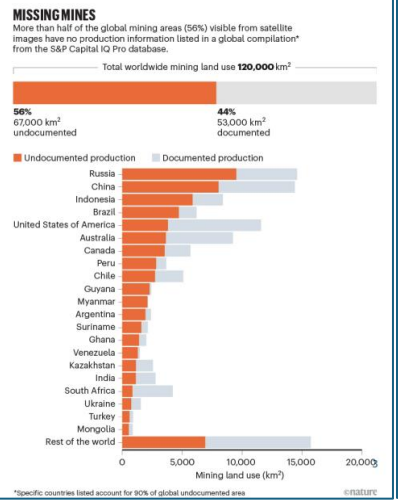
Appendix 3. Presentations

Presentation: Soil function Restoration after Small-scale Gold mining: Case study at Compagniekreek
By *Marcel Hoosbeek*



Increased attention to effects of small-scale gold mining

- Global concern
  - For instance, *Nature comment* my Maus et al. 2024
    - "Setting the agenda in research"
    - Call for better documentation of mining effects on the environment



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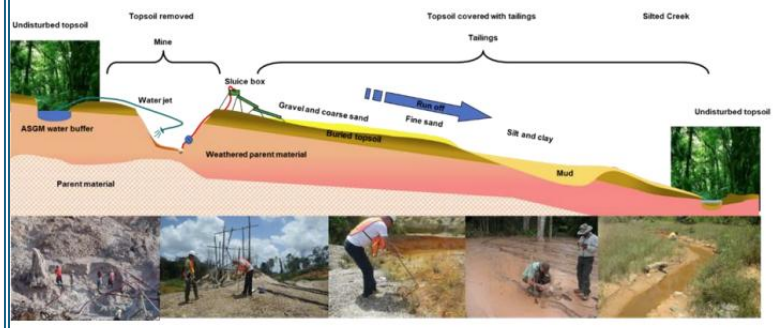
ASGM practices



Zone 1&2	Zone 3	Zone 4 & 5	Zone 6	Zone 7
Forest	Mine pit	Sluice box	Mud pit	Floodplain

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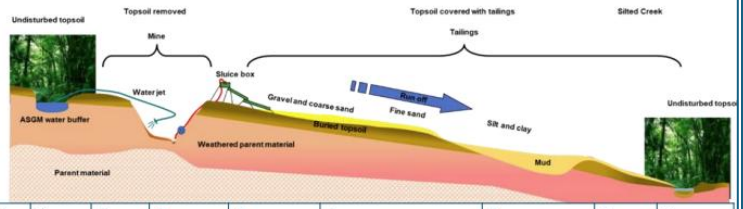
4

ASGM - Relocation of soil material and sediments



Zone	1 upland	2 foot hill	3 mine pit	4 sluice box	5 downhill sluice box	6 mud pit	7 flood Plain	8 creek
Loss	none	soil	soil and saprolite	silt, clay, organic matter	silt, clay, organic matter	silt, clay, organic matter	silt, clay, OM	
Gain				coarse sand	coarse and medium sand	silt, clay, organic matter	sand	suspend-ed load
Health	mercury deposition			mercury spill and deposition				adsorbed mercury

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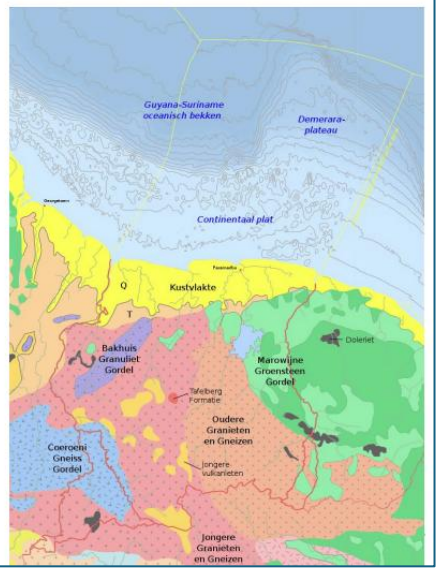
5

Geology

- Green stone belt
  - Rosebel series
  - coarse textured schists



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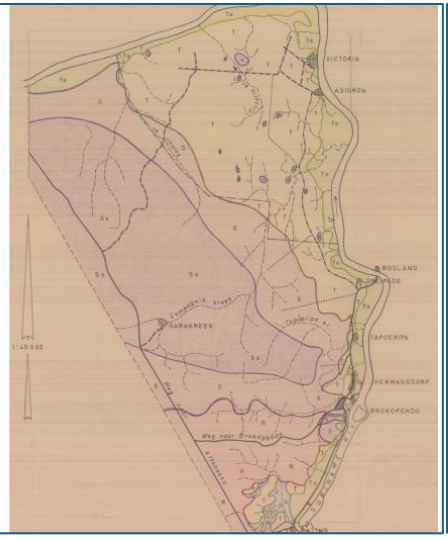
Soils

- **Ss** higher schist-landscape of the Rosebel series; plateaus, hill-tops and steep slopes. Well-drained plinthitic soils, sandy loam, loam, clay loam.
- **S** lower part of the schist landscape
- **T** terraces
- **T_0** floodplain
- **K** creek-valley landscape



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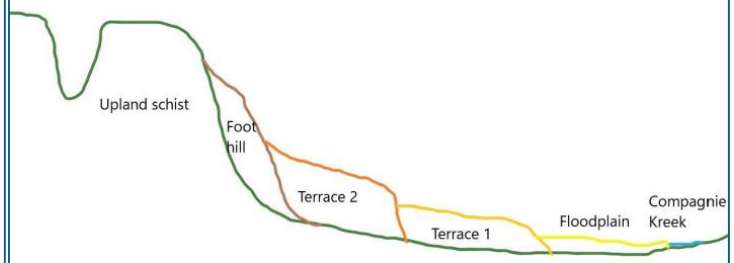
Upland – terrace – creek valley landscape



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Representative soil profiles

Terrace 1, Coebitie series, soil profile BRO-11

Hor	Soil depth (cm)	Description	Gravel %	Sand %	Silt %	Clay %	C% WB	pH H_2O	CEC mEq /100g	BS %
A1	0 – 17	7.5YR 4/2 sandy loam, fine subangular blocky, fine to large biopores	0.0	57.9	31.7	10.4	2.1	5.3	3.5	39
A3	17 – 29	10YR 6/4 sandy loam, 5YR 5/8 mottles, fine subangular blocky, fine and few large biopores	0.0	73.8	17.7	8.5	0.44	5.4	1.1	
B21	29 – 55	10YR 7/6 sandy loam, 5YR 7/8 mottles, fine subangular blocky, fine and few large biopores	11.4	75.5	15.5	9.0	0.18	5.1	1.0	25
B22	55 – 110+	10YR 7/8 sandy loam, 5YR 5/8 mottles, fine subangular blocky, few fine biopores	0.0	77.1	15.2	7.7	0.16	5.0	0.8	11

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Representative soil profiles

Floodplain

Kreek complex series

soil profile BRO-10

Hor	Soil depth (cm)	Description	Gravel %	Sand %	Silt %	Clay %	C% WB	pH H_2O	CEC mEq /100g	BS %
A1	0 – 13	10YR 4/3 loam, fine subangular blocky, fine to large biopores	0.0	37.7	36.6	25.7	2.55	5.0	7.6	62
AB	13 – 21	10YR 6/4 clay loam, fine subangular blocky, fine to large biopores	0.0	40.0	32.1	28.0	1.92	4.6	4.8	25
B	21 – 49	10YR 6/4 clay loam, few fine 5YR 6/8 mottles, fine subangular blocky, few fine biopores	3.6	30.9	31.6	37.5	0.90	5.0	3.1	17
2A1g	49 – 73	Buried profile. 10YR 6/3 clay, 2.5 YR 6/6 mottles, medium subangular blocky, few fine biopores	0.0	13.8	36.9	49.1	0.90	4.8	3.7	10
2A3g	73 – 88	10YR 7/3 clay, 5YR 5/8 mottles, fine subangular blocky, few fine biopores	0.0	13.3	38.4	48.4	0.83	4.8	3.2	8
2Bg	88 – 110	10YR 6/3 clay, 5YR 4/8 mottles, fine subangular blocky, few fine biopores	0.0	21.0	37.6	41.5	0.82	4.8	2.9	30
3Cg	110 – 150	10YR 6/3 sandy loam, 10R 5/8 mottles, few fine biopores								
4Cg	150 +	10YR 7/2 loamy coarse sand, 7.5YR 8/6 mottles, no structure, no pores								

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Representative soil profiles

Based on comparable geology and geomorphology, the representative soil profiles may serve to

- get an impression of the pre-ASGM situation
- assess types of soil material that have been affected by ASGM practices
- provide an aim for soil restoration

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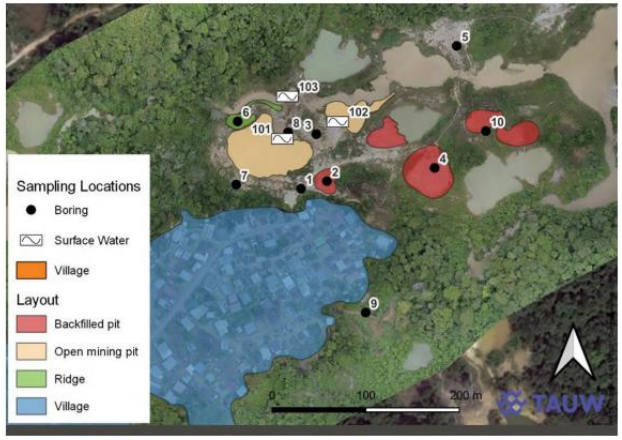
Initial field work



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Restoration of ASGM site

1. Physical landscape phase
   - create a suitable surface for several land-use types
     - estimate volumes of soil / sediments to be moved
     - reduce erosion
2. Environmental health phase
   - Mercury distribution
   - immobilization of Mercury
3. Soil restoration phase
   - creation of topsoil (soil structure and nutrients)
   - planting of nursed vegetation
   - vegetation growth

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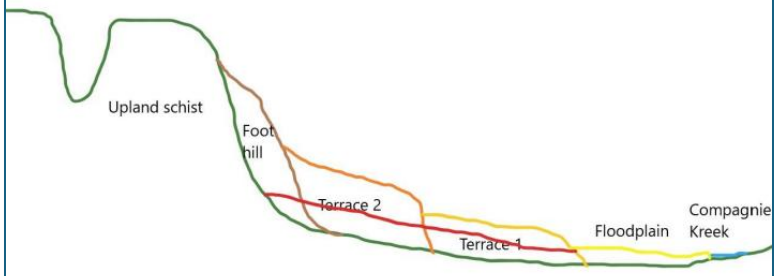
Phase 1 - landscaping

- Re-relocation of large soil and sediment volumes to refill mine pits, water pits and mud pits
  - however, a large part of the sediments left the area
    1. fill-in mine and mud pits with area-foreign material (e.g. clean mine tailing from Zijin Rosebel gold mines)
    2. fill-in with coarse material from zones 4 and 5
       - not enough

       → ***denudation of the levelled landscape***

Phase 1 – denudated landscape



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Phase 2 – Environmental health

UNEP 2012 Reducing mercury use in artisanal and small-scale gold mining – a practical guide

High mercury emission and deposition →

high mercury deposition

mercury condensation and recycling

low mercury deposition

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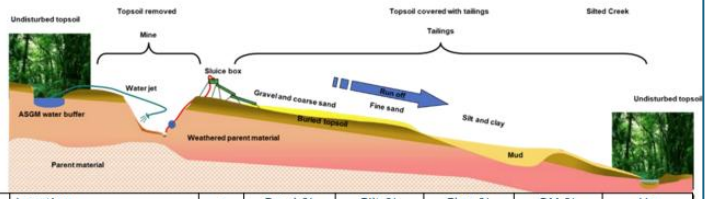
Phase 2 – Environmental health



Zone	Location	n	Sand %	Silt %	Clay %	OM %	Hg µg g^{-1} d.w.
1	primary forest soil	4	21.9	35.5	42.6	8.4	0.20
2	secondary forest soil	4	22.7	36.3	41.0	6.5	0.20
3	near mine pit sediment	7	41.9	34.1	24.1	1.9	0.20
4	sluice box sediment	8	62.9	21.9	15.2	1.6	0.78
5, 6	near and in mud pit	6	36.5	36.9	26.6	2.0	0.25
7	floodplain upstream	3	35.8	28.2	36.0	2.2	0.31
7	floodplain downstream	3	30.0	36.5	33.6	2.2	0.30

Soil and sediment texture data, organic matter percentage (weight) and mercury concentrations (µg g^{-1} dry weight) for different locations at the Witi Creek ASGM site (Arets et al. 2006).

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Phase 2 – Environmental health

- Miller et al. (2003) provided ranges of background mercury concentrations in soils along rivers (µg g^{-1})
  - Tapajas river, Brazil 0.043 – 0.143
  - Negro river, Brazil up to 0.212
  - French Guyana 0.122 – 0.318
  - Madeira river, Brazil 0.406 – 0.054
- Kroonenberg et al. (2022) observed soil Hg concentrations of 0.20 – 0.80 µg/g due to soil forming processes within the Guiana Shield region
- Arets et al. (2006) regarded their mercury concentrations lower than expected and postulate that part of the mercury is not locally retained but flushed away by run off to the stream.

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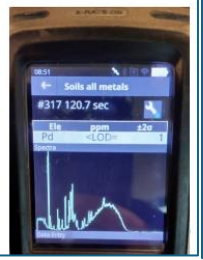
Phase 2 – Environmental health

- Results of Hg inventory at Compagnie Kreek area
  - handheld XRF analyser detected mercury levels below the detection limit in all soil and sediment samples
  - laboratory analyses
    - soil: <0.05 – 0.12 µg/g
    - sediment: 0.27 – 0.54 µg/g
  - all Hg data are within the 'natural' range



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Phase 2 – Environmental health

- We hypothesize that Hg-vapor was

deposited and diluted over surrounding forest area

adsorbed by soil particles and transported as suspended load by the river

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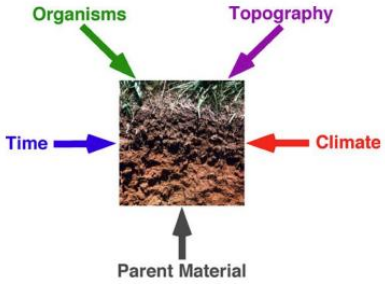
Phase 3 – Soil restoration

- Parent material
  - mix of sand, slit and clay
- Topography
  - levelled landscape
- Climate
  - given
- Organisms
  - seed bank
  - nursed trees
  - soil organism
  - nutrient cycling
- Time ...



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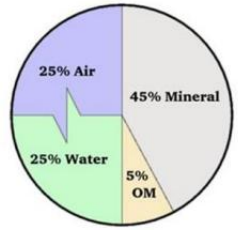
Soil components

- Solid particles
  - mineral
    - clay, silt, sand, ...
  - organic matter
    - plant remains, microorganisms, humus
- Water
  - soil solution contains dissolved organic and inorganic solutes
- Air
  - N_2, O_2, CO_2, traces of other gasses



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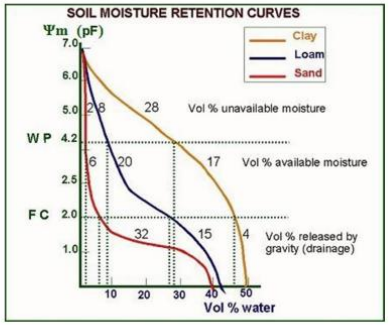
Phase 3 – Soil restoration

Creation of a topsoil by mixing

- sand
- silt and clay
- organic matter

Large pore size distribution due to variety in particle sizes

- high infiltration capacity
- high gas diffusion (O_2 in, CO_2 out)



Phase 3 – Soil restoration

Addition of organic matter will be crucial to

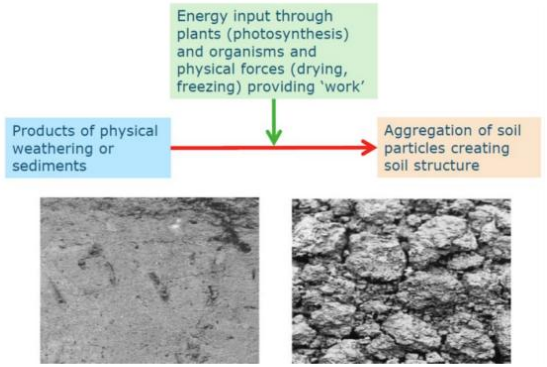
- Improve soil structure
- Enhance water holding capacity
- Provide CEC (mineral CEC is expected to be negligible)
- Immobilize mercury
- Provide nutrients (NH_4^+, NO_3^-, PO_4^{3-}, etc.) after mineralisation

Phase 3 – Soil restoration

Sources of organic matter

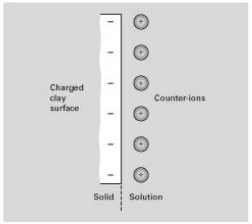
- by-products of agricultural production
- (limited) litter collection

Soil structure

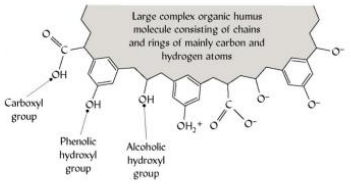


The charged particle – solution interface

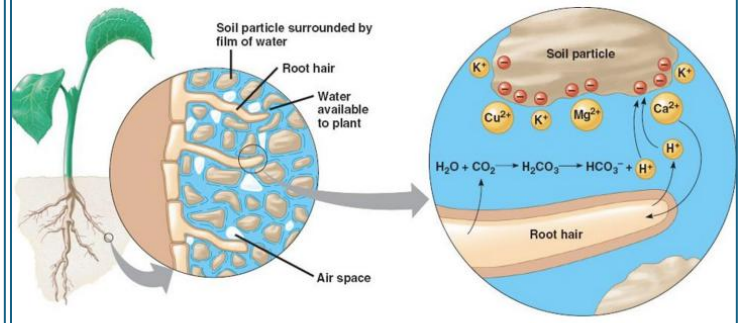
- Clay minerals have thin platy structures
  - negative surface charge



- Organic matter
  - negative surface charg
    pH > 3

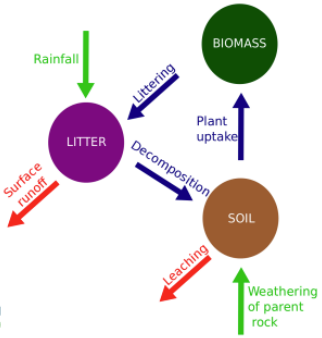


Cation exchange



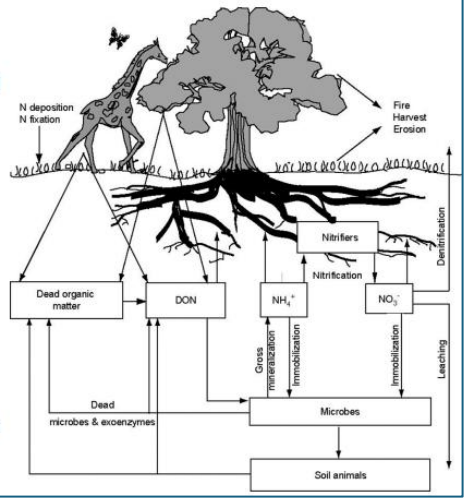
Nutrient cycling

- Nutrient flows between
  - inorganic pool – mineral soil
  - biomass pool – living organisms
  - organic pool – litter and SOM



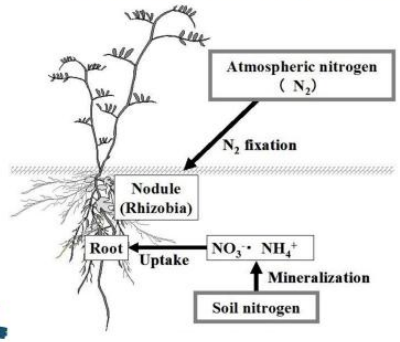
N cycling

- OM is decomposed by extracellular enzymes and N is released as DON (dissolved organic N)
- DON is mineralised to NH_4^+
- Nitrifying bacteria derive energy from oxidising
  - $NH_4^+ \rightarrow NO_2^-$
  - $NO_2^- \rightarrow NO_3^-$
- Denitrification: bacteria reduce NO_2^- and NO_3^- to gaseous NO, N_2O, and N_2



N_2-fixation

- Plants living in symbiosis with N_2-fixing bacteria use two sources of N
  - regular uptake of NO_3^- and NH_4^+ from soil solution
  - uptake of NH_4^+ after N_2-fixation from the atmosphere



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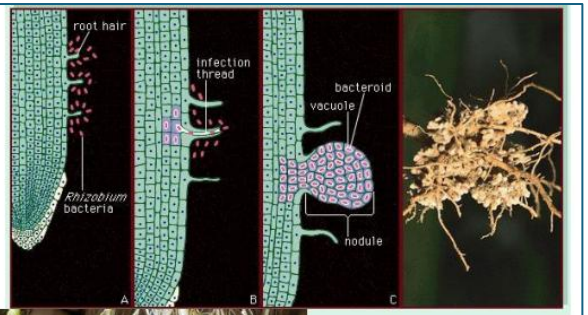
Symbiotic N_2-fixation



- The plant provides carbohydrates to the endophyte
- Amino acids formed from the reduced N are made available to the host

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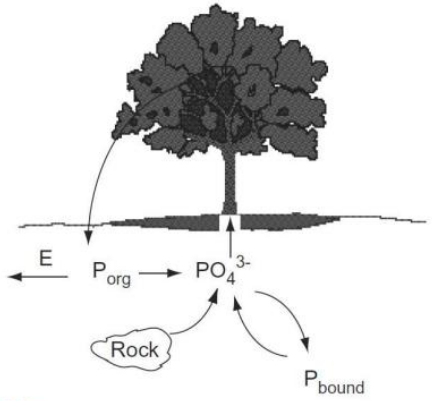
P-cycling

- Next to N, P is an essential element for plant growth



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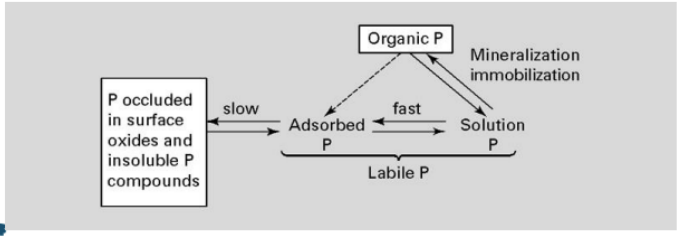
Chapin et al 2011 Principles of terrestrial ecosystem ecology

Soil P availability

- After weathering and/or mineralization, soluble ortho-P (depending on pH either PO_4^{3-}, HPO_4^{2-} or $H_2PO_4^-$) is
  - immobilized by micro-organisms
  - taken up by roots
  - adsorbed onto surfaces where it can be readily desorbed
  - occluded by (almost) irreversible adsorption onto Fe- and Al-oxides



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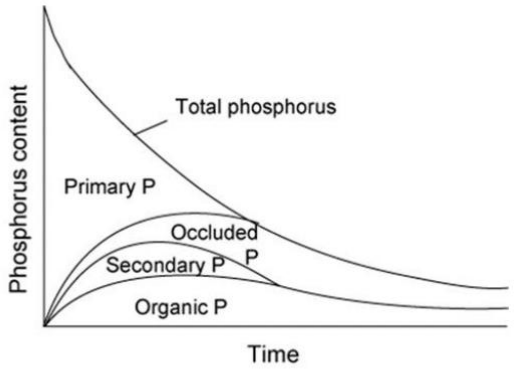
Soil P fractions change over time



Effect of weathering and soil formation on the distribution of P (Walker and Syers 1976 in Chapin et al. 2006).

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Vegetation recovery

Many studies indicate that natural recovery of vegetation at ASGM sites is limited due to

- disrupted soils
- occurrence of water pits

Solutions include (for references see desktop study)

- refilling of pits
- creation of viable topsoil
- reintroduction of seedbank
- replanting of local tree species

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Restoration pathways

Expected situation at Compagnie Kreek

- soil contaminated? No
- mine pits backfilled? No

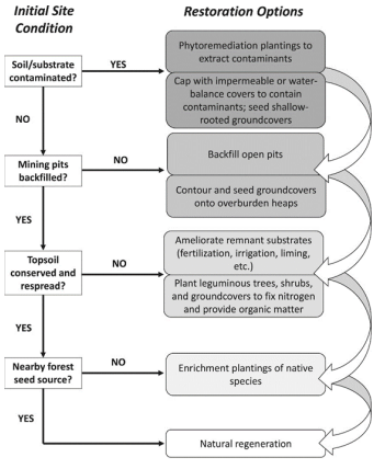
→ backfill open pits

→ ameliorate remnant sediments with OM

→ plant leguminous vegetation

→ add native seeds and (nursed) plants

→ further natural regeneration



Restoration options at former ASGM sites (Timsina et al. 2022)

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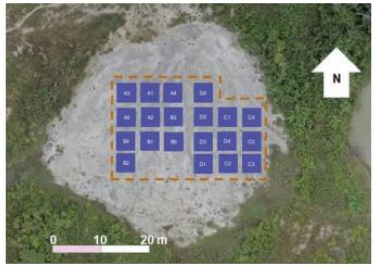
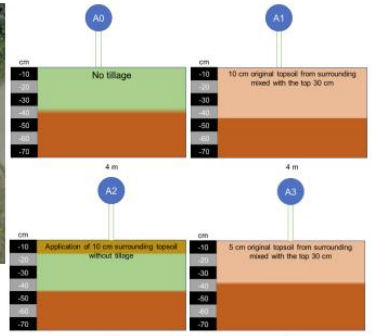
Pilot plots soil restoration





Layout and preparation of 20 plots

- 5 different treatments

Pilot plots soil restoration

- First crop
  - Mucuna Sp (Okray Pesi)
    - high yielding leguminous (N-fixing) forage crop
    - quick ground cover
    - green manure for enhancing soil structure and fertility
- Second crop
  - Cassava
    - after cutting Okray Pesi and tillage treatments
    - planting of Cassava cuttings

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Preliminary results pilot plots

Treatment	Vegetation cover %		Number of Cassave plants		Organic matter % - analyzed	
	mean	se	mean	se	Mean	se
0	2.0	0.9	3.0	0.0	0.7	0.0
1	52.5	11.4	3.5	2.0	1.7	0.2
2	60.0	9.4	4.0	1.4	3.1	0.4
3	27.5	4.1	2.3	0.8	0.9	0.1
4	62.5	4.1	3.5	1.6	1.0	0.1

- ANOVA-model with Trmt (fixed factor) and Block (random factor)
- Vegetation cover affected (P=0.01) by treatments "+ 10 cm topsoil (with or without tillage)" and "clay + humus"
- No treatment effect on number of cassava plants (ants, grasshoppers, ...)
- OM% significantly enhanced by addition of 10 cm topsoil (without tillage)

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Preliminary results pilot plots

- Of the 5 amendment and tillage treatments, the application of 10 cm local topsoil without tillage was most successful
  - ease of application
  - introduction of seedbank, soil structure, organic matter
  - but, limited water holding capacity (drought sensitive)
    - especially below 10 cm depth
  - removal of topsoil may cause ecosystem damage elsewhere
- Okray Pesi increased organic matter and induced nutrient cycling

6 November 2024 | 24 November 2024 | 22 Januari 2025 | 16 Februari 2025

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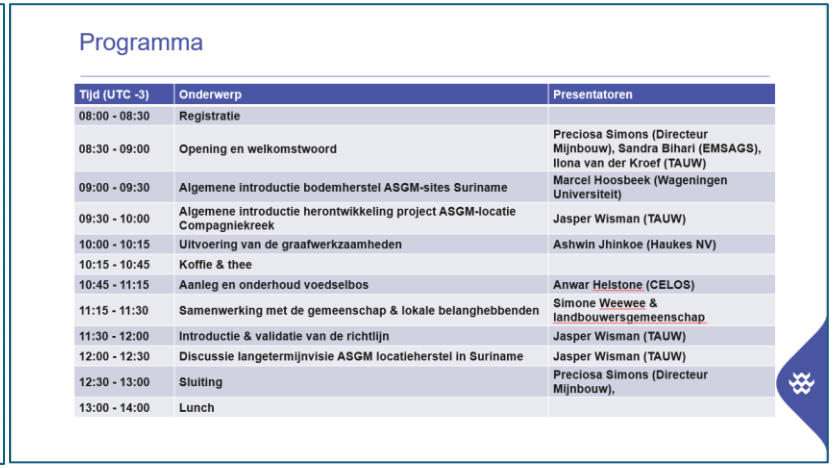
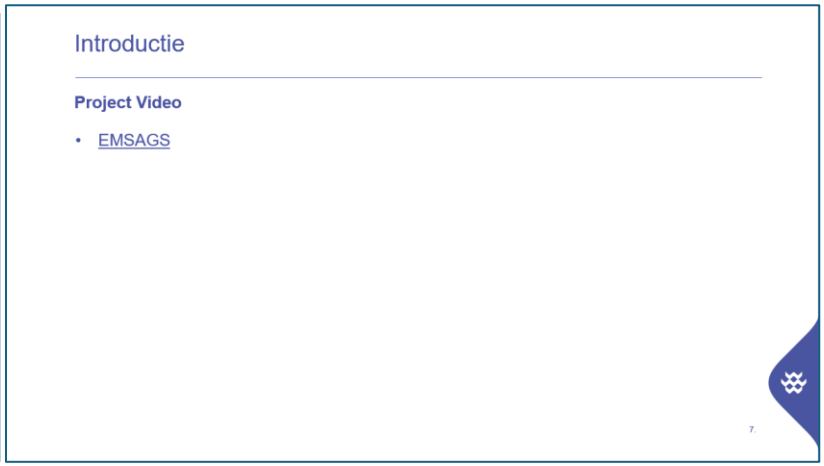
Presentation: General Introduction to the Redevelopment project at the ASGM site at Compagniekreek
By Jasper Wisman



Tijd (UTC -3)	Onderwerp	Presentatoren
08:00 - 08:30	Registratie	
08:30 - 09:00	Opening en welkomstwoord	Preciosa Simons (Directeur Mijnbouw), Sandra Bihari (EMSAGS), Ilona van der Kroef (TAUW)
09:00 - 09:30	Algemene introductie bodemherstel ASGM-sites Suriname	Marcel Hoosbeek (Wageningen Universiteit)
09:30 - 10:00	Algemene introductie herontwikkeling project ASGM-locatie Compagniekreek	Jasper Wisman (TAUW)
10:00 - 10:15	Uitvoering van de graafwerkzaamheden	Ashwin Jhinkoe (Haukes NV)
10:15 - 10:45	Koffie & thee	
10:45 - 11:15	Aanleg en onderhoud voedselbos	Anwar Helstone (CELOS)
11:15 - 11:30	Samenwerking met de gemeenschap & lokale belanghebbenden	Simone Weewee & landbouwersgemeenschap
11:30 - 12:00	Introductie & validatie van de richtlijn	Jasper Wisman (TAUW)
12:00 - 12:30	Discussie langetermijnvisie ASGM locatieherstel in Suriname	Jasper Wisman (TAUW)
12:30 - 13:00	Sluiting	Preciosa Simons (Directeur Mijnbouw),
13:00 - 14:00	Lunch	



Herontwikkeling Project in Compagniekreek

Activiteiten en Partners

8.

Projectfasen Compagniekreek

Van bodemrestauratieproof tot richtlijn (2024 - 2026)

9.

Best Practices for Soil Restoration at post-ASGM Sites

Doel en hoofdstappen

- Gericht op iedereen wie herstel van ASGM sites wil uitvoeren
- Inclusief niet-technische communicatie tool / praatplaat
- Lessen van de twee projecten bij Compagnie Kreek zijn inbegrepen

Hoofdstappen:

- Nulmetingen
- Herstelplan opstellen inclusief besliskader
- Implementatie protocollen en veiligheid
- Bodemrestauratie
- Monitoring, evaluatie en adaptief management
- Governance en afstemming financiering

Best Practices for Soil Restoration at post-ASGM Sites

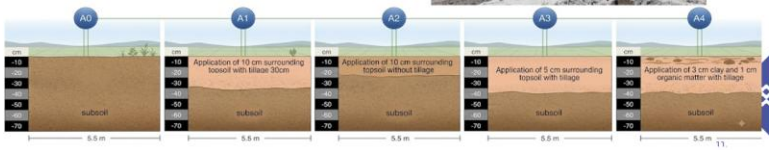
Participatory Guideline for the Guiana Shield and Tropical Regions

10.

Bodemrestoratie Proef

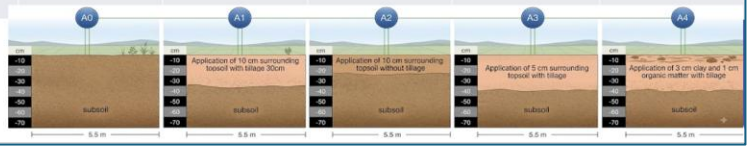
Ontwerp

- 20 proefvelden waarop vier methoden voor bodemverbetering worden vergeleken
- Groenbemesters / Leguminosae (Okra Pesi): geteeld van november 2024 t/m mei 2025
- Cassave: geplant van mei 2025 tot en met januari 2026, met tussentijdse herbeplanting
- *Maar: veel last gehad van vraat en droogte*



11.

	0	1	2	3	4
Textuur	Grof zand met fijn grind	Lemig zand	Lemig zand	Lemig zand met grind	Lemig grof zand met kleibrokken
Kleur	Bruingrijs - grijs	Grijsgeelbruin	Grijsbruin	Grijsgeelbruin	Grijsgeelbruin
Begroeid oppervlak	<5% begroeid oppervlak	**30-80% begroeid oppervlak**	**30-70% begroeid oppervlak**	20-40% begroeid oppervlak	**50-70% begroeid oppervlak**
Overlevende casave planten	3 cassaveplanten	**1-10 cassaveplanten**	**1-8 cassaveplanten**	1-5 cassaveplanten	**1-9 cassaveplanten**
Gemiddelde %OM in 2024	0.7	1.6	**1.9**	0.8	0.7
Gemiddelde %OM in 2026	<0.7	1.7	**3.1**	0.9	1



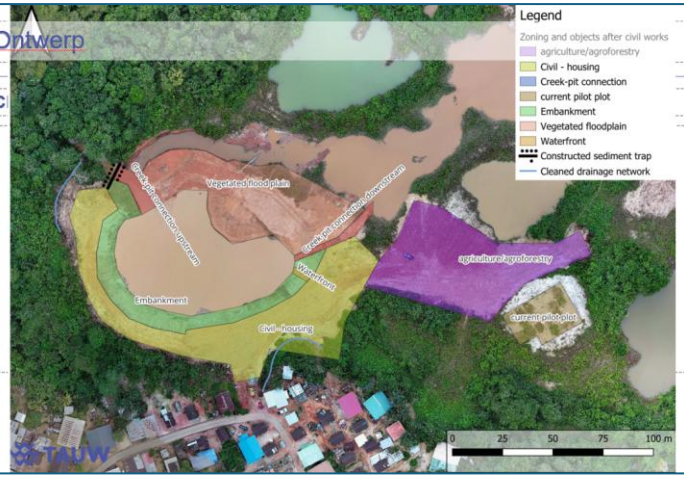
Herontwikkeling

Projectdoelen

- Veilig maken
- Dorpsuitbreiding
- Waterkwaliteitsverbetering
- Bodemherstel

- Gebaseerd op wensen en gesprekken met de gemeenschap!

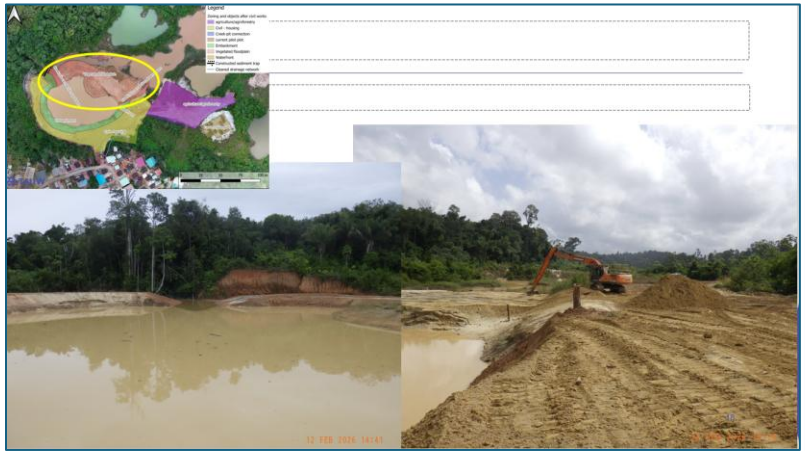
Ontwerp



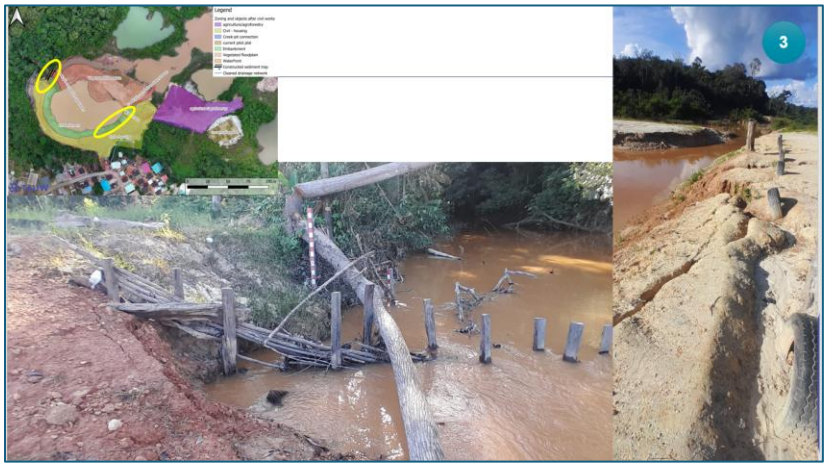
Herontwikkelingsproject

Nul-onderzoek


Grondverzet – luchtfoto voor werkzaamheden
0 25 50 75 100 m
TAUW




3

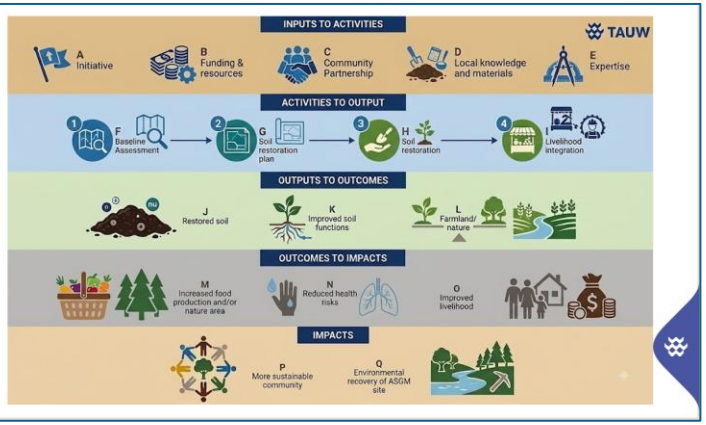


Resultaten

DOEL	RESULTATEN	OPEN EINDJES
Veilig maken	Randen van pit afgevlakt	Meer erosie op deze hellingen dan verwacht => herprofilering en gras aanplanten
Dorpsuitbreiding	Ong 3800 m2 uitbreiding Voetbalveldje aangelegd	
Verbetering waterkwaliteit	Sedimentdam aangelegd Pit geopend als sedimentatie basin	Schade aan dam door omgevallen boom, mogelijk verplaatsing voor optimalisatie
Bodemherstel	3350 m2 agroforestry aangelegd **%OM meer dan verdubbeld => van gem. 1,8 naar 3,9 %)**	
Gebaseerd op wensen en gesprekken met de gemeenschap!	Constant gesproken over wensen en haalbaarheid	

23.

Presentation: Validation of Guidelines
By Jasper Wisman



Gemeenschaps-gestuurd werken

Rehabilitatie begint bij de gemeenschap volgens FPIC

Belangrijke vragen:

- Welke problemen veroorzaakt de oude mijn?
- Wat wil de gemeenschap terugkrijgen?
- Welke functies zijn belangrijk?

1	2	3	4
Free	**Prior**	**Informed**	**Consent**
Vrijwillig gegeven, zonder dwang of manipulatie	Ruim vóór besluit of start van activiteiten	Volledige, begrijpelijke informatie in eigen taal	Collectief besluit via eigen besluitvormings-wijze

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Nulmeting (Baseline Assessment)

- **Doel**: Begrijpen van de fysieke en sociale context.
- **Aanpak**:
  - Participatieve Kartering: Lokale kennis benutten (waar werd gemijnd? waar stroomde water?).
  - Technische Bodembemonstering:
    - Textuur & Nutriënten (Klei, organische stof).
    - Verontreiniging van bodem en water (Kwik hotspots identificeren met XRF).
  - Water bemonstering
- **Resultaten**:
  - Een kaart met duidelijke landschapselementen (bijv. mijnput, tailings, kamp van mijners met sluice box en daal).
  - Ruimtelijk overzicht van bodem en water kwaliteit en vervuiling

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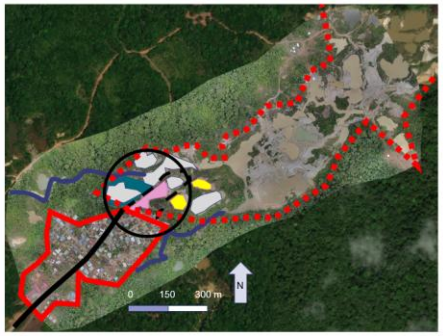
Nulmeting (Baseline Assessment)

Voorbeeld kartering bij Compagnie Kreek



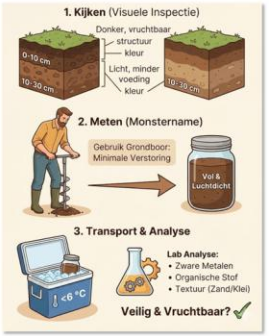
- De locatie met de verwijderde bovengrond als gevolg van de goudmijnig (rode stippel lijn)
- Het project gebied (zwarte cirkel)
- De mijnputten met stilstaand water (lichtblauwe polygoon)
- De opgevulde mijnputten zonder stilstaand water (gele polygoon)
- De locaties van grof mijnafval (lichtbruine polygoon)
- De locaties van fijn mijnafval (bruine polygoon)
- De kreek (blauwe lijn)
- Het dorp (rode polygoon)
- De wegen en voetpaden (zwarte lijn)
- De gemeten diepte van deze mijnputten
- Enzovoort.

Nulmeting (Baseline Assessment)

Bodembemonstering

Gebruik een grondboor om verstoring te minimaliseren; zo voorkom je dat vluchtige stoffen (zoals kwik) ontsnappen.

- Vullen: Doe de grond direct in een glazen pot. Vul deze tot de rand (geen lucht) en sluit hem luchtdicht af.
- Koelen: Plaats de potten direct in een koelbox (< 6 °C) en transporteer naar laboratorium
- Analyse: Laat het laboratorium testen op zware metalen, organische stof en textuur.

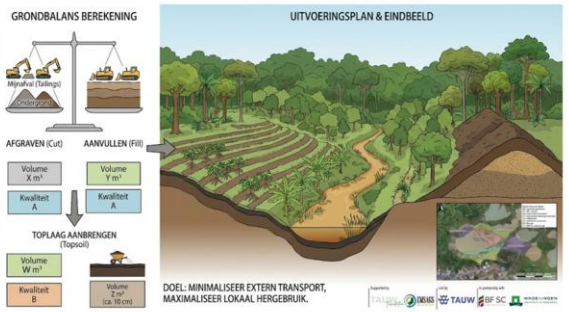


Herstelplan opstellen inclusief besliskader

Besliskader

Opstellen Bodemherstelplan

Grondbalans



Opstellen Bodemherstelplan

Grondbalans voorbeeld – Compagnie Kreek

Zone	Geschatte oppervlakte (m^2)	Geschatte verandering in hoogte (m)	Geschatte hoeveelheid verwijderd materiaal (m^3)	Geschatte hoeveelheid geplaatst materiaal (m^3)
Gebied voor dorpsuitbreiding	4,000	1	0	4,000
Overstromingsvlakte	3,000	-2	6,000	0
Flauwe oever	1,500	0	0	0
Agroforestry	3,350	1	0	3,350
Bovenstroomse verbinding pit en kreek	150	-2,5	375	0
Benedenstroomse verbinding pit en kreek	150	-2,5	375	0
Totaal	**12,150**	-	**6,750**	**7,350**

Opstellen Bodemherstelplan

Integratie van levensonderhoud

- **Integratie Bestaansmiddelen**:
  - **Agroforestry**: Combinatie van bomen en gewassen (voedselbos).
  - **Aquacultuur**: In verontdiepte mijnputten met veilige afgevlakte kanten
- **Natuurontwikkeling**:
  - **Applied Nucleation**: Planten van "eilanden" met bomen om vogels/zaden aan te trekken (goedkoper dan volledige aanplant).

Implementatie werkplan

- **Van Plan naar Actie**:
  - Standard Operating Procedures (SOPs): Stap-voor-stap instructies voor veldwerkers.
  - HSE (Veiligheid): Verplichte PBM's en risico-analyses.
  - Betrokkenheid: Training van lokale arbeidskrachten (capaciteitsopbouw).

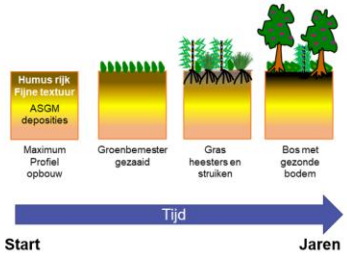
Maar flexibel

- **Planning**:
  - Rekening houden met seizoenen (regentijd vs. droge tijd).
  - Voorbereid zijn op onverwachte zaken
  - Ruimte om af te wijken van plan

Ideaal is

- Ruimte in de planning
- Ruimte in het budget

Bodemrestauratie en vegetatie ontwikkeling



Monitoring, Evaluatie & Adaptief Beheer

- **Meten is weten:**
  - Erosie, overlevingskans zaailingen, bodem pH, organische stof.
  - Participatieve Monitoring: Gemeenschap meet indicatoren.
- **Adaptief Beheer:**
  - Reageren op resultaten: "Als <60% overleeft, dan bijplanten".
  - Herstel is geen rechte lijn; bijsturen is noodzakelijk.

Handleiding voor Bodemherstel op verlaten ASGM-locaties

Governance & Afstemming Financiering

- Verankering:
  - Regelgeving: Aansluiting bij nationale wetten en het Minamata Verdrag (NAP).
  - Rollen: Duidelijke afspraken via een RACI-matrix (Wie is verantwoordelijk?).
- Financiering:
  - Zoeken naar diverse bronnen: GEF, Carbon Credits, PES (Payment for Ecosystem Services).
  - Lange termijn beheer borgen via inkomsten uit het land (bijv. verkoop gewassen)

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Discussie langetermijnvisie ASGM locatieherstel

Jasper Wisman

Discussie langetermijnvisie ASGM locatieherstel

Strategische Roadmap voor het Herstel van Verlaten ASGM-Locaties in Suriname

- Nationale Inventarisatie en Risicogebaseerde Prioritering
- Gediversifieerde Internationale en Private Financieringsstrategie
- Verankering in Bestaand Beleid en Governance
- Capaciteitsopbouw en Opschaling via Best Practices

Wat is de belangrijkste actie die Suriname nu kan nemen? En wie moet hier een belangrijke rol in spelen?

51.

Discussie langetermijnvisie ASGM locatieherstel

Gezag van (locale) overheid

- Les uit Ghana: gemeenschappen zijn pas bereid te investeren in herstel bij garantie dat de vruchten hieruit ook hun toekomen
- Denk aan lokaal gezag wat kan profiteren van mijnbouw, of juist onvoldoende middelen heeft om hier gezag over uit te oevenen

Hoe kunnen we ervoor zorgen dat het (lokaal) bevoegdgezag meer controle krijgt over het land en wordt beschermd tegen de goudbouw mijn industrie?

52.

Discussie langetermijnvisie ASGM locatieherstel

Lopende initiatieven

- Denk aan initiatieven vanuit:
  - Nationale overheid
  - Lokale overheid
  - Internationale organisaties
  - Private sector

Welke initiatieven lopen er op dit moment om verandering te weeg te brengen?

53.

Discussie langetermijnvisie ASGM locatieherstel

Financiering

- Denk bijvoorbeeld aan:
  - (Inter)nationale financiering
  - Koolstofkredieten
  - PES
  - CSR

Wat is er nodig om via koolstofkredieten rehabilitatieprojecten te financieren?

54.

Handleiding voor Bodemherstel op verlaten ASGM-locaties

De 7 Stappen van Site Rehabilitation

1. Nulmeting (Baseline Assessment)
2. Risicogebaseerde besluitvorming
3. Opstellen bodemherstelplan
4. Integratie van levensonderhoud
5. Implementatie flexible werkplan
6. Bodemvorming en vegetatie ontwikkeling
7. Monitoring, Evaluatie & Adaptief Beheer

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Doel van de handleiding

- Het geven van een integrale leidraad voor de revalidatie van ASGM locaties
- Hiermee wordt de gebruiker instaat gesteld om verlaten ASGM-locaties te transformeren van milieulasten naar veilige, productieve activa voor lokale gemeenschappen, door:
  - Gemeenschaps-gestuurd
  - Wetenschappelijk onderbouwd
  - Pragmatisch en financieel haalbaar
- Op basis van
  1. Wetenschappelijke stand van zaken
  2. Internationale ervaringen (literatuur)
  3. Lessen van twee projecten bij Compagnie Kreek

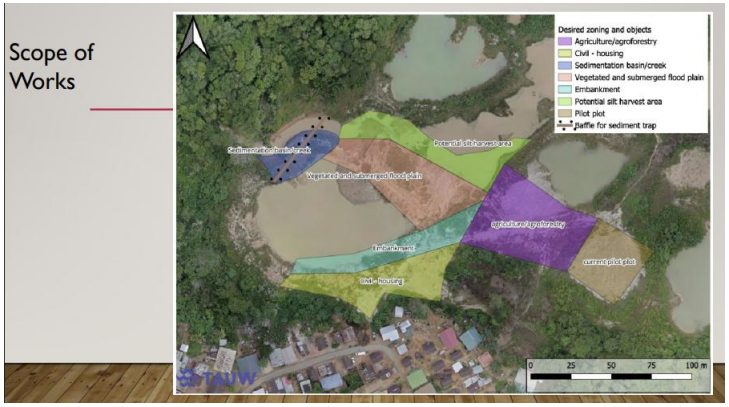
58.

Wat staat er in de guidelines?

- Conceptueel raamwerk
- Uit te voeren activiteiten (wat moet er gebeuren, waarom, en hoe)
  - Nulmetingen
  - Herstelplan opstellen inclusief besliskader
  - Implementatie protocollen en veiligheid
  - Bodemrestauratie
  - Monitoring, evaluatie en adaptief management
  - Governance en afstemming financiering
- Case studies

59.

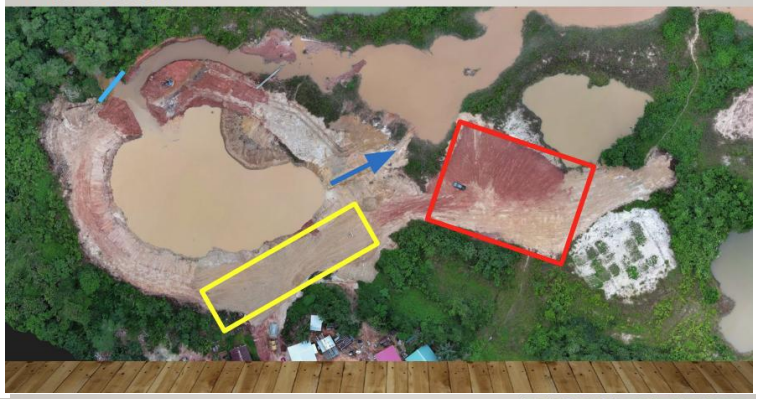
Presentation: Execution of earthmoving works by Haukes N.V.
By Ashwin Jhinkoe



Project metrics:

Description	Quantity
Aanleg aanvoerwegen	100-150m
Grondverzet	Approx. 1600m3
Aanleg sediment trap	1x
Grondverzet tbv civil housing	Approx. 1000m2
Project execution	2 weeks

After execution



Lessons learned

Sediment trap

Observation

Prensentatie: Participatory Site Rehabilitation at Compagniekreek
By Anwar Helstone

Background of the partnership with TAUW BV

- **Community Communication and participation**
  - *Primary Liasion*
  - *Consultation leadership*
  - *Resource coordination*
- **Implementation supervision and Training**
  - *Field support*
  - *Technical assistance*
  - *Capacity building*
- **Installation of Agroforestry Plots**
  - *Biomass production*
  - *Nursery*
  - *Planting*
  - *Irrigation*
- **Monitoring and maintenance**
  - *Maintenance and planning*
  - *Field monitoring and reporting*
- **Final Evaluation and Validation**
  - *Final assessment*
  - *Validation Forum*
  - *Guidelines update*

CELOS Vision on Agroforestry

- Livelihood alternative
- Soil fertility management
- Resilience against climate change and economic fluctuation
- Food and wood production
- Agro ecology and biodiversity balance

Reshape of the Compangie Kreek landscape

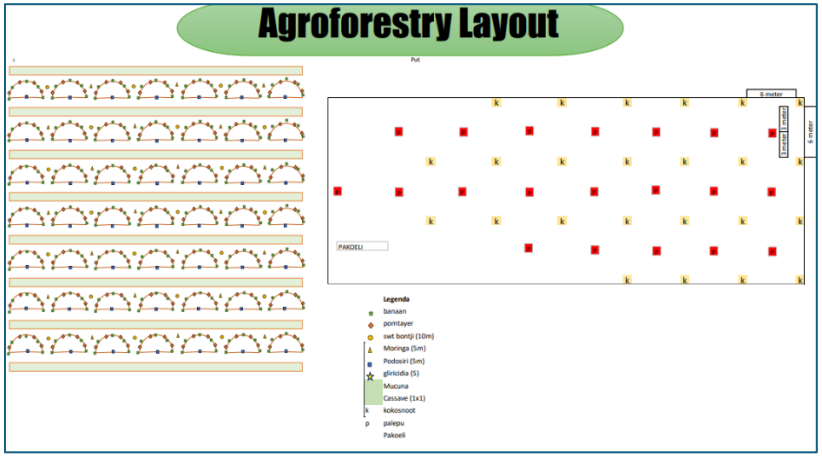
- May 2024- May 2025 => introduction of Celos Agroforestry System (CAFS) in Compangie Kreek
- Connection started in June 2025
- "based on" exit strategy and post project activity Celos implemented:
  - Coaching and training
  - Inclusion in other Celos training & learning activities
  - Collaboration with TuMaw group of Brownsweg
  - WhatsApp group based on a Celos community development approach

The Area: 3000 m^2

Landscape Agroforestry Design based on:

- Celos Agroforestry knowledge development
- Studies by Tauw
- Studies of other stakeholders in the Emsags program
- Desktop review

Agroforestry Layout

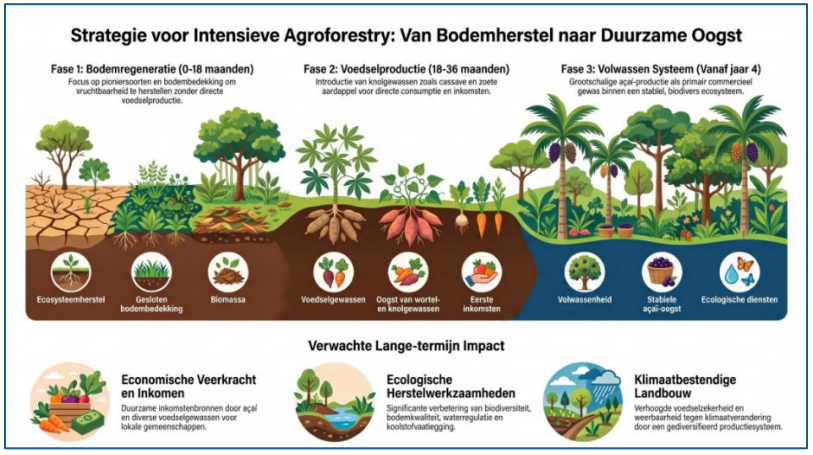


Intensive CELOS Agroforestry system

Main goal : Development of a agroforestry landscape as an alternative for the livelihood for food production and ecological services

Approach :

- **Year 1/2 (0 – 18 months)** : Stimulate the vegetative growth by having a closed soil cover based on a diversity of plants. The crops in this phase won't be used for consumption.
- **Year 2/3 (18 – 36 months)** : Production of food crops (root and cormels)
- **After year 4** : Production of Acai berries and selected food crops



Overview of crops and trees (Area 3000 m)		
Crop / Tree	**Total Inplant**	**Unit**
Plantain (Musa sp.)	**235**	Cormel
Acai (Euterpe olereaceae var. BRS-Para	**84**	Seedling
Tania (Xanthosoma sp.)	**160**	Seedling
Moringa (M olefeira)	**59**	Seedling
Inga (Inga sp.)	**8**	Seedling
Mucuna (Mucuna sp.)	**755**	Seed
Bittere Cassave (M.esculenta)	**1060**	Stem cut
Gliricidia (G. sepium)	**61**	Stem cut
Vigna (Vigna sp.)	**1530**	Seed
Maïs (Zea mais)	**1342**	Seed
Kokos (C. nucifera)	**24**	Seedling
Palepu (Bactris gasipaes)	**20**	Seedling
Pakoeli (Platonia insignis) Teak (*Tectona grandis*) Cedre (*C.odorata*)	**0**	Seedling

Period 2026	Activity	Output	Result
Februari – maart	Terreinvoorbereiding	Grondboringen, palen plaatsen, veiligheidsmaatregelen, uitzetten	Terrein voorbereid
Maart	Bedden en plantgaten	C-vormige ruggen, halve manen/boogjes en plantgaten	Plantstructuur aangelegd
Maart – april	Eerste aanplant	Banaan, podosiri, pomtayer, moringa, sweet bontjie	Meerdere gewassen aangeplant
April – mei	Uitbreiding aanplant	Mucuna, cassave, gliricidia, capucijner	Demoveld verder ingericht
Mei – juni	Bodembeheer	Mulchen en bemesten	Bodem bedekt en bemest
April – juni	Monitoring	Opkomst en plantgezondheid gecontroleerd	Uitval vastgesteld en opgevolgd
Mei – juli	Inboeten	Nieuwe planten en cassavestokjes aangebracht	Uitgevallen plantmateriaal vervangen
Juni – juli	Gewasbescherming	Bestrijding van geconstateerde aantasting	Schade aangepakt
Juni	Training/participatie	Samen met deelnemers bomen geplant	Praktijkgerichte participatie




Challenges & Opportunities

- Significant growth was observed in an area characterized by poor soil within a six (6) month period
- Effective insect pest management was essential during the initial growth stage of the crops.
- A Living Lab was created as a platform for science-based learning and experimentation.

CELOS intends to sustain the developed agroforestry landscape through ongoing stakeholder collaboration.

- Ensuring community participation throughout the project's development and implementation
- Biomass incorporated every six (6) months to enhance soil fertility and organic matter content.
- Soil fauna and soil development processes monitored every three (3) months.
- Regular measurement of crop and tree species growth performance.
- Water quality monitored to ensure suitability for irrigation.
- Air quality monitoring conducted to assess environmental conditions.

Presentation: The importance of community engagement - The Case: Compagniekreek
By Simone Weewee

VALIDATIE WORKSHOP

The importance of community engagement

The case: Compagniekreek

[13-08-2026] | [Courtyard by Marriot] | [S. Weewee]

Gemeenschap informeren

December 2025

Kennismaking met de activiteiten

Waarom rehabilitatie van verlaten mijnlocaties belangrijk is

LAND

- Lokale kennis:
  - (her)gebruik van het land op een duurzame wijze;
- Wat valt er nog te doen nadat er daar goud is gewonnen?

WATER

- Lokale kennis:
  - De kreek is verplaatst;
  - De open put is zeer gevaarlijk;
  - Geen vertrouwen in verandering
- Kunnen de mensen het water weer gebruiken en hoe veilig is dat?
- Kunnen wij erin baden, zwemmen, de afwas doen en onze kleren wassen?

MENSEN

- Lokale kennis van begin situatie;
- Rehabilitatie gaat niet alleen over landherstel. Het gaat voornamelijk ook over herstel van vertrouwen, veiligheid, toegang tot duurzaam (her)gebruik met speciale, niet te onderschatten aandacht voor de lokale gemeenschap.

Van kennismaking naar validatiesessie

Dec. 2025
Informatiesessies

Jan. 2026
Online en fysieke sessies

Febr. 2026
Sessie in MTEC/Site visit/voorbereiding m.b.t werkzaamheden Haukes

Maart – Mei 2026
Werkzaamheden Haukes/Community mobiliseren om de veiligheid te waarborgen

Juni - Juli 2026
Validatiesessie

Aug. 2026 Mobiliseren om deel te nemen aan deze workshop/forward

Appendix 4. Pictures




PRECIOSA SIMONS





Participatory Site
Rehabilitation Pilot at
Compangiekreek
Paramaribo, 12 August 2026
Helstone A. MSc.
COURTYARD
CMS AGS