

Reefs and anthropogenic pressures: from mine to lagoon

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Aerial view of the Nakéty mining massif (east coast), where red contrasts with green vegetation and blue ocean. © P.-A. Pantz

New Caledonia from the sky, the clash of red and blue

Seen from the sky, New Caledonia's Grande Terre is a colorful composition dominated by the green of the mountain chain forests in the center and mangroves along the coast, the blue of the lagoon around it and the patches of red of the mining massifs. These colors can be interpreted in two different ways. Where the dominant color is red, open-pit nickel mines are the defining elements of the landscape and the lagoon is perceived as a threatened ecosystem that receives the terrigenous pollution generated by mining. In contrast, one can choose to focus on the "world's largest lagoon",

according to LABOUE *et al.* (1999). In this interpretation, New Caledonia is then essentially surrounded by the blue of its marine environment. This red and blue conflict often structures political debates about the economic future of the country. Today, everyone acknowledges the exceptional natural assets that represent the reefs and lagoons of New Caledonia. With a total surface of approximately 23,500 km², New Caledonia harbors significant marine biodiversity, accounting for over 15,000 known species. However, many areas and biological groups are still poorly known (PAYRI and RICHER DE FORGES, 2007). For more than a century, nickel mining and the associated metallurgical industry have dominated New Caledonia's productive economy. During the 2006-2016 decade, they accounted for 90% of the value of exports, reaching 1,040 billion euros in 2016

despite the very low world market price of nickel (8,500 dollars per ton in January 2016 when it was twice as much in 2011). This sustained export value is due to record levels of ore and nickel metal production in 2016. Mining has never been so intense in New Caledonia's history and, as a consequence, viewed from the sky over New Caledonia, each year the red patches become more visible.

Pressures are dominated by human action: Catchment areas and urban centers

Although New Caledonia is affected by climate change, like the rest of the region, the future of the reefs also largely depends on human activities that occur along the coasts and catchment areas. These anthropogenic pressures include urban or agricultural pollution and environmental disturbances caused by nickel mining. Since the opening of the first metallurgical plant in Nouméa in 1877, open-pit mines have proliferated and left open wounds on the sides of the mountains. Meanwhile, New Caledonia's Grande Terre is one of the southwestern Pacific regions most affected by tropical cyclones (8 to 9 tropical cyclones and storms per year), daily rainfall is close to world records and the catchment areas are often steep. In this context, limiting the erosion of mining sites is a priority. It requires the management of runoff and revegetation⁸ by planting either fast growing native species such as *Acacia spirorbis* and *Casuarina collina*, or a combination of species from the local flora on mining massifs (L' HUIILLIER *et al.*, 2010). Soil erosion resulting from poor agricultural practices, overgrazing of livestock (cattle) and overpopulation by non-endemic wild deer, or wildfires⁹ can also impact the lagoons locally. During periods of frequent and intense rainfall, the use of fertilizers and pesticides can create further local problems, especially in the South Province, where most farms of more than 100 ha, including vegetable farms, are located.

In urban areas, poor wastewater treatment is the major issue. Over 70% of the population lives in Grand-Nouméa, the capital and its three neighboring municipalities (Paita, Dumbéa and Mont-Dore), and in the urban conurbation of the North Province, which spreads

over the Voh-Koné-Pouembout area (DAVID *et al.*, 1999; BOUARD *et al.* 2016). Outside these main urban areas, municipalities that have more than 1,000 inhabitants are relatively rare and developing collective waste water treatment is very expensive.

Pressures from the lagoon

Due to the size of the fishable area (7,280 km², including 5,490 km² of coral reefs and 1,800 km² of lagoon soft bottoms), the overall impact of fishing on reef formations is limited. However, there is a local risk of overfishing. This is particularly true in areas close to urban centers, mainly because of the high recreational fishing activity and the quotas authorized by public authorities (JOLLIT *et al.*, 2010). Species valued on the international market are also highly vulnerable to overfishing. These are mainly trochus (or top-shaped sea snails, used for button manufacture in the high-end textile industry) and holothurians (sea cucumbers or bêche-de-mer). Bêche-de-mer is highly valued on the Chinese market, and fishing for this marine invertebrate has increased sharply since 2006. The annual international demand for 70,000 tons of dried product is difficult to supply, and prices can reach 2,000 euros per kilogram on the international market. As a result, there is increasing pressure on the countries that still have resources, and illegal fishing by Vietnamese vessels occurred in 2016 and 2017 in the New Caledonian lagoon (chap. 31).

In many countries around the world, aquaculture is a very environmentally significant activity. In New Caledonia, the small size and low number of prawn farms (18 companies with an average surface area of 40.2 ha), the low densities of prawns (average yield is 2.5 t/ha/yr) and the ban on chemical fertilizers and pesticides work together to limit the impact of effluents on coastal waters. Ponds are located on 723 ha of saltmarshes (salted grounds at the back of mangroves) which prevents the degradation of mangrove cover, unlike what is found elsewhere in the world for extensive prawn farms. The preservation of the environment is also essential to the quality standards of the New Caledonian product and an important asset for export to foreign markets. Besides prawn farming, aquaculture is still underdeveloped.

⁸ Where the sites were built before 1975, their rehabilitation is the responsibility of the French State and where they were built after that date, the responsibility is that of the Government of New Caledonia.

⁹ Depending on the year, fires can destroy tens of thousands of hectares of land.



Shrimp farm, west coast of Grande Terre. © P.-A. Pantz

In 2017, it was limited to two caged farms, one for the emperor red snapper (*Lutjanus sebae*) and the other for the golden-lined spinefoot (*Siganus lineatus*). Due to the small size of these farms, their impact on the lagoon is minimal.

Apart from fishing and aquaculture, the recreational use of the lagoon and islets can also affect the quality of ecosystems, especially around Nouméa (chap. 33). In rural areas, the extraction of sand from shallow waters can significantly increase coastal erosion

World Heritage inscription and pressure reduction

The year 2008 is a remarkable date for New Caledonia's reefs with the inscription on UNESCO's World Heritage List of 15,808 km² of reef barrier and lagoon, an increase by 35 of the protected area which previously stood at 446 km². Six sites were listed, two in each of the three provinces and two buffer zones were also included. The first covers 8,206 km² of the Southern Lagoon and adjacent waters. It includes the coastal zone near the Goro metallurgical plant where a 26 km long pipe discharges waste water offshore at a controlled toxicity level.

The second covers most of the catchment areas of the municipalities of La Foa, Moindou and Bourail and one third of the land area to the north-east of Grande Terre, a total of 5,146 km². Besides Grand Nouméa, these drainage basins are the areas of the South Province most affected by man. Their designation as buffer zones is an opportunity to develop integrated drainage basin and coastal zone management.

Ultimately, listing the reefs of New Caledonia as heritage sites, such as the creation of the Marine Park of the Coral Sea in 2014, represents a valuable opportunity for more environmentally friendly public policies. This includes the generalization of wastewater treatment, and changes to individual behavior in order to reduce pressures on the reef environment. The ambition is that within 20 to 30 years New Caledonia will be established as one of the rare places on the planet where the reef ecosystem is in good condition.

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