

# How to mitigate small-scale gold mining activities impacts on the environment?

## Lessons learnt from the observatory platform in French Guiana

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### Introduction

In French Guiana overseas region, tropical forest covers 96% of the territory, and because of access difficulties, many activities are undocumented.

This is the case with illegal small-scale gold mining, which degrades the natural environment, causes severe pollution in rivers due to inappropriate techniques, and involves precarious working conditions that are inherent to illicit sites.

Illegal small-scale gold mining affects tropical forests by clear-cutting, stream pollution, alluvium perturbation and social downfall.

The National Forestry Office is responsible for managing Guiana's vast tracks of forest, covering some 5.3 Mha.

The current resurgence of conflicts over illegal resource exploitation demands the implementation of an operational monitoring system.

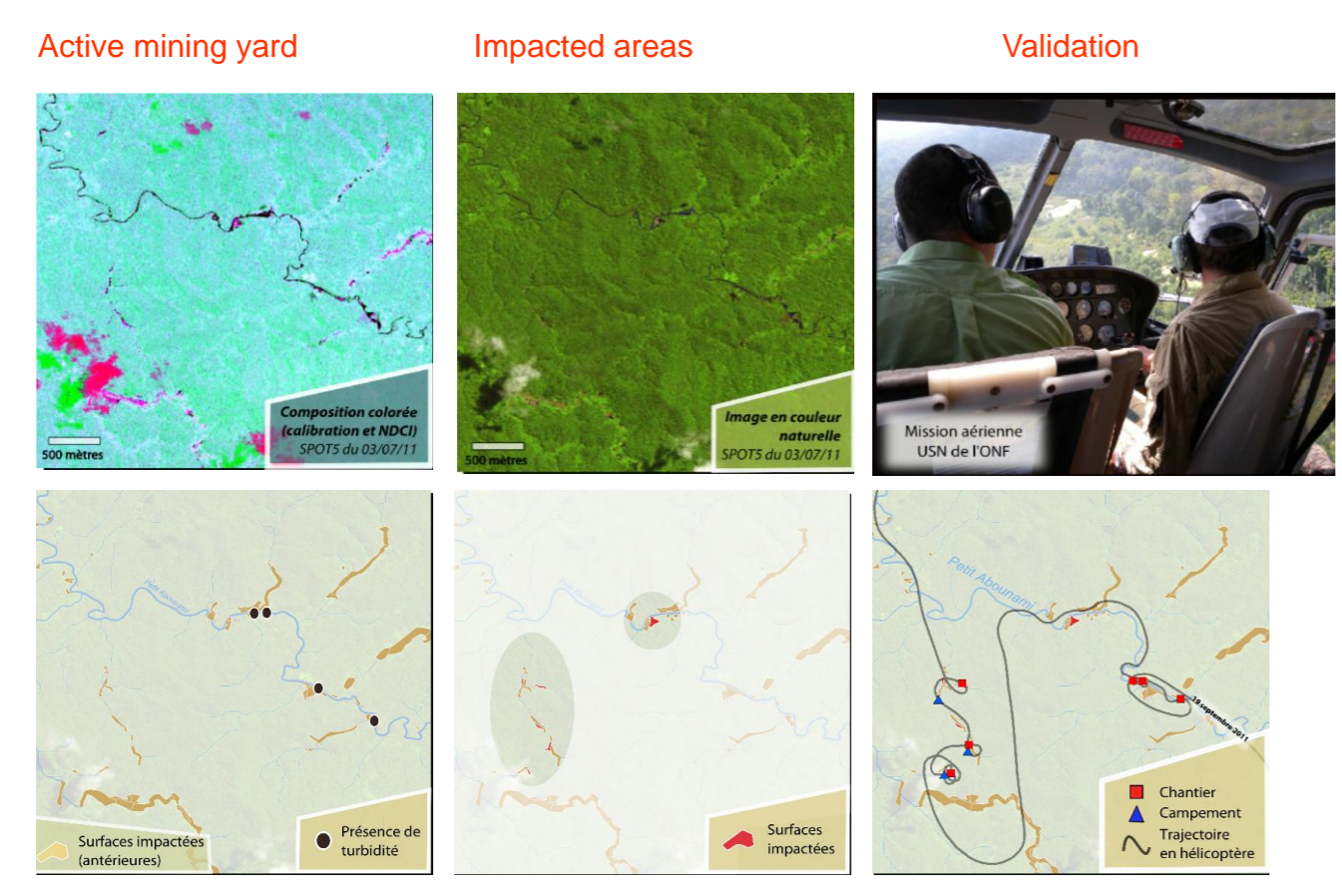
### Materials and methods

Because deforestation from gold mining is clearly visible on remote sensing data such as SPOT-5 satellite (10m resolution), it makes it possible to pinpoint the area being worked.

The type of gold mining practised in French Guiana releases large quantities of substances in suspension into water courses. Turbid waters have a distinctive spectral signature that is very discriminatory, which makes automatic processing possible.

In this study we propose this remotely sensed approach to detect active illegal artisanal gold mining using daily repetitiveness of high resolution satellite data.

This repetitiveness is allowed by the proximity of the SPOT receiving station SEAS located in Cayenne since 2007 and the priority action decided by the French government.

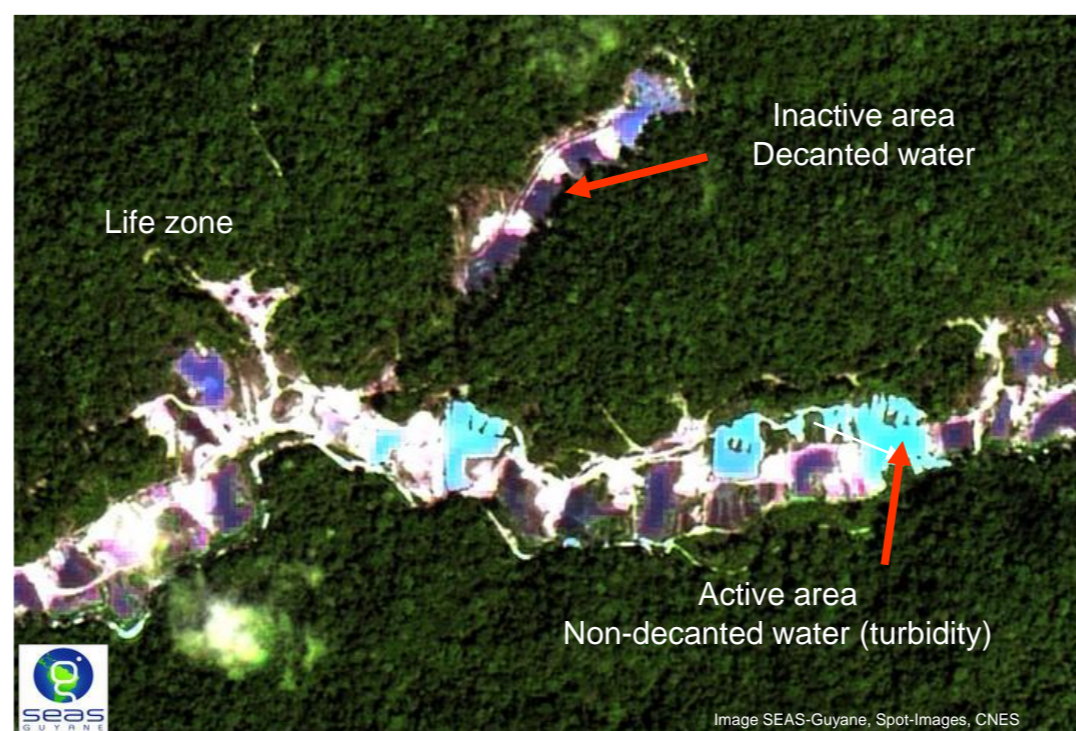


### Acknowledgements

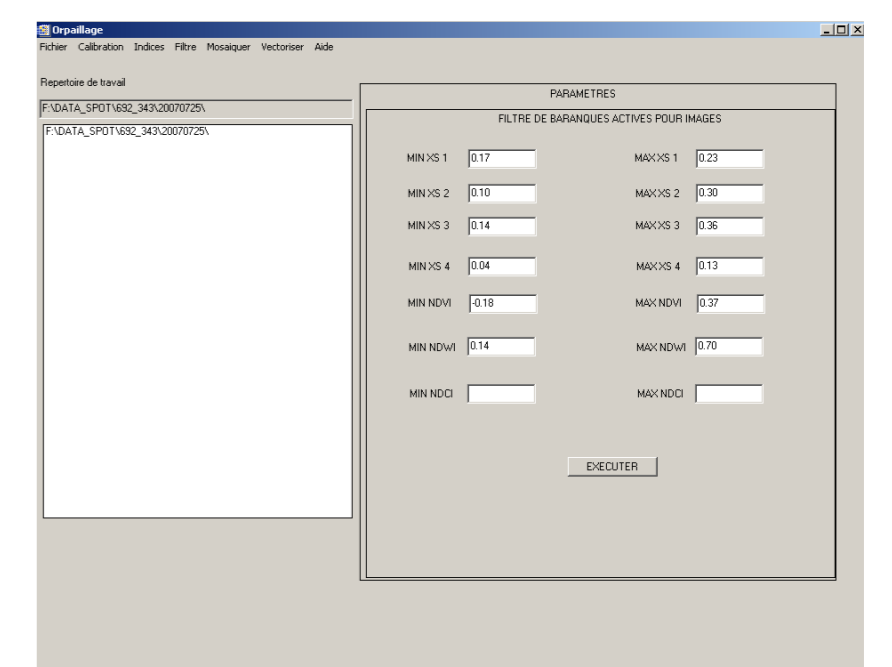
The authors thanks the SEAS reception station in Cayenne to provide SPOT data and make the system operational since 2008.

### Results

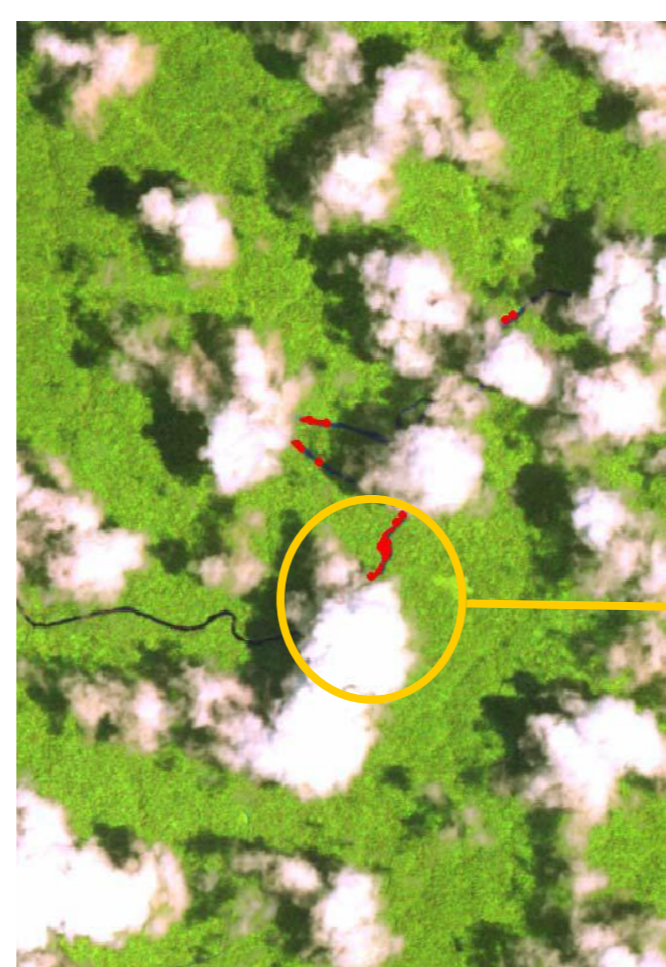
The result is the installation of a semi automatic processing chain based on SPOT-5 imagery able to monthly and annually map the mining activity location. Manual operation are needed to eliminate artefacts (natural rocks) and photointerpretation is also necessary.



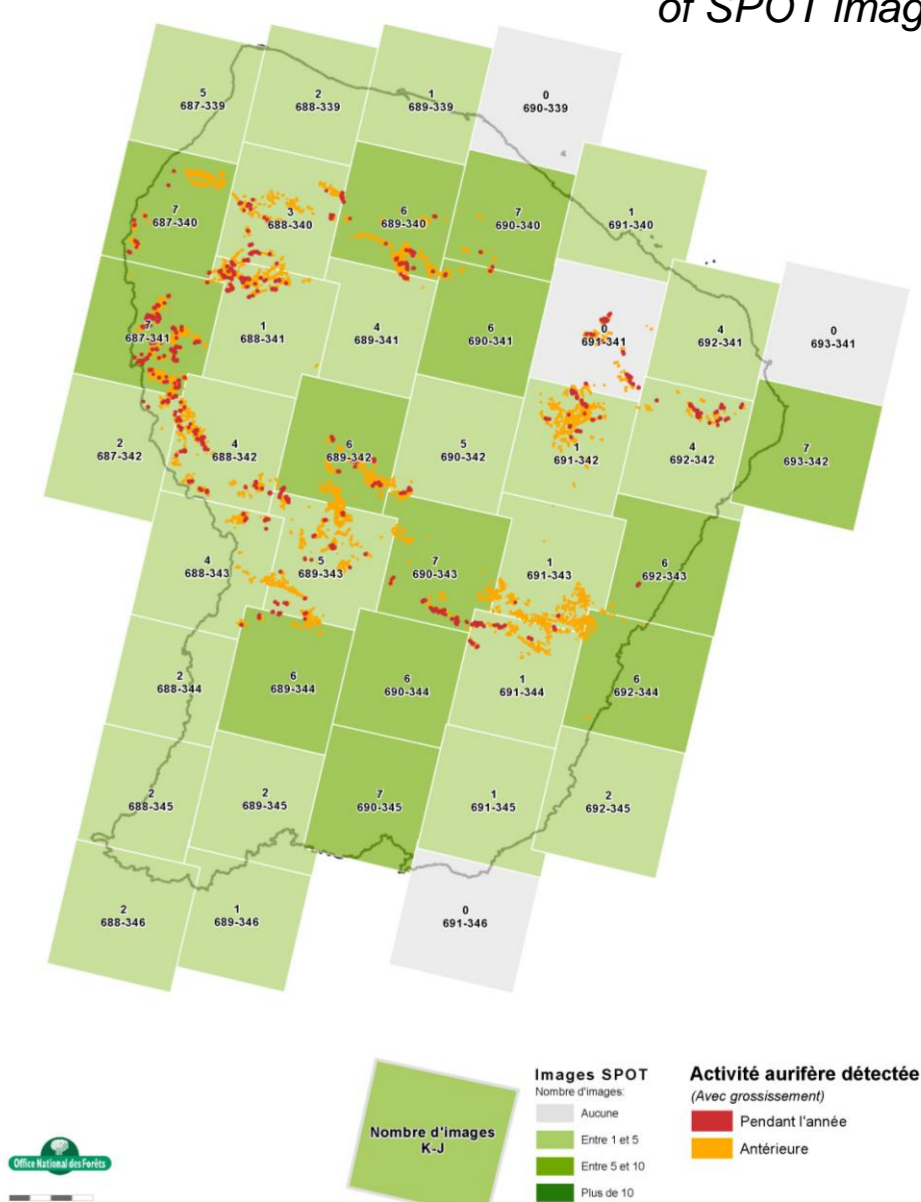
On a high resolution SPOT image (2.5m) detection of water turbidity is possible using spectral information. Photo (right) shows the impact of illegal gold mining in the forest.



Software interface for automatic processing of SPOT images



The process detects (in red on left) the pollution coming from creek going in the main river (right)



Annual mapping is provided and differentiate previous yearly activity (yellow) and annual supplementary activity (red)

This Observatory Platform is operational in French Guiana since 2008 under the French government authority (préfet) and provides spatial and temporal information dedicated to fight against small-scale illegal gold mining.

At this time 1374 SPOT-5 images (10m resolution) were processed. By providing almost real time information, it allows to fight illegal small-scale gold mining in the field. All the spatial information are centralised and each administration involved in the project has access to the data.

### Conclusions

The exchange rate of gold on the international market is the main driver of gold rush. The gold price encourages poor people to give a chance to escape poverty. At the end, small-scale illegal gold mining offers very bad working and sanitary conditions which let open a door to mafia and slave organizations.

Mining techniques have been adapted by illegal miners to avoid being detected by aerial monitoring and satellite observation. As a consequence they are less destructive for forest – less trees are cut - and probably less pollutant for the environment – exploitation sites are chosen at a distance from the rivers. Which in somehow is a less worst thing. Nevertheless this does not mean that the problem is solved, and the increasing number of mining sites provokes more sprayed river pollution. In parallel the upper river are exploited recently which have irremediable consequences on these hot spot of biodiversity. Remote sensing monitoring and police interference has to be updated to face the workers adoption of new techniques.

As this problem is happening all over the tropical forests, it is important to develop and export the monitoring techniques to others countries to promote international cooperation against this trans-border problem.

### References

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