Restoration of Bauxite Lands in Jamaica: Life after Bauxite

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Abstract

Bauxite occurrence in Jamaica is somewhat unique among the world's large producers in that Jamaican bauxite deposits occur in numerous small discrete depressions in karst limestone in the central part of the island. The logistics of mining is determined by topography, and by the fact that unlike our South American neighbours, there is population everywhere in among these bauxite deposits. Over the past 70 years, bauxite mining has had to take place with communities in close proximity. The Government had to ensure that citizens' rights were protected, allowing them to co-exist with bauxite mining going on around them while minimizing the potential impacts of dust and noise. Also, Jamaica is a small island and any loss of land is significant, so the land has to be restored to a usable state as soon as mining is completed. The benefits of bauxite mining to the economy of Jamaica are obvious, but these could not be attained to the detriment of the people. To this end, mining regulations were enacted which mandated the time frame within which land restoration had to be completed, and the end use to which the restored lands could be put. These regulations are rigorously enforced to ensure that the island is not left as a post-mining wasteland, and that there will indeed be "life after bauxite".

Keywords: Jamaican bauxite, Restoration, Mining regulations.

1. Introduction

The origin of Jamaican bauxite is thought to be Miocene volcanic ash erupting from volcanic centres possibly in Hispaniola or Central America. The ash fall mantled the thick deposits of karst limestone of middle Eocene to lower Miocene age, accumulating in karst depressions and fault-controlled valleys. The contact between the red bauxite and the Tertiary white limestone is very sharp and irregular. There is no transition zone, and it is likely that the limestone contact is an erosion surface of the reefal limestones which were above sea level at the time. The bauxite is very uniform in appearance, earthy in texture, and is extremely fine grained. Alumina minerals occur mainly in the form of gibbsite (34-46%) and boehmite (1-12%), thus Jamaican bauxite may be classified as `mixed' trihydrate/monohydrate or gibbsite/boehmite bauxite. The proportion of trihydrate to monohydrate is important as the processing requirements are very different between the two. Blending is encouraged in order to maximize use of the resource. The main impurities are hematite or goethite (17-21%), and silica (1-8%), with minor amounts of titania, phosphorus, zinc, and manganese. Trace elements include the rare earth elements. Some radioactive elements also occur in the bauxite and these, along with the REEs, are concentrated in the red mud residue. Research at the Jamaica Bauxite Institute has proven values of approximately 2 500 ppm REEs in the red mud.

The limestone regions hosting bauxite deposits have a general topography resembling an upturned egg box. Small discrete deposits occur in low-lying areas between rounded limestone hillocks, and thus road construction to access each individual orebody is challenging and forms a major part of mining expenses (Figure 1). The limestone terrain on the northern side of the island is more rugged, with smaller deeper deposits. These can be difficult to both mine and restore. On the southern side, the landscape is more open and undulating, and accessibility to deposits is easier.

Figure 1. Bauxite occurrence in Jamaica.

Population in Jamaica is widely distributed, even in what would appear to be the more remote areas away from population centres. This is likely a legacy from the slavery era, when slaves would escape into the mountains to get away from the plantations, and after slavery they were able to settle on mountainous and other marginal lands that were undesirable for other agricultural activities. Mining in populated areas has created its own set of challenges unique to Jamaica, and the bauxite industry has had to find creative ways to work within this environment.

Bauxite mining began in Jamaica in 1952, and some attempts at restoration began shortly after. In December 1953, the first Certificate of Restoration was issued by the Government of Jamaica. Over the next few years, experiments were carried out in a number of mined out orebodies using orchard crops such as avocado, citrus, ackee, lychee and coffee. However, it soon became obvious that this was not sustainable as it required intensive fertilization and constant extension services which all came at a very high cost. In addition, the need for a rapid vegetative cover to prevent soil erosion on the steep-sided reclaimed pits meant that the use of orchard crops was not the most suitable option. The use of grass in restoration then became widespread, especially given that the mining companies were also engaged in cattle rearing on the unmined lands as a land management strategy[1].

In over 70 years of bauxite mining, the Jamaican industry has seen significant changes in mining practices. Some of these are in a direct attempt to reduce costs, but also very important is the issue of mining in populated areas and the increasing scrutiny of the industry by environmentalists. Mining companies have had to adjust their practices in order to conform to fairly rigid mining and environmental laws, and to be able to co-exist with communities in proximity to the mines.

Main Laws Governing the Bauxite and Alumina Industry

- The Mining Act, 1947
- The Minerals (Vesting) Act, 1947
- The Mining Regulation, 1947
- The Bauxite and Alumina Industries (Special Provisions) Act, 1977 (1982)
- The Bauxite (Production Levy) Act (1974) (1998)
- The Bauxite and Alumina Industries (Encouragement) Act (1950) (1997)
- Natural Resources Conservation Authority Act, 1991
- Natural Resources Conservation (Permits and Licences) Regulations, 1996 (amended 2015)

Mining is permitted in Jamaica through the granting of a Mining Lease. This Lease has conditions specific to the mining operation, and the legislations have had to be put in place to ensure that conditions of the leases can be enforced. The Mining Act was originally passed in 1947 when Jamaica was still a British colony. The supporting Regulations were later prepared and all have since been amended. These laws control mining and prospecting for minerals in Jamaica, which importantly, includes bauxite. Under the Act, one may acquire a Mining Lease which usually lasts no longer than 25 years, but it can be renewed. "Minerals" are defined under the Act and include all metalliferous minerals and coal but not oil, nor construction materials, which each has respective legislations addressing petroleum and quarries.

The reclamation of mined out bauxite lands is governed by the Mining Regulations. Section 53 of the law says:

"As soon as **may** be practicable, and in any event not later than three years after mining operations are concluded in **any** area, the holder of the mining lease shall restore every hectare of land disturbed for mining in such area, as nearly as may be practicable, to the level of agricultural or pastoral productivity or of utilization for afforestation purposes or such other uses as may be approved by the Commissioner or the Town and Country Planning Authority."

Of note is that there are some lands that cannot be mined under the Mining Act without the permission of the Commissioner of Mines. The Statutory Limits include land dedicated or set apart for a public purpose (other than mining), a burial ground or within 100 metres of these places, any area within a town or village, any area which is the site of or is within 100 metres of any building, works, reservoir or dam owned or occupied by the Government or by a public authority, or land within 100 metres of any building, except with the permission of the occupier. (Sec. 8, Mining Act).

2. Restoration Processes

In order to comply with the stipulation in the Mining Regulations, the mining company first has to remove the topsoil from the orebody, usually no more than about 50 centimetres, and stockpile this topsoil adjacent to the pit for use later in reclamation. After this, mining of the deposit begins as there is virtually no overburden. The size of deposits varies considerably, with the smallest being just over one hectare, and average depths are about 7 metres. Small pits may hold only 5,000 tonnes of bauxite and last only a few weeks, whereas larger ones may be in excess of 1 million tonnes and are mined over several months. At any given time, the mining company may have a number of pits open in order to be able to blend the ore to the specifications required by their refinery. Once the orebody is completely mined, the mining company receives a 'mined-out' permit from the Commissioner of Mines to begin reclamation.

Reclamation is the process through which the mined out area is reshaped and top-soiled. Restoration refers to the activities required for the revegetation of the newly reclaimed area. Reclamation and restoration processes are coupled and referred to as rehabilitation. In the early days of reclaiming bauxite pits, various techniques were used. Some resulted in steep, almost vertical slopes at the sides of the pit, with a flat bottom planted with grass. Other pits had a benched profile. Pit reclamation has now shifted to a "smooth bowl" profile where material is cut from the sides (the 'swell area') to backfill, smoothen, and raise the height of the pit bottom. This best practice is now the industry standard, and steep slopes are generally not allowed due to safety considerations. This practice results in a final restored area which is greater than the original pit and intrusion on forest vegetation at the edge of the pits is minimized (Figure 2).

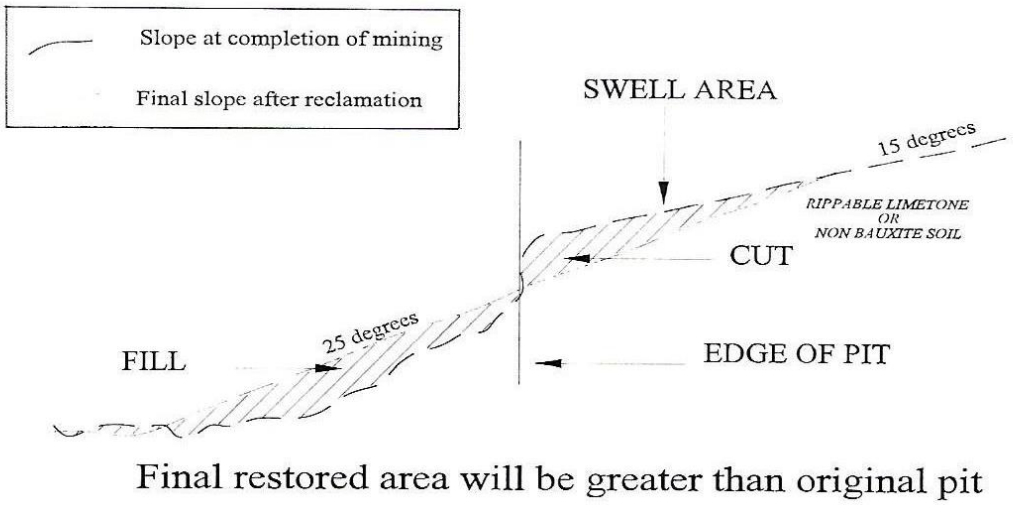

Figure 2. The Smooth Bowl Reclamation Technique. [1]

The first step therefore, is the reshaping of the limestone floor of the pits. The bowl-shaped profile is created by cutting back the edges of the pit to a gentler gradient, thereby opening it out. On the northern side of the island, this can be quite a challenge because the pits may reach a depth of 30 metres but have a small surface area, giving the configuration of a cylinder. The pits are surrounded by heavily forested hillocks of limestone which should ideally should not be touched in the reclamation process. Once the reshaping is complete, the next step is top-soiling. Topsoil that was removed and stockpiled at the start of mining is now spread over the reshaped surface. This may become problematic because by widening the footprint of the pit, the surface area increases, creating a "swell area" and the layer of topsoil removed may not be sufficient to adequately drape the freshly generated surface. Additional topsoil oftentimes has to be brought in to supplement the shortfall. The layer of topsoil should be a minimum of 30 cm deep. This allows for the planting of the common cash crops, and studies have shown this to produce acceptable yields. Tree crops require deeper soils, and take longer to establish. In such cases, the three-year time frame may be too short. However, exemptions/extensions can be given by the Commissioner of Mines under specific circumstances.

Even after reshaping, slopes can still be relatively steep so control of runoff is very important to minimize erosion of the topsoil and prevent it from being washed down into the middle of the pit. Limestone boulders are used to create check-dams along the contours to slow down the flow of rainwater and divert it to the lowest point of the pit where it will percolate into the fractured karst limestone below. Vegetative barriers may also be used e.g. *Leucaena leucocephala* (river tamarind) is planted along the contour for soil conservation as well as for animal fodder.

On completion of the top-soiling, the pit is usually planted with a species of grass. Trials conducted by the mining companies using different grass species have shown that Napier grass, Pennesetum pupureum, works best, being more drought resistant and more nutritious for animals. Other grasses used are Bracharia decumbens, not as good under drought conditions, and Cynodon nlemfuensis (African star), which is invasive but slow growing.

The use of grass assumes that the end-use will be pasture. The planting phase is normally timed to coincide with the rainy season in order to give the grass the best chance of survival and to quickly cover and protect the topsoil. In areas where there are farmers who want land to produce crops, the pit would be handed over to the farmers after certification, with the support of the mining company's extension services. Common crops include sweet potato, cabbage, pumpkin, yam and cassava. Crops that will give a quick cover of vegetation as close to 100% as possible

are best. Organic manure, primarily poultry litter, is used to improve organic content, moisture retention capacity and fertility, but only for those pits not near to communities because of the odour and attraction to flies.

In recent times, pits have been used for the harvesting of rainwater as the bauxite areas tend to have limited rainfall and the water table is very deep. This has allowed for associated greenhouse farming to replace field cultivation in those areas and has produced a very successful conversion of mined out lands into agriculture. The greenhouse farms do very well, and farmers have a ready market for their crops in the hotel and tourism sector.

Currently, there has been a strong urge to use mined out lands for the planting of castor beans as it naturally grows wild on these bauxite lands. There is now a significant market for castor oil for beauty treatments and therapy. In addition to its therapeutic properties, castor oil has numerous industrial applications in transportation fuels, and the manufacturing of caulks and adhesives, dyes, brake fluids, lubricants, and many other products that play integral roles in everyday life.

Once the mining company has achieved full vegetative cover on the pit, they request the Commissioner of Mines to conduct an inspection exercise in keeping with their legal obligations as in Section 54 of the Regulations which states:

"Upon concluding mining operations in any pit the lessee shall apply to the Commissioner for a certificate that the requirements of sub-paragraph (c) of paragraph **(1)** of regulation 53 have been complied with, and the Commissioner upon being satisfied that such requirements have been complied with shall issue to the lessee a certificate to that effect."

If the conditions are not met within the three year window, Section 55 may be effected:

(1) A holder of a mining lease who fails to obtain a certificate under regulation 54 upon the conclusion of mining operations in a pit shall pay to the Commissioner for and on behalf of the Government the sum of twenty-five thousand dollars in the currency of the United States of America or the equivalent of that amount in the currency of Jamaica for each hectare of such land.

(2) Where a pit is not restored within the period specified in regulation 53(1) the holder of the mining lease shall, for each year during which the pit remains unrestored, pay to the Commissioner, the sum of two thousand five hundred dollars in the currency of the United States of America or its equivalent in the currency of Jamaica for each hectare of land disturbed for mining.

(3) The Commissioner may extend the period for restoration of the pit if the lessee satisfies the Commissioner that such extension is reasonably warranted.

Thus, once a mining company has successfully completed restoration, they are entitled to receive a Certificate of Compliance. If they fail to obtain this certificate within three years after the conclusion of mining in each pit, then they are liable to pay the fine of US$25 000 or the Jamaican dollar equivalent for each hectare of land. Failing to restore a pit after the three-year period attracts an additional fine of US$2 500 or the Jamaican dollar equivalent, for each hectare of land for every year that the pit remains unrestored. However, the Commissioner can exempt the mining company from the duty to restore the land or extend the time period for restoration given specific circumstances.

The certification process for restored areas is conducted by a multi-disciplinary team of Government officers from the Mines and Geology Division, the Ministry of Agriculture, the Jamaica Bauxite Institute, and sometimes the Forestry Department.

Criteria for certification includes:

- Soil depth – minimum 30 cm
- % vegetative cover – preferably 100%
- No evidence of soil erosion/measures to control erosion
- Loose stones on the surface – should be piled up on the sides or used for check dams
- Absence of vertical faces – safety issue

If all requirements are met, the pit is deemed satisfactorily restored and a certificate is issued for each pit. Conditional certification is also possible, if the work is mostly satisfactory but there are minor faults to be corrected (re-inspection will be conducted at a later date).

If the work has failed to meet the standard, the pit is rejected outright. The restoration will have to be redone and the pit presented again at a later date. If there is a challenge with the reclamation which will cause the pit not to be ready for certification within the specified three-year timeline, an application for extension can be made before the deadline to the Commissioner of Mines.

All the mining companies have been 100% compliant with the law in terms of the three year deadline, and often exceed the requirements stipulated by the law. The shortest time in which a mined out pit has been certified is six months. The cost of rehabilitation is a significant expense, however mining companies do not want to be in breach and be fined. More importantly, the mining companies understand that in order co-exist harmoniously with the residents in the mining areas, they have to leave the land in a productive state when mining is completed as the demand for land is very high. In addition, where residents are impacted by noise and dust pollution, compensation has to be paid to them by the mining company. Rehabilitation cost varies depending on the end use and ruggedness of the terrain and can run anywhere between USD 20 000 and USD 40 000 per hectare, so it is a significant operational cost.

Apart from restoration for agricultural purposes (Figure 3), land is often required for resettlement of residents which were moved off the land for mining. If the land was originally privately owned i.e. not owned by the Government, the owner may request to be put back in the same location once the land is mined and restored, or on a land parcel of their choice nearby. In previous times, residents would sell their land to mining companies for cash but at present, potential vendors more often opt for a land swap instead.

Figure 3. Growing cabbage on reclaimed land

Some are willing to go into formal housing developments established by the mining company, especially if they are located near to a hub of commercial activity. It has been observed that when older residents pass away, the heirs to their lands are more amenable to selling, especially in remote areas, and moving closer to the towns.

Parish development authorities or community groups can also request lands certified restored for housing, school playgrounds, community centres and so on, depending on the needs of the local population. These lands will then be reclaimed for the specific purpose, thereby improving the quality of life of the residents.

Figure 4 shows the approximate acreages of land which were disturbed for mining as opposed to lands which have already been certified restored. Thus at any given time, roughly 80% of lands which have been disturbed have either already been restored or are in the process of being restored. Only 15 % of lands are either actively being mined or as yet unreclaimed. 2% of lands are exempt, and this category includes orebodies which were used as residue disposal sites. "Other" category includes infrastructure such as roads.

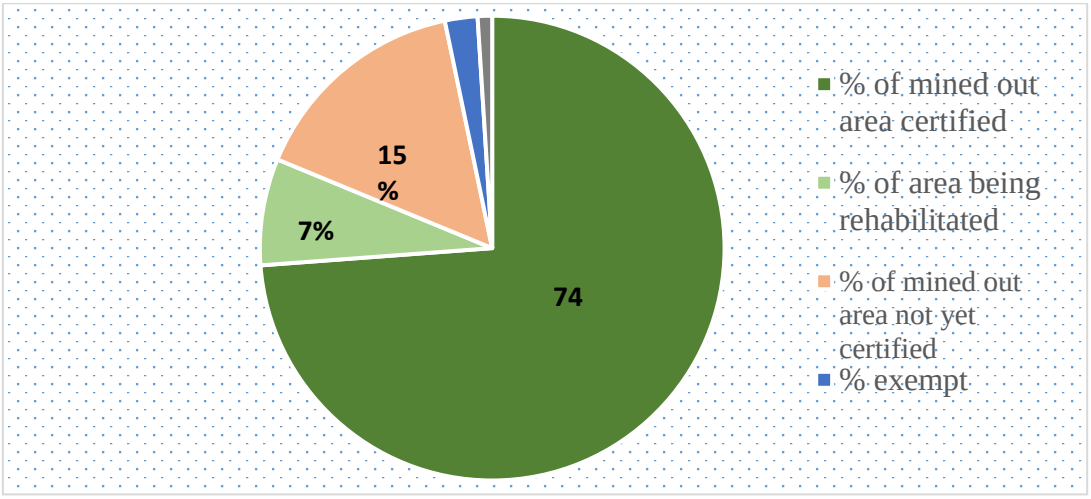

Figure 4. Categories of areas disturbed for mining.

To lessen environmental impacts, some mining companies have established plant sanctuaries where orchids or bromeliad species which would be impacted by mining are relocated prior to mining. In order to cut costs of road building, all mining companies now use standard road trucks to haul bauxite thereby reducing haul road footprint. This has the added advantage of lessening the impact on the limestone forest as building of haul roads are the main cause of deforestation in mining areas and not the actual mining of the orebody itself. In addition, haulage is now carried out solely by local contractors, thereby getting the communities involved in mining directly and indirectly.

Figure 5 shows the approximate proportion of end use in each category.

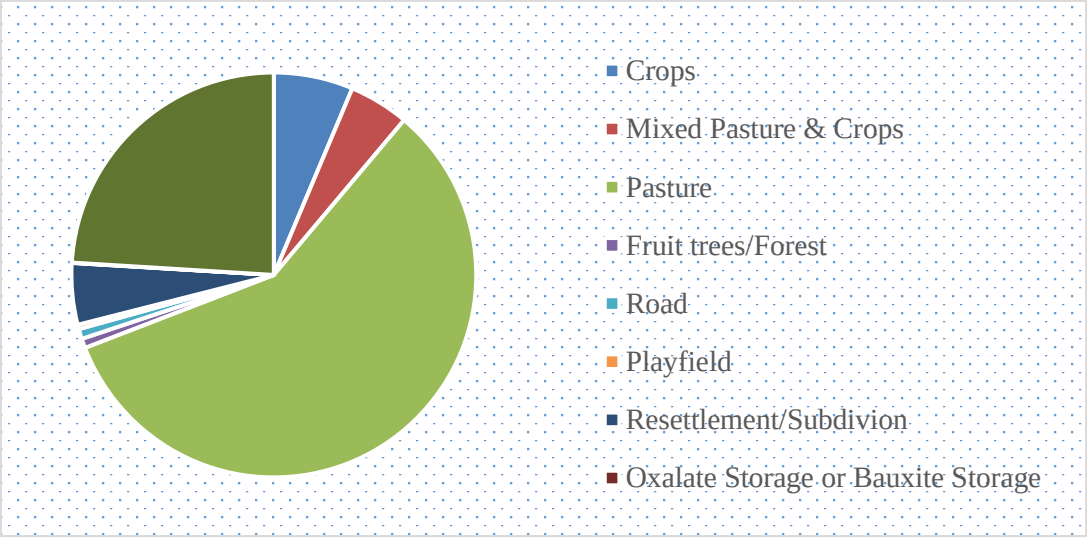

Figure 5. Categories of end use.

3. South America Comparison

In stark contrast to the Jamaican scenario, the laterite type bauxite deposits of South America are much more extensive in occurrence. South American bauxite often forms a thin seam in comparison to the depth of the overburden. For example, the Surinamese Coastal plain bauxites have an average thickness of 6 m. The Coermotibo bauxite is a buried deposit located in the eastern part of the Guiana Coastal Plain. Here, the bauxite-capped plateau has a total surface area of approximately 20 km^2 .The bauxite layer is 3–6 m thick, with an overburden of approximately 40 m [3]. Mining operations began in Suriname over 100 years ago, and other than the Coermotibo deposit, most of the Coastal Plain bauxites have been mined out, but reclamation activities have only just been carried out in recent years, more or less as part of Suralco's closure plans. These activities met with varying success initially, as the revegetation process turned out to be not as straightforward as might have been expected. Much experimentation has gone into the work that has been done so far, and it has been very challenging to get regrowth in some areas as the loose sandy soil does not readily support seedlings. However, significant improvements have taken place with time and deposits such as New Boon, Wane and Peto Hill have been successfully restored. There were no regulations in place that would have ensured that reclamation kept pace with mining.

In Guyana, the coastal bauxite deposits occur in a belt 20-40 km wide and 250 miles long roughly parallel to the Atlantic Coast and up to 100 km from the coast. The general geological setting throughout comprises lenticular bauxite bodies of between 1 m and 10 m in thickness, situated beneath an overburden of between 1 m and over 100 m of sands and clays. The underlying bauxite is not continuous, but most likely exists atop palaeo-plateaus, with little expression on the present topography.

In the Linden-Mackenzie area, occurrences of bauxite cover an area ~25 km in diameter. Here, the bauxite can occur over 100 metres below surface and only 12 metres in thickness. The Bonasika deposits, for example, are regarded as shallow at 15-30 metres and are about 4 metres in thickness. The stripping ratio (overburden to ore ratio) is the main determining factor in whether or not it will be economical to mine. A maximum ratio of 6:1 is used, beyond which it is uneconomical.

The overburden of white sand and clays is pushed into areas already mined out or just put out of the way of mining, but no attempt is made to reshape or revegetate the area and it does not

naturally revegetate over time. In Jamaica, if the orebody is top-soiled and left as is, within 10 years it will be fully vegetated with scrub and a few taller trees.

Ground water is a major issue in Linden as bauxite lands may only be 15 metres above a river. The bauxite is below the water table so the mines will be flooded if the water is not pumped out. Excavation also encounters natural springs which have to be channelled and pumped, especially in the rainy season. There are large artificial lakes of blue water in the mining area, coloured by the minerals in the water. To date, no attempts have ever been made to reclaim any of the bauxite mining areas in Guyana. As with Suriname, the disturbed areas do not easily revegetate naturally.

A similar situation exists in the deposits of the Paranam bauxite district in Suriname. This type of deposit would be impossible to reclaim in the usual way, especially as the ground water is acidic, as low as pH3. The closure process for all the "wet" mines is similar - reduce the slopes at the edges of the pit, and then allow them to fill with rainwater or groundwater. The normal run-off from rainfall is also acidic due to organic acids, so pH is generally in 5-6 range.

In Brazil, the situation is quite different. Most of the remaining reserves of current rainforests in the world are in the Brazilian Amazon, which has a crucial role in global climate regulation. The region also plays a key role in carbon storage and in the planet's hydrological cycles. Thus Brazil has numerous regulations and laws about the recovery of degraded environments. The main one is the Forest Code (Updated version - Law No. 12.651/2012). This policy establishes that all damage caused to the environment must be reversed, obliging those who degrade to recover their areas. The bauxite mines occur within the Amazon rain forest and any clearance of forest must be subject to approval from the federal environment authorities. A legal requirement to restore the forest has been in effect since 1984.

One of the largest bauxite mines in the world, Mineração Rio do Norte (MRN) Trombetas mine is located on the Trombetas tributary of the Amazon River. MRN started production in 1979, and reforestation began in 1984. Now reforestation commences as soon as a mining area is closed.
The bauxite deposits are surface-mined in open pits. First, the forest is cleared, and the topsoil (about 50 cm thick) and overburden (8-12 m thick) are separately removed and stockpiled for later use in reclamation. Once mining is completed, the topsoil is replaced and planted with rainforest tree seedlings. To date, thousands of hectares have been restored to forest with millions of seedlings of native trees planted to re-create the high-biodiversity rainforest. The ultimate goal is to re-establish the forest so that it is as close to the original as possible.

Wildlife monitoring is initiated in the years prior to mining and continues during forest clearance. Slow-moving animals, such as sloths and tortoises, are relocated to previously restored forest areas. Plant specimens like orchids, tree seedlings and the nests of stingless bees—vital for the pollination of many forest plants and trees, are saved for later replacement. Species selection is based on their speed of growth for soil protection, their ability to attract animals through fruit and flower production to import seeds from outside the area, and their use to people in terms of fruit and nut production, medicinal properties and timber.

The Paragominas bauxite deposit, operated by Hydro, lies within the eastern Amazon region and the Maranhão Basin. The bauxitic zone extends over at least 1,000 km² with an average thickness 2.2 ±1m in a nearly continuous tabular body. Strip mining in Paragominas began in 2007. The mining sequence consists of deforestation, waste stripping, mining of the crystallized bauxite layer, waste fill (from subsequent strip) and reforestation [4]. The ore is crushed and transported in a 244 kilometer-long pipeline to the Alunorte alumina refinery in Barcarena. Their reforestation program commenced in 2009 and large amounts of research into the restoration of biodiversity has been conducted. Although most of the area being mined had already been

affected by logging, ranching and farming, the aim is to return the already altered areas to a better condition than before they arrived.

Studies done by the Brazil-Norway Biodiversity Research Consortium (BRC) have gone a far way to achieving their objective of environmental recovery by re-establishing the elements of the ecosystem. After eight years of reforestation, many species of birds that feed on seeds, fruits or plant parts were found. Another important indicator is the fact that all species found reproduce at the site.

Figure 6. Ecological trail in rehabilitated area, Paragominas, Brasil

Almost 2 500 hectares have been reforested in the Paragominas mine region since 2009. About 70% of the reforestation was carried out with the nucleation technique and 30% with traditional planting. Nucleation consists of the formation of "islands" or vegetation nuclei with species with ecological capacity to significantly improve the environment, facilitating the occupation of this area by other species. Topsoil and cut wood are unevenly distributed simulate a natural landscape and trap rainwater. The wood creates shelters for insects and animals and improves the growing conditions for plants and fungi. The species used in the recovery were inventoried prior to the extraction of the ore, with approximately 50 species adaptable to the conditions of the region. In areas where reforestation has already taken place the regrowth of plants and return of animals is monitored and registered. A pilot projected installed 30 camera traps all over the property to improve the monitoring of jaguars and tapirs. Hydro's goal is to recover a ratio of 1:1, that is, for every 1 hectare made available in the year, 1 hectare will be recovered within two years after availability. The investment in research allows the company to know if the method being used in each location is enabling the mined area to be recovered and if the animals that lived there in the past will be able to return.

A major difference between bauxite mining in Jamaica and in South America is that in the latter, there is very little population to be impacted in the mining areas. There is little need for consideration of compensation of residents for noise or dust, and rarely any need for relocation as usually if there is population in the mining areas, it could be indigenous people who may be accustomed to a nomadic lifestyle and simply will relocate themselves. The local population who lives in the towns seem somewhat unaware of the impact of mining because it is taking place far away from them, and on vast acreages of land which are just taken for granted. Because of this, the pressure to reclaim is not as intense as in Jamaica, a small island of 10 991 km² where every hectare counts.

Jamaican mining companies have to contend with periodic community protests – road blocks, placard demonstrations, sometimes physical altercations, with use of the media (including social media) to air their discontent. In order to help resolve these problems, the bauxite industry has formed community councils with joint representation from community groups, mining company personnel, government agencies such as the Mines and Geology Division, and the Jamaica Bauxite Institute. So far there are 17 active community councils in areas impacted by the bauxite/alumina industry – mines, refineries, ports, and railway lines. Community members have a forum in which to raise the issues of concern to them at monthly meetings and towards obtaining resolution. The success of this problem-solving mechanism led to the councils developing a wider scope of community development, assisted by the Bauxite Community Development Programme, which is administered by the JBI and provides funding for projects in these areas. The BCDP's mantra is "Life After Bauxite" and the long term goal is to prepare residents in mining areas for the day when there is no further income to be had from mining. Communities would have developed skills to allow them to continue to grow and develop sustainable economic activities.

In recent times in Jamaica, there has been a lot of anti-mining sentiment, initiated, funded and sustained by large environmental groups. This environmental lobby is very powerful, and are willing to use litigation to achieve their ultimate desire of shutting down the mining industry. They publish a lot of misinformation and disinformation, making use of social media to manipulate the emotions of Jamaicans at home and abroad. However, people need to realize that as long as they are consumers of goods, they create demand and provide a market, making them a part of the problem. Everyone wants to drive a nice car made of aluminium, but no one want to face the reality that the bauxite to supply the aluminium has to come from somewhere. We can't bury our heads in the sand and pretend that having a new smart phone every year does not have any environmental consequences.

Jamaican bauxite reserves are no longer believed to be infinite. In fact, we now have no unallocated bauxite-bearing areas left. All deposits are now under lease to some mining entity. We can have another good 20-25 years of mining left. To maximize benefits and reduce negative impacts, we must mine responsibly and restore to the highest standards. We have proven that strong legislation facilitates this, as the same company who is a model citizen in one part of the world does not have the same sense of corporate responsibility elsewhere and will basically do whatever they are allowed to get away with. Some mining companies take great pride in their reputations for corporate responsibility. For those who don't, legislation must be put in place to force them to restore the land to its former state as much as possible. This is especially important where bauxite mining is being conducted by multi-nationals who can just walk away when the business is no longer deemed profitable, leaving the host country to deal with the aftermath. Closure plans for the operations should be required by law, including the mining areas. We are part of one planet, and whatever occurs in one location, no matter how remote, will eventually affect us all. We are all accountable.

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