

A Tale of Twin Towns: Natural Capital Degradation

by

Vandana A. Gudi, Department of Science, Robert Morgan Educational Center, Miami, FL

On the beautiful, pearly white beaches of Blue Lagoon you will find a big city called Sea Star. Until recently Sea Star was a tourist attraction, but now tourists no longer find it an ideal vacation spot. In the last ten years, off-shore oil drilling has changed the city completely. Oil-refining industries have popped up like mushrooms on a rotting log. To transport their products, a big railway station was built. As industrialization increased, the mayor sanctioned an airport on the outskirts of the city, which has been operating at capacity for the last seven years.

Several miles to the east of Sea Star, the plains give way to the lovely ranges of the Blue-Green Mountains. Nestled in these mountains in the thickets of tropical trees you will find our first town: Top Ville. Top Ville is on the windward side of Sea Star. As you climb down the rocky terrain and reach the valley on the other side, you come across the shores of a lovely expanse of fresh water called Crystal Lake. As the name suggests, the lake's water is crystal clear. Settled on the other side of the shore of Crystal Lake you will find our second town, Bottom Ville.

Top Ville and Bottom Ville are considered twin towns because they share the water from Crystal Lake. Most of the water supply for Bottom Ville comes from Crystal Lake. However, as you go away from the lake, the population of Bottom Ville becomes sparse and the source of fresh water changes from the lake to a few bore wells from an underground, confined aquifer.

Many families have lived happily in these twin towns for generations. The primary means of livelihood for people in Top Ville is the logging of tall trees. The majority of the people of Bottom Ville make their living via agriculture. A small but not insignificant number of people from both towns make their living by fishing in Crystal Lake.

Lately though, the rosy picture of this simple and happy life in the twin towns has been changing. A big mining company has acquired the slopes around Top Ville and has begun coal strip mining. A new plant has started to produce pesticides as well as artificial fertilizers on the outskirts of Bottom Ville. Due to the economic opportunities, the population of the twin towns has grown rapidly, especially in Bottom Ville where there is more room for development. Furthermore, the rapid economic growth of Sea Star has attracted a lot of professionals who prefer to live in the twin towns and commute, rather than live in the polluted industrial environment of Sea Star. To develop land for this growing population, the twin towns had to clear a considerable amount of old growth forest that their ancestors never touched. In addition, because of the increased demand for water, more wells are being dug as the developments crawl eastward on the expanding boundaries of Bottom Ville.

In the beginning, both towns welcomed the mining and the pesticide plant as they created new job opportunities. Residents welcomed the wave of developers since they thought that the increasing population would bring in more revenue. Both mayors of the twin towns wanted to fulfill their election promises to modernize, and they thought that the economic growth would bring prosperity.

However, these days the mayoral offices are bombarded with complaints from the scared and concerned citizens. The most common issues are the following:

1. The secondary forests of tropical trees are showing weak growth, succumbing to various insect infections and collapsing suddenly.
2. The vegetation surrounding the coal strip mine has vanished entirely, leaving not a single blade of growing grass.
3. There is a sharp rise in bladder and lung cancer cases among baby boomers.
4. The number of cases of “blue baby syndrome” has tripled in Bottom Ville.
5. There is a sudden rise in the number of cases of crippling backbone and neck damage.
6. The few dental offices are overwhelmed with a variety of dental problems rarely seen before in the communities.
7. The frequency of outbursts of diarrhea and dysentery has increased during wet seasons.
8. The water of Crystal Lake is showing a distinct green tinge with excessive weed growth and is cloudy most of the time. The fishermen are complaining about a decreased catch compared to just five years before.

The mayors of the twin towns are completely baffled and have vowed to work together to get to the bottom of the issues as quickly as possible. They have contacted the Department of Environmental Resources Management (DERM). You are a chief scientist working for the DERM. You have a strong background in organic chemistry, industrial waste management, and ecology.

When you arrive at Bottom Ville, you are pleasantly surprised to meet John, a young, environmentally conscious graduate from Sea Star University. John has been tracking the dissolved oxygen (DO) content in Crystal Lake for the last eight years. He shares this information with you.

Year	DO content at 20° C (parts per million)
2006	8.3
2007	7.5
2008	7.3
2009	6.3
2010	5.8
2011	5.2
2012	4.8
2013	4.7

You find another important piece of information in the local library archives. The town records show that the rock surrounding the aquifer is rich in fluoride. This is why the municipality did not grant any permits to develop land in the outskirts for the last several decades. This is now where a lot of developments are being built and wells are being dug. Somehow this important information was lost in the passage of time.

The leader of the local environmental group, Sam, along with other members, meets you to convey their anger towards the big corporation that owns the pesticide plant. Their investigation has revealed that the waste pool of the pesticide factory does not have lining on the bottom or on the sides, as the factory wanted to save some money. This is the third important piece of information.

Assignment

This story is rich in details about industrial environmental pollution. Your job is to find out the cause for each of the identified citizen complaints and suggest a reasonable and cost effective solution. Incorporate all the details into your analysis as you carry out the following tasks.

1. Draw a map displaying all the details provided in the case study. Use arrows to indicate the movement of wind currents, (all) pollutants, etc. Label everything.
2. Compose and type a report that follows these guidelines:
 - a. Incorporate all of the data included in the story.
 - b. For each problem you identify, clearly describe in detail the cause and the effect and then propose a solution.
 - c. Be creative. You can use any format to tell your story; it can be a news report, journal entry based on field notes collected, etc.
 - d. Give a good title.

Ancillary Activities

1. Recommend preventive measures for the future to the mayors who would like to continue the industrial and economic development of the twin towns.
2. Google a map of acidic deposition in the US, examine it, infer the effects on vegetation, and then test the inference with known impacts.
3. A commission appointed by the mayors has recommended several strategies worth \$12 million to contain the economic, social and ecological consequences of the industrialization of the twin towns. The budget of the twin towns can allocate only \$6 million. Can you help the mayors?

You are required to use the following concepts:

1. Point and nonpoint sources
2. Surface and ground water contamination
3. Agricultural runoff
4. Acid rain
5. Cultural eutrophication
6. Confined aquifer
7. Deforestation
8. Soil degradation
9. Soil erosion
10. Acid-mine drainage
11. Land disturbance due to surface mining
12. Underground leakage (from landfills, waste ponds and septic tanks)
13. Natural presence of heavy metals in rocks and soils
14. Damage to the vegetation due to anthropogenic activities
15. Contaminated drinking water and natural capital degradation



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