Open Data and Infographics about the Gold Rush in the Peruvian Amazon

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Abstract

A gold rush of small and illegal mining is devastating large areas of precious ecosystems in the Amazon and contaminating them with heavy metals like mercury. This complex problem needs comprehensive action in multiple levels, encompassing the combined efforts of several government branches and organisations (NGOs) working on the field, to map and carry out possible pathways for solutions.

This proposal is composed of 2 intertwined strategies: the first is about investigating the possibility to put in place an open data strategy to help ease access and organise the various, and sometimes conflicting, data sources about illegal mining and related activities, in order to foster a better coordination between institutions, the creation of shared indicators, better validation of data, among other reasons.

The second proposal is inspired by sites such as of yourbudgit.com in Nigeria. It is about creating a one stop site to gather and present powerful and consistent visualisations and infographics tailored towards different non-expert audiences, that help understand the size and scope of the problem, put numbers in meaningful contexts, and inform people on how to get involved.

Mining settlement

Table of Contents

1. Context - About illegal mining and its impacts

A gold rush, fueled by high prices of gold, has become the biggest threat to the conservation of the Amazon forest in Peruvian region of Madre de Dios (MDD). Known for its incredible biodiversity, MDD is home to over 1000 species of birds, 200+ mammals, several thousands of plants. An estimated 300 000 hectares have been been hit so far by deforestation, with more than 6000 added every year.

According to a study by the company Macroconsult, hired by the Ministry of Environment, in 2011 the excedents of illegal mining in Peru surpassed those of drug trafficking close to 50% - $1793 millions against $1208 millions. Informal gold mining continues to expand since then, constituting itself as the largest illegal activity of Peru. 98% of the gold produced in MDD is illegal. Keep in mind, that according to the Drug Czar of the United States, Peru is the world's top cocaine producer.

This type of mining is very labor intensive and a major source of employment in MDD, where it currently amounts to 52% of its GDP, but it pays no taxes (at least $ 300 millions). There are approximately 50 000+ miners in MDD, according to the latest estimates by the Ministry of Environment, which placed the figure at 30 000 in a 2011 report. The region has one of the highest rates in population growth, indicating an increasing presence of migrants related to this activity. At the same time, MDD has the lowest monetary poverty rate of Perú's regions and also the lowest malnutrition (almost none).

The water and air are being polluted with dangerous levels of mercury. An estimate of 70,000 kilograms of mercury are being spilled into the rivers every year, which has led to 3 out of 4 inhabitants of Puerto Maldonado, the capital of MDD, register higher levels of mercury as those accepted by the WHO. Mercury poisoning causes serious neurological impairment in fetuses and a range of other health issues, which ultimately can lead to death.

Additional problems are the continuous social conflicts related to this activity, human trafficking and underaged prostitution.

2. Assessing the case for Open Data

2.1 Introduction

Tackling this complex problem requires a comprehensive, multilateral and coordinated effort by different branches of national and regional government, and also the contribution of various NGOs and institutions. All of them rely on data to plan and measure the results of their actions, support their claims and get necessary funding.

Most of these tasks require cross related data (for example conducting research on alternative

production chains). Different government branches, such as the ministries of environment, energy and mining, economy, transport, health and agriculture currently provide large portions of their data through their individual sites, which are quite unfriendly and difficult to navigate. Data is mostly in pdf format, which makes it difficult to reuse and is mostly presented in “cooked” form: it has already been transformed into a particular visualization or chart.

Additionally, there are several NGOs and research institutions, national and international, consuming and producing data about different topics. Their agendas include issues such as:

- ensuring and collaborating with law enforcement and fighting against corruption
- the conservation of pristine forests and national parks.
- stopping deforestation
- reforestation and sustainable logging
- curbing mercury contamination and inform the population about its effects
- conducting research on alternative production chains and promoting sustainable goods and practices
- education and training for conservation and sustainable practices
- promoting ecotourism
- conducting research

These organizations often partner with the government, which in turn uses their data to back its own claims. Data produced by this organizations is also spread across the web, mostly in pdfs and blog posts. These documents sometimes point towards conflicting data, making it difficult to identify reliable sources.

In this context open data could:

- substantively ease the access to data sources and help organize them.
- allow different uses and cross relations of the same data.
- foster a better understanding and coordination and serve as a basis for collaboration between the institutions.
- create shared indicators.
- help validate the data by various actors.
- help create a culture of more continuous data gathering, shared methodologies, promote standards, fill in the blanks.

The government, as part of its commitments to the Open Government Partnership, is putting forward an open data agenda, but the effort will require a longer period of time. The question remains, though, how to include and where to host data produced by other institutions, which the government continuously uses to back up their claims.

2.2 Open Data assessment, workshops and pilot platform

This proposal calls for a preliminary research involving some relevant institutions in the area, to assess the possible benefits, actual demand, and find relevant data sets. It includes interviews with a set of experts and key organizations, investigating the current ways in which they produce, work and share datasets, in order to find possible areas of implementation, as well as mapping out viable procedures for publishing datasets in open formats.

Most organizations are not familiarized with the concept of open data, its possible benefits and hardships. In this cases, a preliminary effort has to made to explain what open data is about, offering workshops and training about the concept and procedures involved.
Datasets identified as potential candidates to be published, can be uploaded to an existing open data platform or deploy a special one stop platform for this purpose, using free software like CKAN.

2.2 Some data examples

2.2.1 Deforestation

Deforestation figures change substantively according to different sources. The Ministry of Environment, in one of their most comprehensive reports to date in 2011 [1], estimated the deforestation caused at 18 000 hectares, adding another 150 000 of degraded forests. But the Peruvian Society of Environmental Right (NGO) cites estimates by the Ministry of Agriculture and INRENA (the former institution in charge of protected areas), that placed the number in 2009 close to 300 000 hectares [2]. The stark differences are probably due to different concepts and methodology.

A recent study by the Carnegie Institution of Science and the Ministry of Environment [3], that featured a new technique to detect deforestation, states that the numbers are even worse than thought before. While they don't mention an absolute number, apparently there has been an increase of 400% from 1999 to 2012 in mining areas showing signs of deforestation. From 1999 to 2008, before the financial crisis, the annual deforestation rate was 2165 hectares. But as a result of the crisis and the corresponding hike in gold prices, it increased in 2009 through 2012 to a stunning rate of 6143 hectares. I haven't been able to find the report on the web, just related blog posts.

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[1] "Minería Aurífera en Madre de Dios y Contaminación con Mercurio - una bomba de tiempo", Ministerio del Ambiente y IIAP, 2011 http://cdam.minam.gob.pe/novedades/mineriamadrededios.pdf
[2] Infography by SPDA (Peruvian Society of Environmental Rights) http://www.alertaambiental.pe/sites/default/files/field/image/Infografia-final-MdD.jpg
[3] "Illegal gold is destroying the Amazon", blog post in www.theverge.com, 2011 http://www.theverge.com/2013/10/28/5023638/peru-illegal-gold-mines-destroy-amazon-rainforest-study-carnegie-institution

The Terra-i system (http://www.terra-i.org) and Nasa (global forest heights in 2011) provide data about deforestation. But a quick look on the map visualizations in infoamazonia.org (an important source of news and GIS data for the amazon), would not suggest an accelerated pace of deforestation, specially compared to Brazil. The studies by Carnegie counter that notion.

If open data of all this sources were to be available and organized in one place (or at least a few), including corresponding metadata, it could shed some light into why the differences in findings, and make it easier to arrive at a common number. This is an crucial indicator for decision making and lots of different studies.

2.2.2 Concessions and mining rights

The Peruvian constitution allows for small informal miners to seek concessions of land and mining rights, and the regional government still hands them over in Madre de Dios. But sometimes this rights conflict with other types of land concessions handed out by the national government. There even seems to be juxtaposing concessions and mining concessions next to ecotourism and farming ones. Concession data is not open and is being managed through a closed source system by the national government, that requires payment to be used.

At the same time, in order to operate formally, miners have to fulfill a series of regulations, including studies of environmental impact, which in many cases are impossible to comply with. A considerable part of these locations only allow for certain types of activities, excluding mining. Thus, giving out mining rights without later being able to follow through, is creating contradictions used by miners to establish themselves in the limbo of law.

The formalization procedures pushed forward by national government should solve some of the problems cited above, letting some concessions expire, but it is not clear at this moment how this issue is going to be resolved. Because of its potential for social conflict, the government is treating this in a fuzzy and non-transparent way, what later leads to more social unrest, when miners find out, they cannot actually use the land they have been conceded for their activity.

This is definitely a case for open data between different branches of government, regional and national. They could benefit from an open system, that is transparent and allows to coordinate concession regulations and monitoring. It could also help NGOs, Companies, and Research institutions conduct investigations and collaborate with the government on different fronts. Ultimately, a greater transparency can also be of benefit to miners and the general public.

2.2.3 Mercury

Mercury contamination is seriously endangering ecosystems and the human population.

Exposure to high levels of mercury can affect the brain, heart, kidneys, lungs and immunological system. According to the Ministry of Environment, a rough estimate of 2.8kg [4](number changes according to different sources) of mercury is used per each kg of gold produced to separate the gold from the rest of the soil (amalgamation). Close to 70,000 kg [5]of mercury enter the rivers each year, directly affecting miners and the river food chain. But mercury is not only present in the water. It later gets released into the air in urban areas, where gold is melted in commerces in order to purify it.

The Carnegie Institution for Science has formed an alliance with universities and NGOs to measure mercury contamination in fish and in humans, that seems to be the most broadly accepted source. Featuring new methodologies, their latest study reveals much higher than anticipated results: 77.8% [6] of the people in Puerto Maldonado (currently estimated 200,000 inhabitants) has higher levels than accepted by the WHO. 60% of the fish in Puerto Maldonado's market is contaminated.

There are previous findings by institutions such as the Ministry of Health, that in 2010 only detected high levels in 5 out of 192 subjects in the major mining zone of Huepetuhe [7]. Local universities, the national Authority of Water, and individual thesis students put out different studies, sometimes dating back 2 decades, and are difficult to relate to each other because of the different methodologies and conflicting numbers.

Until recently, there were almost no legal impediments or regulations regarding mercury commerce, until the decrees regulating illegal mining in April 2012. The issue has gained more media awareness and is beginning to be pursued by the justice department, as an article in “El Comercio”, an important newspaper of Perú, suggests (a group of companies imported 180 tons of mercury, ties to illegal mining suspected) [8]. Open government data can ease the monitoring of mercury imports by government and non-government institutions, and it can help cross relate this figures with the trends of mercury contamination in the field.

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[4] “Minería Aurífera en Madre de Dios y Contaminación con Mercurio - una bomba de tiempo”, Ministerio del Ambiente y IIAP, 2011 http://cdam.minam.gob.pe/novedades/mineriamadrededios.pdf

[5] Second infography by SPDA (Peruvian Society of Environmental Rights) http://www.alertaambiental.pe/sites/default/files/field/image/Infografia-final-MdD.jpg

[6] “Mercury in Madre de Dios”, Carnegie Amazon Mercury Ecosystem Project, March 2013 http://dge.stanford.edu/research/CAMEP/CAMEP%20Research%20Brief%20-%20Puerto%20Maldonado%20English%20-%20FINAL.pdf

[7] “Niveles de exposición de mercurio en población de Huepetuhe - Madre de Dios y factores de riesgo de exposición”, CENSOPAS (Institution of the Ministry of Health), 2010 http://www.bvs.ins.gob.pe/insprint/CENSOPAS/metales_pesados/INFORME%20FINAL%20HUEPETUHE%202011.pdf

[8] “Más de 180 toneladas de mercurio fueron traídas de EE.UU. y España. ¿A dónde van?” , Online edition of “El Comercio”, August 1st 2012 http://elcomercio.pe/actualidad/1449616/noticia-mas-180-toneladas-mercurio-fueron-traidas-eeuu-y-espana-donde-van

3. Creating a site with visualizations and infographics

3.1 Introduction

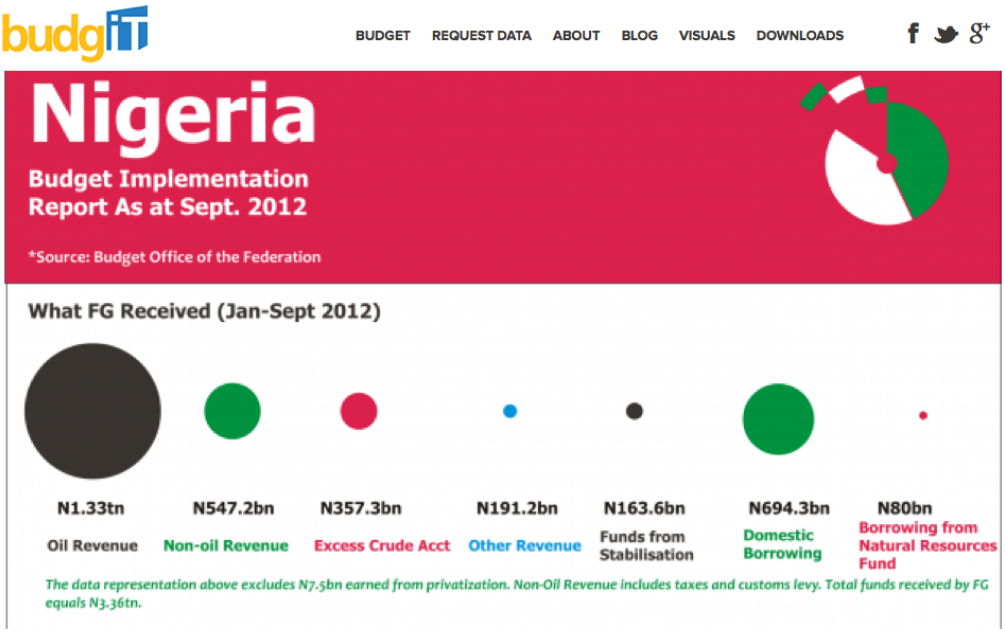
Creating a one stop site for open data about this type of gold mining could be an important first step. But opening data is not enough. We need to go out and advocate for solutions, try our best to help people understand the size and scope of the problem, the current trends, while also advocating for open data and a better culture around data and continuous gathering.

There is no one-stop site to access a comprehensive set of visualizations and infographics tailored to non-expert audiences, that help make sense of data by putting it into more personal and meaningful contexts.

3.2 Inspirations

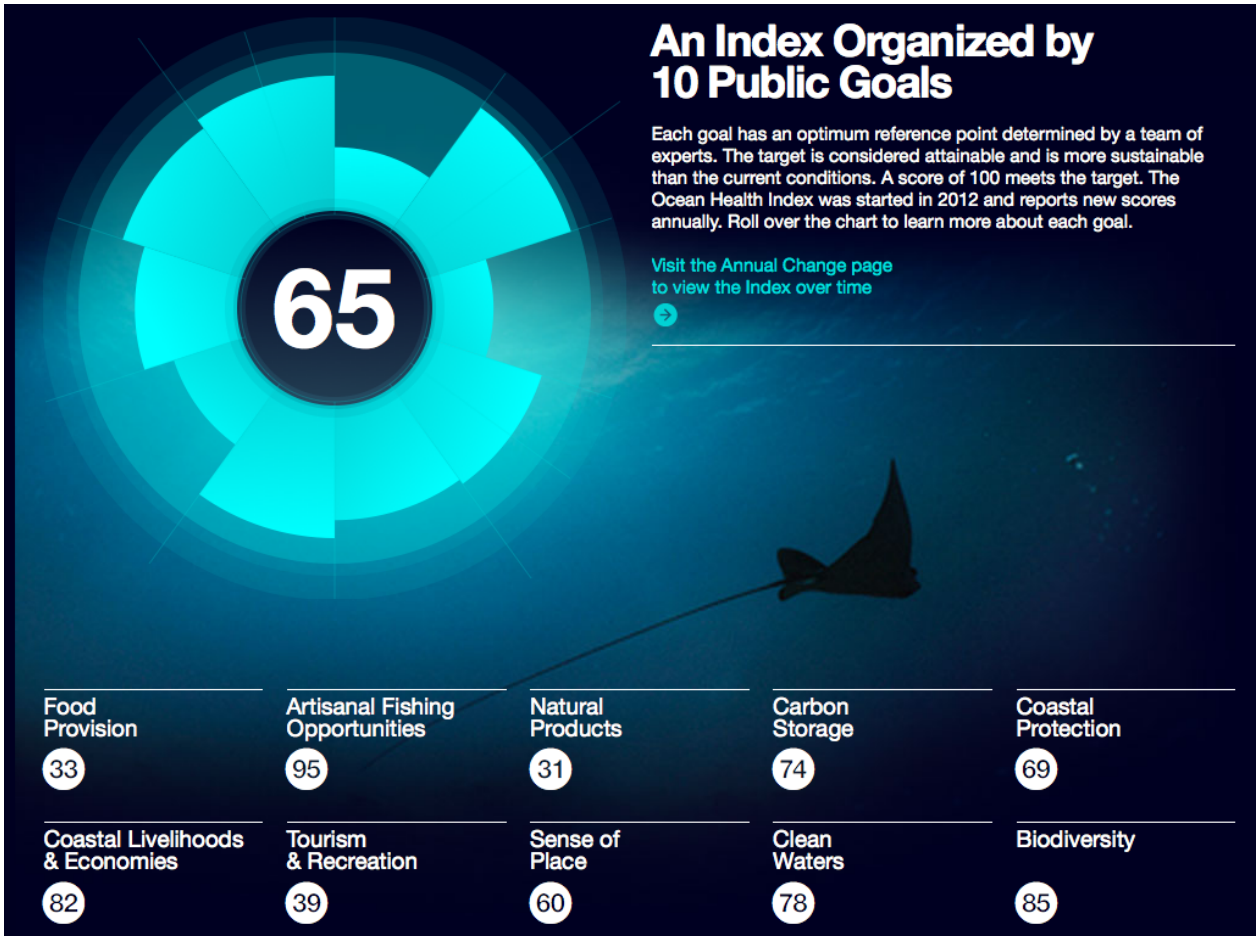
The following platforms have inspired this proposal:

YourBudgit.com
Yourbudgit offers a comprehensive set of infographics and simple games that help a non-expert audience to understand the Nigerian budget and the consequences of budget decisions. The infographics are published under flexible licenses that allow them to be re-published in different contexts (social networks, press, print etc). A simple game helps putting Nigerian oil revenue numbers into contexts people can relate to, by letting them choose a range of options, like for example, the number of new classrooms that could have been built with it.



The Ocean Health Index

The Ocean Health Index is web page that serves as an observatory, monitoring 10 important indicators about the health of maritime ecosystems. These indicators are curated and monitored by experts. The site offers a visually appealing and easy to understand approach to learn about the latest developments of in ocean health, as well as allowing to compare indicators over greater time periods.



Al Gore's “Our choice”

This interactive e-book available for ipad includes texts, videos, images and interactive infographics about climate change. This proposal is also inspired by these infographics, created by Bret Victor. They feature several techniques, starting with rather simple diagrams, which might get analyzed in greater depth by user who wishes to do so. The feature that could be interesting to consider for this proposal, is that this infographics allow the user to inquire them, changing the assumptions on which they are based or playing around with the number relations. In this way, the audience is not only able to project different scenarios into the future, but they also get a better sense of the actual meaning and consequences of the numbers by being able to switch them into a more personal scale or context.

3.3 Proposal: One stop site with visualizations and infographics (The alternative gold index)

We envision the creation of a site inspired by the examples above, gathering infographics and visualizations backed up by solid data sources and tailored towards different audiences. Its main goal is to inform and advocate about this serious problem in different contexts (social networks, press, print etc).

There is no central place on the web where a non-expert audience can have access to an organized set of visualizations and infographics about this topic using continuously updated data, that might help to easily understand the size and scope of the problem, the current trends (or trends over time), and also have an insight of the actual effectiveness of government measures and other institutions. What most people perceive are fragmented pieces of information in various news outlets and tv reports, tending to focus on spectacular reports of law enforcement actions by the military. While they might give a vague sense that something is being done, they rarely focus on the big picture, finding effective ways to counter this development and how people can get involved.

The site has the following goals:

- Be the one-stop site tailored to non-expert audiences, that help understand the size, scope and current trends of the devastating effects illegal gold mining has on the environment.
- Educate about the real price of gold, taking into account destroyed forests, contamination and related health issues, amount CO2 that lingers in the atmosphere etc.
- Inform about different solutions, progress being made (or lack of), and what we can do in a daily basis to contribute to solve this problem.
- Make projections into the future based on current data.

Similarly to the examples cited above, in order to achieve this goals, this project would have to:

- Sum up a group or board of experts (individuals, partner institutions) to create a set of indicators that can be reliably measured over time, also validating and proposing new sources of data for visualizations and infographics.
- Create a team to design and develop the page on a continuous basis (every once in a while come up with updates or something new).
- Offer visualizations and infographics in formats that are suitable for different contexts (web, print), easily shared, and are published under flexible licenses.
- Create “calculators”, and/or simple interactive game in order to help people put numbers into meaningful contexts and provide ways for the audience to go deeper and inquire

possible scenarios for the future, possibly using animations to

3.4 Brief examples of better contexts for communicating data

For the “calculators” and infographics section, I’ve been trying to identify numbers that help us understand the real price of gold, when taking into account all the destruction left behind. My opinion about putting out big numbers, like the ones mentioned from different sources, is that it is hard to relate to them in our personal sense of scale. Most are annual figures, like the deforestation rate, which uses units that are difficult to grasp (hectares).

This is why making a small effort to translate those numbers into more manageable scales or time periods can be of significant importance: deforestation caused per kilogram of gold, area destroyed per day, and so on. By changing the units into more immediate contexts, people get a much more powerful sense of urgency.

According to numbers by the Carnegie Institution for Science already mentioned above, 6143 hectares are being destroyed every year. Madre de Dios is producing around 16 000 kg of gold every year according to the Ministry of Environment (2011) [9]. Cross relating this data and transforming it into kilograms we arrive at:

1kg gold = 3839 m² of forest destroyed (41077 ft²)

Taking the current price of Gold as reference, 1234.8 US$ per ounce (as of 12/13/2013), a kilogram of gold costs 43,556 US$. If we had estimates about people contaminated with mercury per year, instead of general figures, we could add the number of people contaminated with mercury per kilogram of gold to this equation.

A second example is putting the deforestation numbers into much shorter time periods, while also changing the units into square meters:

168,301 m²	per day
7, 012 m²	per hour
116 m²	per minute
1.94 m²	per second

Suddenly the scale and urgency of this problem becomes absolutely striking.

[9] “Minería Aurífera en Madre de Dios y Contaminación con Mercurio - una bomba de tiempo”, p. 15, Ministerio del Ambiente y IIAP, 2011 http://cdam.minam.gob.pe/novedades/mineriamadrededios.pdf

4. Partial list of organizations working to solve this problem

These are the institutions and organizations that I've encountered during my research. It is only a partial list.

NGOs with local presence:

Peruvian Society of Environmental RIghts (http://www.spda.org.pe)
Works together with government officials to ensure law enforcement of ecologic crimes, mostly related to illegal mining.

Association for the Conservation of the Amazon Basin (http://www.acca.org.pe)
Research on forests resource management and sustainable practices. Promotes conservation.

Wildlife Conservation Society (http://wcs.org)
Protect Wildlife and Landscapes

World Wildlife Fund WWF (http://peru.panda.org/)
Participatory protection of natural reserves, promotion of sustainable practices, research on carbon programs and more

Conservation International
(http://www.conservation.org/where/south_america/peru/Pages/overview.aspx)
Creating opportunities with indigenous communities near protected areas. Works with the indigenous community of Ese'eja de Infierno (Madre de Dios).

ANIA (http://mundodeania.org)
Promotes education for children in conservation and sustainable practices.

Pronaturaleza (http://www.pronaturaleza.org/)
Promotes conservation of natural resources.

Sociedad Zoológica de Francfort (http://www.szfperu.org/)
Conservation, Education, Training, Wildlife monitoring

Andes To Amazon Biodiversity Program (http://www.andesamazon.org/)
International research community of biodiversity

Profonanpe (http://www.profonanpe.org.pe)
Peruvian Trust fund for national parks and protected areas.

Cooperaccíon (http://cooperaccion.org.pe)

IIAP - Instituto de Investigiones de la Amazonia Peruana (http://www.iiap.org.pe)
Research institute of the Peruvian Amazon

Carnegie Institution for Science (http://carnegiescience.edu/)
Conducting research about mercury contamination and deforestation

government institutions (only a few here):

SERNANP (http://www.sernanp.gob.pe)
Government institution in charge of managing protected areas and national parks.

Environment Ministry - MINAM (http://www.minam.gob.pe)

Mining and Energy Ministry - MINEM (http://www.minem.gob.pe)

Autoridad Nacional del Agua - ANA (http://www.ana.gob.pe/)
Water Authority

Ministry of Agriculture - MINAG (http://www.minag.gob.pe)

Defensoría del pueblo (http://www.defensoria.gob.pe/)
Ombudsman

Regional Government of Madre de Dios http://www.regionmadrededios.gob.pe

Regional Mining Management of Madre de Dios - DREM
http://www.regionmadrededios.gob.pe/portal/direccion-regional-minas

International Foundations and NGOs:

There are large international Foundations like the Moore Foundation (http://www.moore.org/grants/list/page/2?cat=f1dcf360-a10f-68a5-8452-ff00002785c8) , that issue grants on behalf of this local partners and institutions. And also NGOs that partner with local insitutions:

ICAA - USAID http://www.amazonia-andina.org

Amazon Aid Foundation (http://amazonaid.org/gold-mining-understanding/#more-5457):

Adresses gold mining specifically, has an interesting crowdfunding like project of conservation, but with a poor interface, called acre+care. Partners with ACCA.

Greenhart (http://www.greenheart.ca/)
Promotes sustainable tourism in the rainforest

ACEER (http://www.wcupa.edu/aceer/)
Environmental education programs, supporting basic and applied research, and protecting unique tracts of land.