

# Education and Remediation Efforts to Reduce Mercury Use and Contamination in the ASGM sector of Puno and Madre de Dios.

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# About Pure Earth

Pure Earth (formerly known as “Blacksmith Institute”) is a not-for-profit organization founded in New York in 1999.

- Pure Earth partners with governments, NGOs and community groups to mitigate health risks at contaminated sites in low- and middle-income countries
- Pure Earth is the secretary of the Global Alliance on Health and Pollution (GAHP), of which MINAM is a member



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# ARTISANAL AND SMALL-SCALE GOLD MINING IN PERU

- ASGM releases up to 1,000 tones of Hg/year, over half of which originates from South America.
- Aprox. 500000 miners in the formalization process.
- In recent decades, Peru has experienced an explosion in ASGM, with about 40,000 illegal miners operating in the Madre de Dios Region alone.
- In Madre de Dios, authorities declared a state of emergency in eleven districts in 2016 due to mercury poisoning in local populations.
- ASGM has caused the removal of almost 100,000 ha/247105.38 acres of rainforest in Madre de Dios since 1985, with about 65,000 ha/160618.5 acres deforested from 2010 to 2017
- In December 2018, miners were formalized for the first time in Madre de Dios (4500 in formalisation process)
- In 2019, the Peruvian government began implementing “Operation Mercury 2019,” a 2-year plan to eradicate the illegal mining sector “La Pampa.”



# Project Objectives

## 1. Selection and Evaluation of Sites

Conduct environmental evaluations on the accumulation of mercury in the environment with the support of local miners.

## 2. Health Improvement

Organize educational workshops on the effects of mercury on human health and the environment

## 3. Mercury-Free Mining Techniques

Develop lucrative mercury-free mining techniques

## 4. Remediation Restoration

Implement initiatives that improve soil quality and reduce exposure to mercury by affected communities



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# ENVIRONMENTAL REMEDIATION OF OLLACHEA, PUNO

The Ollachea Remediation Plan included the following components:

- Improvement of tailings ponds
- Removal of soil contaminated with mercury
- Installation of platforms for storing discarded tailing bags
- Improvement of rainwater drainage system



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# IMPROVEMENT OF TAILING PONDS

- Due to inadequate containment and insufficient capacity, tailing leaking occurs
- The project team improved 12 tailings ponds for mine owners who promised to go mercury-free. Ponds can store approximately 500 tons of tailings for a period of 5 to 6 months
- Increasing storage capacity increases economic income by enabling miners to collect more tailings for commercialization ( $[Au] = 17 \text{ gr / ton}$ )
- Reduction of tailing leaking



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# PLATFORMS FOR STORING TAILINGS BAGS

- The platforms provide an appropriate and specified area to store discarded tailing bags
- 5 platforms were installed for use in different areas of the mine



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# REMEDIATION & RESTORATION IN MADRE DE DIOS

- Implementation of mine closure revegetation models in 2 mining concessions
- Conversion to mercury-free mining techniques in 2 mining concessions
- Adoption of smelting process in smelting furnace and handling of suitable fluxes



# CONTEXT OF ALLUVIAL MINING IN MADRE DE DIOS

**NO specific alluvial  
regulations**



**LOW specific scientific and  
technical information**



**WEAK institutional presence,  
illegal mining**



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# RESTORATION/MINE CLOSURE : MINING CONCESSION PAOLITA II

- Mercury in soil : No significant concentrations.
- December 2017, the project identified and restored 2.5 ha of degraded land in the Paolita Mining Concession.
- The Paolita II plantation is the first-ever application of a reforestation mining restoration plan



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# PREVIOUS RESEARCH BY CINCIA

USAID WAKE FOREST UNIVERSITY CENTRO DE INVESTIGACIONES CIENTÍFICAS WWT

## Biochar potential as a soil enhancer for forest restoration in areas degraded by gold mining in the Peruvian Amazon

DAVID LEFRANÇOIS<sup>1</sup>, PEDRO NASCIMENTO<sup>2</sup>, GABRIEL VALDEZ<sup>3</sup>, RONALDO COVARRA<sup>4</sup>, YHONN ESPARZA<sup>5</sup>, VASCO MALAJO<sup>6</sup>, FRANCIS CABELLIARIS<sup>7</sup>, FRANCISCO ROSA-DIABETTES<sup>8</sup>, CESAR ACCONA<sup>9</sup>, BLAS SALAS<sup>10</sup>, LUIS E. FERNANDEZ<sup>11</sup>

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### INTRODUCTION

Soil degradation is a global challenge. It affects soil fertility, water availability, and carbon sequestration. Biochar, a carbon-rich material produced from agricultural waste, has been shown to improve soil properties and reduce greenhouse gas emissions.

### METHODS

Soil samples were collected from a degraded area in the Peruvian Amazon. Biochar was produced from agricultural waste and applied to the soil. Soil properties were measured before and after biochar application.

### RESULTS

The results show that biochar application significantly improved soil fertility and water availability. It also reduced greenhouse gas emissions.

### DISCUSSION

The findings suggest that biochar is a promising soil enhancer for forest restoration in degraded areas. Further research is needed to optimize biochar production and application.

### CONCLUSION

Biochar application is a viable strategy for improving soil quality and reducing greenhouse gas emissions in degraded areas.

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## Initial survivorship of 51 woody species in a reforestation experiment established after gold mining in the Peruvian Amazon

FRED D. POLO VILLANUEVA<sup>1</sup>, JUANA LUCAS-RODRIGUEZ<sup>2</sup>, MARTIN PILLACA<sup>3</sup>, JHON ALVARO<sup>4</sup>, ALAN RIVALLAN<sup>5</sup>, FRANCIS CABELLIARIS<sup>6</sup>, FRANCISCO ROSA-DIABETTES<sup>7</sup>, CESAR ACCONA<sup>8</sup>, BLAS SALAS<sup>9</sup>, LUIS E. FERNANDEZ<sup>10</sup>

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### INTRODUCTION

Reforestation is a key strategy for restoring degraded ecosystems. Understanding the initial survivorship of woody species is crucial for successful reforestation.

### METHODS

A reforestation experiment was established with 51 woody species. Initial survivorship was monitored over time.

### RESULTS & DISCUSSION

The results show that initial survivorship varies among species. Factors such as species characteristics and site conditions influence survivorship.

### CONCLUSION

Understanding initial survivorship helps in selecting species for reforestation and improving restoration outcomes.

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## Using drones for characterization of areas degraded by gold mining in the Peruvian Amazon.

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### INTRODUCTION

Drones provide a cost-effective and efficient way to monitor and characterize degraded areas. They can capture high-resolution imagery and generate 3D models.

### METHODS

Drones were used to capture aerial imagery of degraded areas. The imagery was processed to generate 3D models and maps.

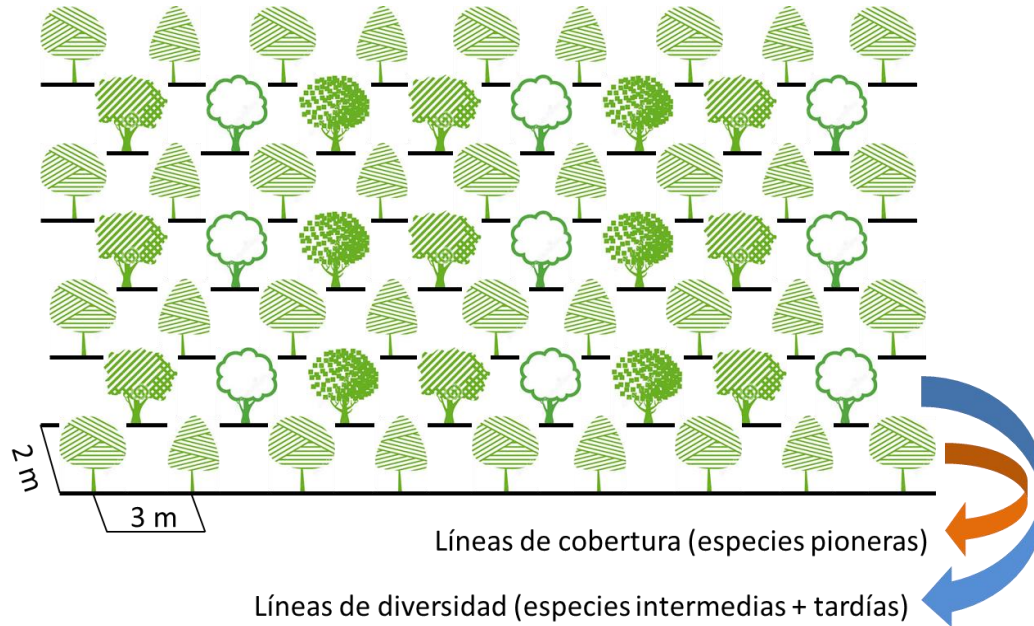
### RESULTS

The results show that drone imagery effectively characterized degraded areas. It provided detailed information on land cover and topography.

### CONCLUSION

Drones are a valuable tool for monitoring and characterizing degraded areas, supporting reforestation efforts.

# PLANTATION DESIGN



Restoration plantation model used in the recovery of Mata Atlántica forests in the Southeast of Brazil (Rodrigues et al. 2009)



## RESTORATION/MINE CLOSURE : MINING CONCESSION FORTUMIL

- Mercury in soil : No significant concentrations.
- November 2018, the project identified and restored 1 ha of degraded land in the FORTUMIL Mining Concession



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# MERCURY-FREE TECHNOLOGIES IN MADRE DE DIOS

Mercury-free Filipino method with borax



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- Problem: limited market for gold that is smelted or in powder-form
- Pure Earth discovered that miners only "burn" gold with mercury, ignoring the process of smelting and flux management
- Result: Hg-free process and final product: gold smelted in one piece

- Gold extracted in molten gravimetric table with fluxes appropriate to the type of material
- Concessionaire: Pedro Ynfantes, project partner and first miner to adopt this process



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# CONCLUSIONS

- The project enabled the piloting of **first-ever mining restoration plans** in the Peruvian Amazon
- Regulation of alluvial mining must be improved; there are many gaps, including mine closure
- There are alternatives to mercury-use that are more efficient and profitable. Research should be conducted to determine the method most suitable in each context
- The transition to “mercury-free” is a gradual process, which is not only technological but also social, cultural and labor-determined
- There are problems with the commercialization of “clean” gold; local gold vendors tend to distrust it
- The recent formalization in Madre de Dios will promote responsible closure of mines and improved mining practices, as well as open new markets
- Work with miners must be constant and sustained in order to generate results