

Human Impact on the Great Barrier Reef

[Introduction](#)

[Climate Change](#)

[Pollution](#)

[Over-fishing](#)

[Conclusion](#)

[Bibliography](#)

Another significant impact humans have had on the coral reef ecosystems in the Great Barrier Reef is its pollution problem. There are numerous ways humans have added harmful pollutants into our oceans that can cause serious damage to the fragile ecosystems of the coral reefs. Deforestation, although not directly involved in coral reef destruction, has many indirect effects that cause many issues. Sediment runoff will bring with it many natural and toxic components that can cause harm to the coral ecosystems. There is also sedimentation buildup that occurs at the mouth of the rivers that lead into the oceans. (Coral Reefs, 2004) Another major pollutant is runoff from mining and farming where the minerals get into rivers that flow into the ocean. Farming has specific negative effects with this type of pollution because of the nutrient runoff from the fertilizers used. These fertilizers add nitrogen and phosphorous into the oceanic ecosystem. These nutrients cause massive algae growth that leads to depletion in oxygen available for other creatures and decreasing the biodiversity in those affected areas. (Bell RPF, 1992) It also leads to algae blooms that take over sections of coral, blocking the sunlight and hurting its ability to survive. The coral reefs also have a hard time surviving through human pollution by petroleum leaks and other chemicals that get dumped into the oceans because of its toxicity the environment. Overall human pollution has been a major source for issues involving the Great Barrier Reefs and its struggle to survive in today's harsh conditions.

Pollution: Fertilizers and pesticides

Pollution has made significant impacts on the Great Barrier Reef and its struggle for survival. Human based pollution that has caused such harm to our reefs needs to be stopped or reduced significantly if we wish to save this fragile ecosystem. Certain model estimates indicate that 22% of the world's coral reefs are threatened by land-based pollution. (Puglise 2007) Main-land based pollution stressing the coral reef ecosystems are chemical and nutrient based. This type of pollution includes fertilizers, herbicides, pesticides, human derived sewage, and large amounts of sedimentation from costal land development. These pollutants have many serious direct impacts on our coral reef's ecosystem such as altering the species composition by fauna shifting from phototrophic to heterotrophic. Largely impart to the corals inability to obtain necessary energy from light because of the increased turbidity of the water due to the pollution process. There is very high nutrient enrichment effecting the Great Barrier Reefs such as nitrogen and phosphorous. Other pollutants also have a great effect on the coral such as heavy metals.

It is noted that 80% of the land adjacent to the Great Barrier

Reef is farmland that supports agricultural production, intensive cropping of sugar cane, and major beef cattle grazing. (GBR, 2007) These types of agriculture and cattle production pose large threats to the Great Barrier Reef close by. Fertilizers are highly used with agriculture and contain high amounts of phosphorous and nitrates. Farmers use nitrogen fertilizers frequently because it is an essential nutrient for crop and animal production, both found on the area near the coral reefs. If the farmers over feed or fertilize with the N fertilizers, it can be lost to ground water and surface water. (Nitrogen Management, 2007) The same is true for the macronutrient fertilizers used such as NPK. This is a fertilizer made up of nitrogen, phosphorous, and potassium, which is also used by numerous farmers on their crops. The same issue of runoff occurs if farmers apply too much. Overall when these fertilizers and the nutrients used, the runoff and leaching that occurs poses a large threat to the coral ecosystem.

<http://commserv.ucdavis.edu/CESanDiego/Schlgrdn/fertilizer.jpg>

Pesticides are another agricultural practice that damages the health of coral reefs. Farmers to kill off specific types of insects and weeds that may be harming their crops specifically use insecticides and herbicides. These pesticides are made up of heavy metals such as lead, mercury, arsenic and other toxins which are not only dangerous to humans, but other aquatic and plant species. (Pesticide, 2007) The pesticides are found in the runoff that occurs with erosion of farm soil, taking the chemicals downstream and into the coral ecosystems off the coast. Both of these farming practices of pesticide and fertilizers have many negative impacts on the Great Barrier Reef and its diverse ecosystem.

Runoff

An example of the dangerous harm the farmers have caused the Great Barrier Reef from runoff are those located in Queensland Australia. There is very compelling evidence that farming is harming the Great Barrier Reef. The Queensland farms have been damaging the reefs because of increased run-off of agricultural sediments, nutrients and chemicals. They have reduced coral cover and biodiversity in recent years. Two scientists, Katharina Fabricius and Glen De'ath of Australia Institute of Marine Science, have compared the health of the reef at several different locations close to agricultural areas with that at several others around 400 kilometers away. The technique used was an epidemiological technique, which was first used to link smoking to lung cancer in the 1960s. In this experiment they used certain criteria to see if there was a casual relationship between farming and its harm on the Great Barrier Reef. These included whether known biological facts support the hypothesis that poor water quality stresses coral, if run-off is

associated with a corals struggling health in other circumstances, and if the dose of pollutants have effects on the coral. The results suggested a casual link between agricultural pollution, low coral biodiversity, and poor re-colonization of the reef. An example from there experiment is that hard coral biodiversity were in greater abundance, almost double, on reefs that were far from agricultural areas than the reefs that were closer. There was also found to be a relationship that as coral cover and biodiversity decreased as the dose of pollutants increased. (Nowak, 2003) Overall this research has led to the conclusion that farming in this area and the pesticides and fertilizers used are a major health risk for the coral and biodiversity of the reefs.

The runoff from many farmlands by the coast is also destroying the biodiversity of the Great Barrier Reef with the major increase in population of the crown-of-thorns starfish. Nutrient run-off has been a main trigger for crown-of-thorns starfish who eat coral across the Great Barrier Reef. There is evidence that this is due to water pollution rather than over-fishing or natural causes. These large increases in crown-of-thorns starfish started back in the early 1960's. Since then around every 15 years there has been another large increase in this starfish. Glenn De'ath and his colleagues chose to look at the influence of chlorophyll levels in reef waters, which indicate the amount of phytoplankton available for the crown-of-thorns starfish larvae to consume. A doubling of the chlorophyll in water leads to a tenfold increase in the crown-of-thorns starfish larvae's survival rate. It is also shown that run-off nutrients such as phosphorous, has increased over the past 50 years which has driven an increase in phytoplankton levels. By changing the nutrient levels found in the water downward, they would decrease significantly the amount of crown-of-thorns starfish that are destroying the Great Barrier Reef. (Young, 2004)

Sedimentation

Sedimentation is another large impact on the Great Barrier Reefs that harms its fragile ecosystem. The sediments that flow out from rivers and large amounts of erosion carry with it many of the pollutants and fertilizers from the farms inland from the reefs. There are various levels of sedimentation and how it can affect the coral communities when run-off occurs. In this table it shows the three degrees of impact and how it can affect the health of the coral ecosystem.

Sedimentation - The degree of impact **Rate mg cm⁻² d⁻³**

1-10

Slight to moderate
Decreased abundance
Altered growth forms
Decreased growth rates

Possible reductions in recruitment
Possible reductions in numbers of species

10-50

Moderate to severe
Greatly decreased abundance
Greatly decreased growth rates
Predominance of altered growth forms
Reduced recruitment
Decreased numbers of species
Possible invasions of opportunistic species

Greater than 50

Severe to catastrophic
Severely decreased abundance
Severe degradation of communities
Most species excluded
Many colonies die
Recruitment severely reduced
Regeneration slowed or stopped
Invasion by opportunistic species

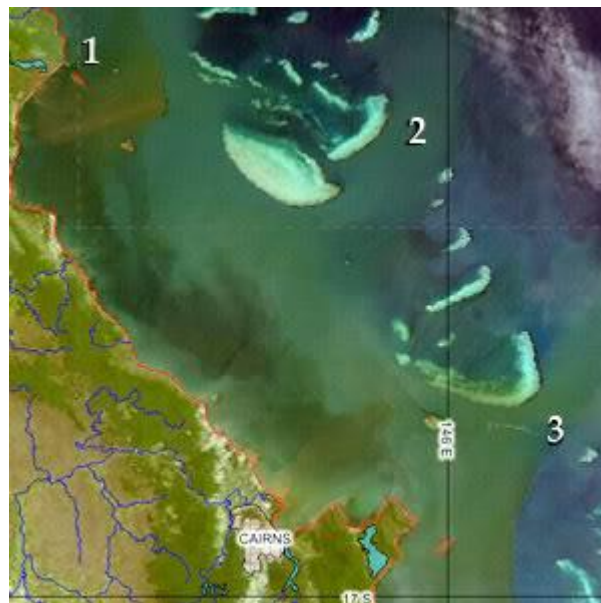
(Pastorok, 1985)

* Data used to generate this table are for reef communities at moderate depth and moderate exposure. Some variation occurs among authors in the sedimentation rates associated with the degree of impact

*Dodge et al. (1974); Ott (1975); Loya (1976b); Randall and Birkeland (1978); Lasker (1980)

*Griffin (1974); Loya (1976b); Randall and Birkeland (1978); Morelock et al. (1979); Lasker (1980)

*Randall and Birkeland (1978)



<http://www.clw.csiro.au/new/2007/sedimentplumes.html>

This is a satellite image that was taken to show the significant impact that sedimentation has had on damaging the Great Barrier Reef. The picture was taken February 9, 2007 of the coastline Australian coastline from Cairns in the south to Daintree in the north. The image shows the

sediment run-off (brown and aqua colors) has clouded the entire inner-reef. In the upper part of the photo it shows the runoff from the Diantree river [1](yellow-brown color) that travels away from the coast towards the Balt Reef and Trinity Opening [2]. The sediment plumes can be seen merging with other plumes from the south rivers that travel over 100kms through the Grafton Passage [3] and into the open ocean. (CSRIO, 2007)

Overall there is major issues that occur with human pollution to our reef ecosystem and changes need to be made in order to save such a diverse and important part of the earth's ecosystem.

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