

# Assessing the Cost of Nature Loss: a Satellite-Based Approach

Showcase 2030

Edoardo Chiarotti

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# Overview

- **Idea:**

- Using satellites to estimate the local **impact** on nature of companies' facilities ("local scope 1") and its **cost** (given by the restoration cost)
- Create a **funding system** by which nature-negative companies repay the nature loss by funding restoration projects through a fund.

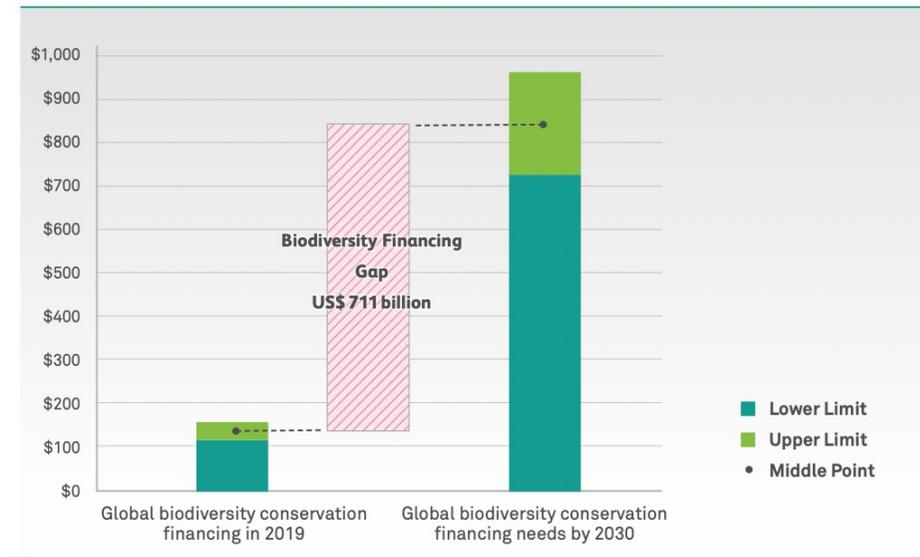
- **Application:** test the damage on vegetation done by Glencore and other companies in the Antamina extraction site in the 1990s and estimate the cost of this vegetation loss

# Why do we need nature monitoring

- Policy makers need to assess the **current status** of nature and biodiversity
  - Bad: e.g. since 1970, 69% decline of the global population of mammals, fish, birds, reptiles and amphibians
- Policy makers need to assess when **international targets** on nature preservation and restoration are reached
  - e.g. COP 15: by 2030 at least 30 per cent of degraded areas are under effective restoration
- Investors who **finance nature restoration** need to assess how much nature their investment is restoring

# Biodiversity Financing Gap

- Current **biodiversity financing gap** around 700 Billion US\$
- 86 % from **public funds**, only 14% from **private funds**. Private companies need to step in
- **COP 15** pledged to create a fund to mobilize at least 200 billion US\$ a year by 2030 into nature preservation and restoration

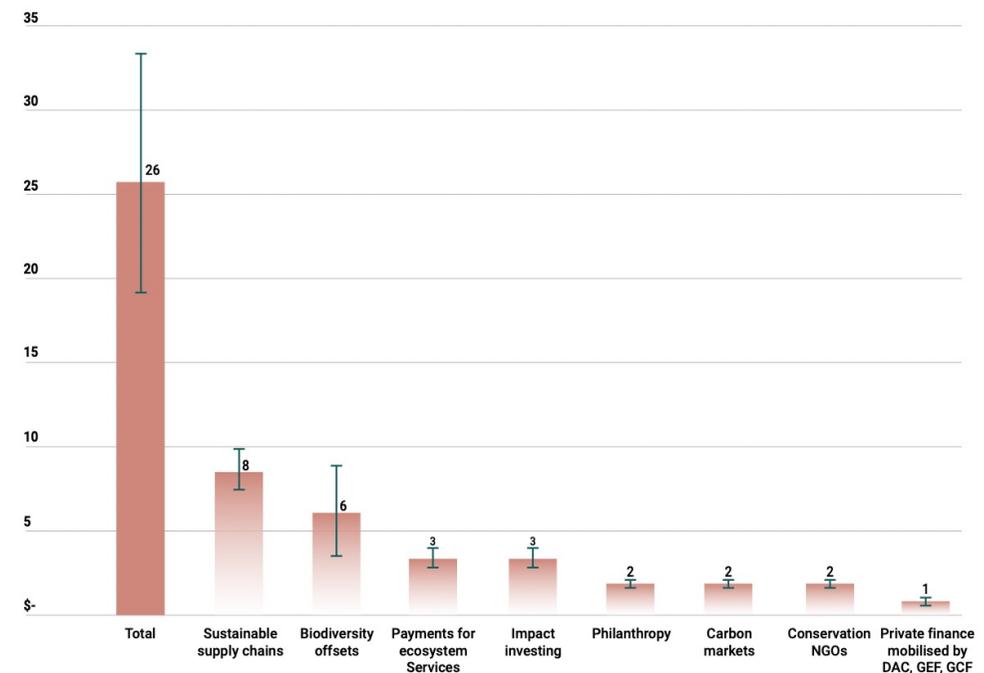


Source: Financing Nature, Closing the Global Biodiversity Financing Gap (Paulson Institute, The Nature Conservancy, Cornell Atkinson).

# Private Finance: Biodiversity Offsets

- **Biodiversity offsets:** new infrastructure projects must limit their impact on biodiversity with a hierarchy of actions, i.e. (i) avoid, (ii) mitigate, (iii) offset.
- Nature-negative companies can outsource restoration activities to **bio banks**
- **Current decentralized system:** around 100 countries with such schemes, involving 12,983 (mostly small) active offset projects in 37 countries
- Use satellites to support the establishment of a **complementary system (fund)** for nature restoration

Figure 3: Annual private financial flows in Biodiversity

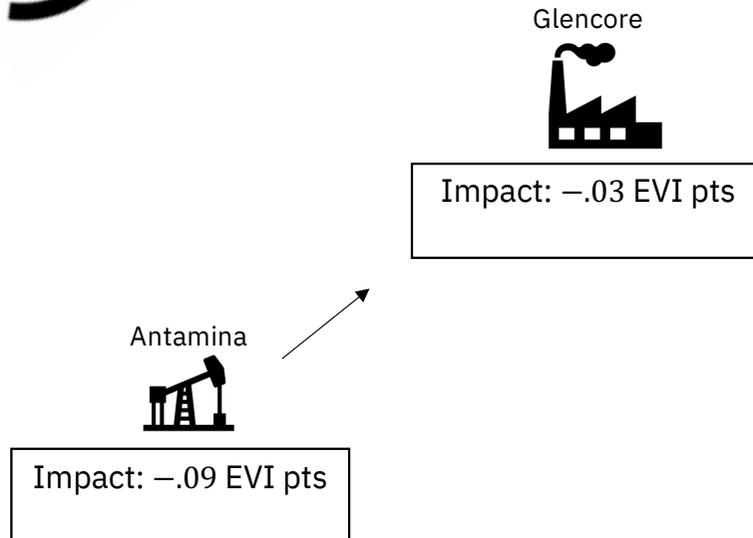


Source: The State of Nature Finance 2022 (UNDP)

## Idea: Fund for Nature

1. Estimate the local **impact** a company's facility has on nature ("local scope 1")
2. Estimate the **cost** of this nature loss by considering the restoration cost
3. The company pays this cost by channeling the due amounts into a **fund**, that reinvests in nature restoration. There are 2 types of payments companies make:
  - a) Payments for **past** nature loss, e.g. nature debt -> tax-like system
  - b) Payments for **new** nature loss, coming from the mentioned biodiversity offsets programs, for centralization purposes (rather than using biocredits) -> offsetting-like system

# Application: Impact on Vegetation for Antamina/Glencore



# Vegetation

- We focus on **vegetation** because it is “easy” to measure with satellites
- During **photosynthesis**, the mesophyll leaf structure scatters near-infrared light, while the chlorophyll absorbs red light
- Normalized Difference Vegetation Index (NDVI) or **Enhanced Vegetation Index**
- EVI is between -1 and 1, and the higher the photosynthesis (the higher the difference between NIR for mesophyll and R for chlorophyll) the higher the EVI
- Data: **Landsat 5** (1984-2012, 30-meter resolution)

# Antamina

- The **Antamina mine** (copper / zinc) is located in the Puna grassland, 270 kilometers north of Lima, at an average elevation of 4,200 meters
- The mine is managed by a joint venture of four companies: **Glencore** plc (33.75%), BHP plc (33.75%), Teck (22.5%), and Mitsubishi Corporation (10%)
- The building phase started in **1998**, and it was operational in 2001

Figure 4: Antamina – Land View Today



Source: Economy (<https://euro.eseuro.com/local/198876.html>)

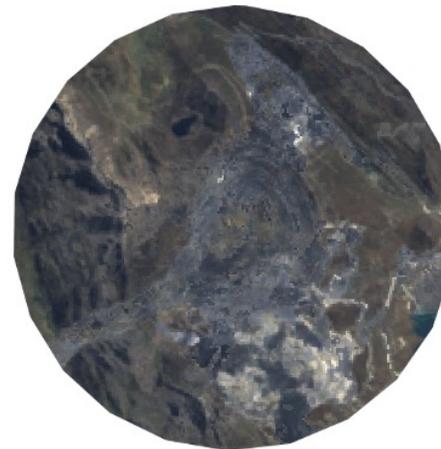
# Antamina: Impact on Vegetation

Figure 5: Antamina – Satellite Composite Pictures

(a) 1994-1997



(b) 2009-2012

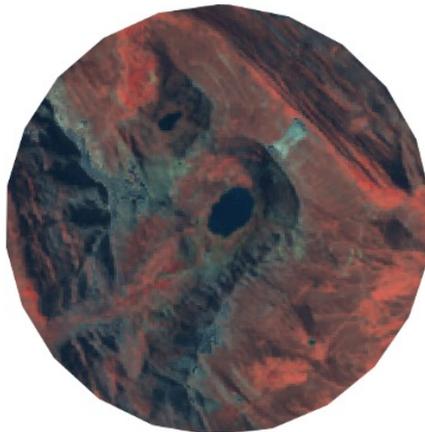


Source: Authors' calculations. This figure reports the images for the Antamina site before and after the site was built (3-km radius). The first image was obtained by compressing all images available in the window 1994-1997. The compression minimized the presence of clouds. The same procedure was applied to obtain the second image over the window 2009-2012 (end of the dataset).

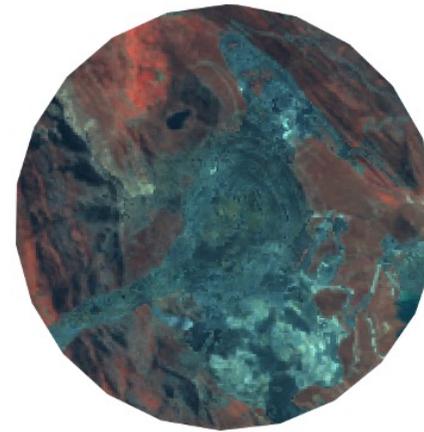
# Antamina: Impact on Vegetation

Figure 6: Antamina – Satellite Infrared Composite Pictures

(a) 1994-1997



(b) 2009-2012

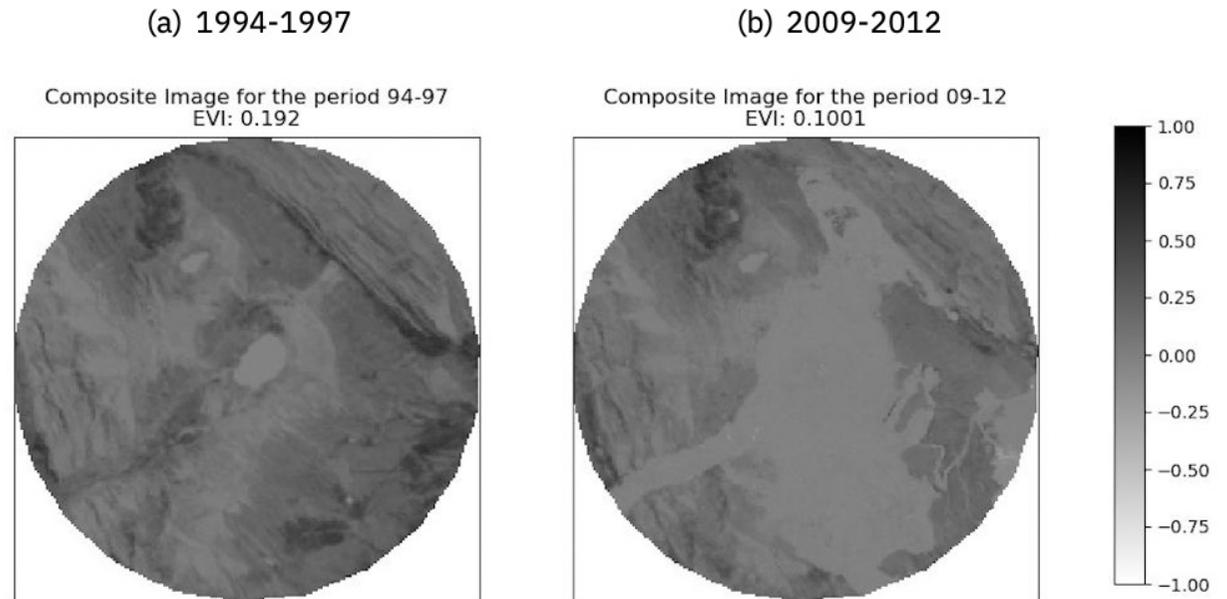


Source: Authors' calculations. This figure reports the infrared composite images for the Antamina site before and after the site was built (3-km radius). The first image was obtained by compressing all images available in the window 1994-1997. The compression minimized the presence of clouds. The same procedure was applied to obtain the second image over the window 2009-2012 (end of the dataset). Red pixels stand for near-infrared light and vegetation, while gray and green pixels indicate an absence of vegetation.

# Antamina: Impact on Vegetation

- EVI goes from 0.192 to 0.1001
- 0.0921 points decrease, i.e. **-48%** decrease in vegetation

Figure 7: Antamina - Changes in the Enhanced Vegetation Index

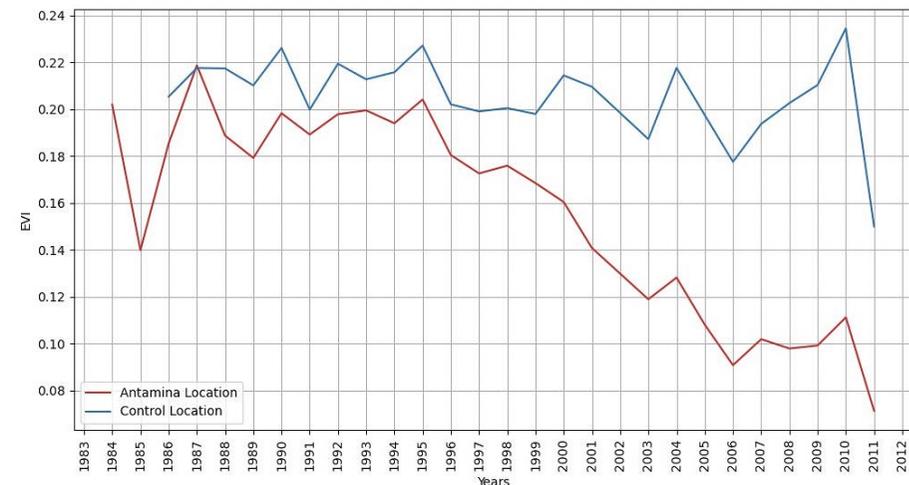


Source: Authors' calculations. This figure reports the values at the pixel level for the Enhanced Vegetation Index in images of the area of the Antamina site before (panel a) and after (panel b) the site was built (3-km radius). Darker pixels are for positive EVI values (presence of vegetation), while clearer pixels are for negative EVI values (absence of vegetation).

# Antamina: Impact on Vegetation

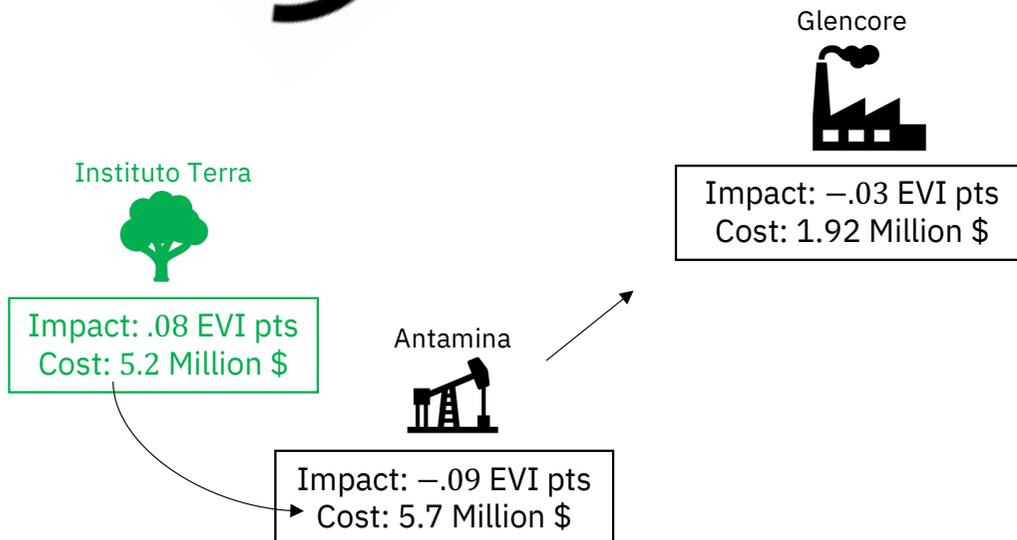
- We “adjust” the change in EVI with the trend in the control location
- The **adjusted change in EVI** (Diff-in-Diff) is **-0.0899** EVI points (rather than -0.0921 points)
- This takes into account natural deforestation (-0.0022 points)
- The loss that can be associated to **Glencore Plc** (ownership 33.75%) is **0.03** EVI points

Figure 7: EVI- Trends in the Antamina and Control Locations

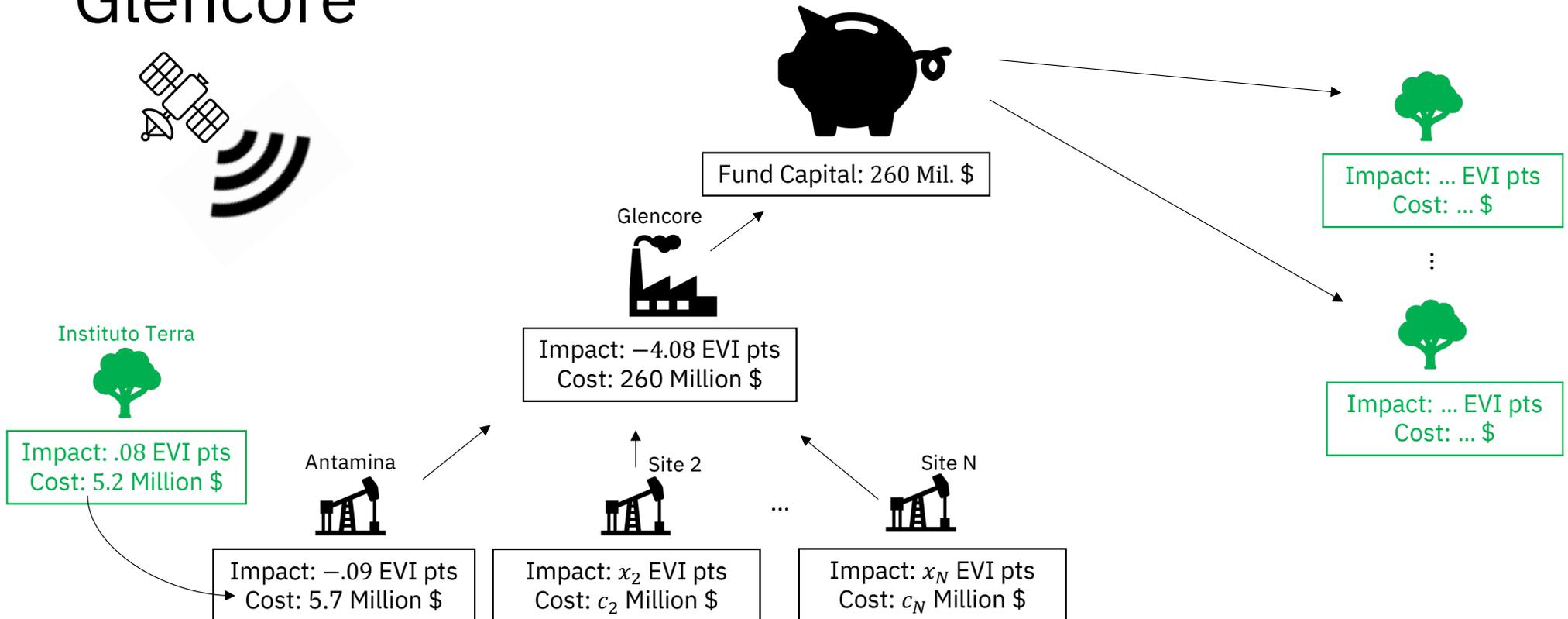


Source: Authors' calculations. This figure reports yearly values for the EVI index for both the Antamina location (blue), and a control location (red) of similar altitude that is 7.1 kilometers away from the Antamina location. The yearly values are obtained by compressing all images from the same season available in each considered year. As we do not have many satellite images for 2002, the value for 2002 is interpolated with an average of values in 2001 and 2003.

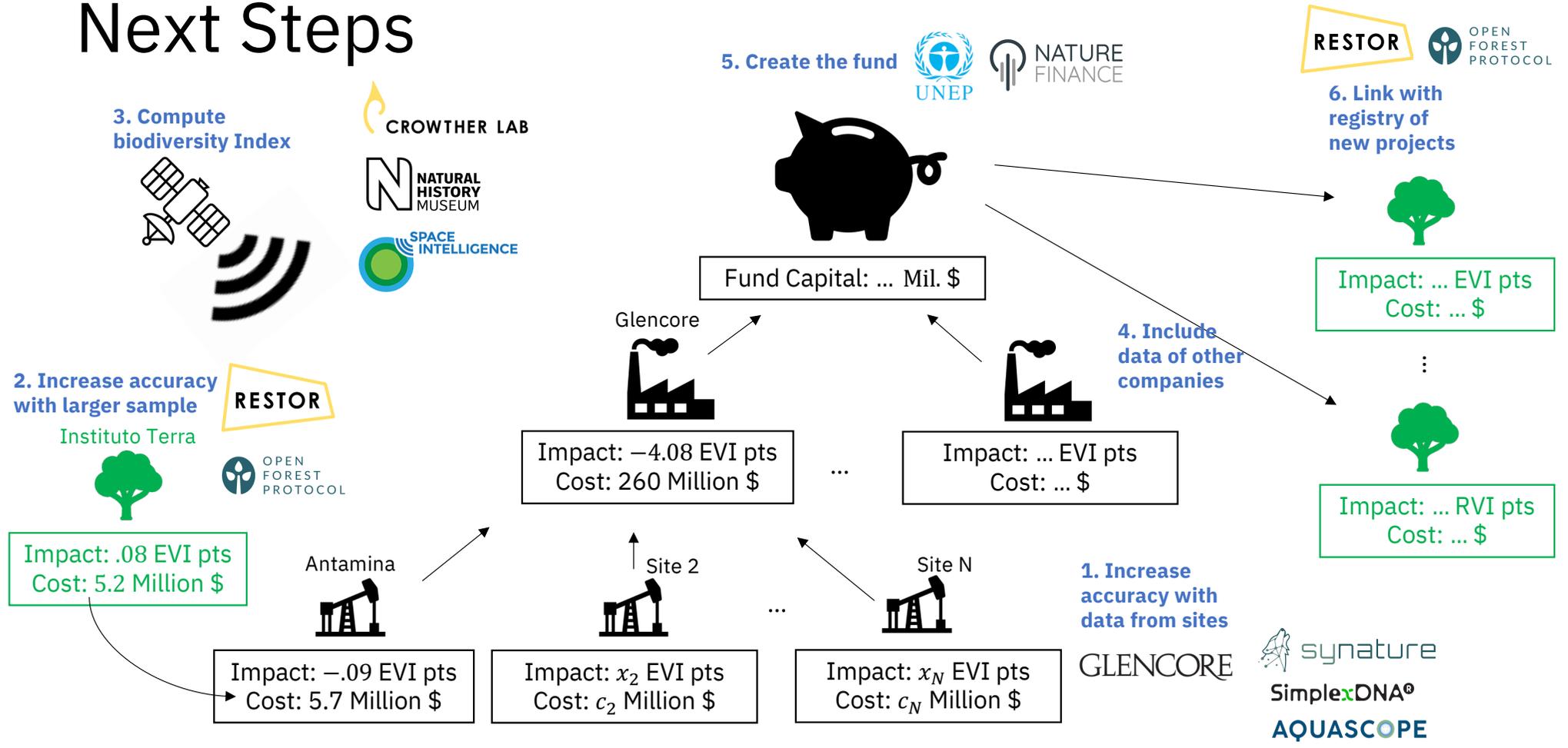
# Application: Cost of Vegetation Loss for Antamina/Glencore



# Application: Cost of Vegetation Loss for Glencore



# Next Steps



Thank you!