

River Contamination: Clean up of the Paraná River

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Summary:

The Paraná river is a massive river in the mid-east of South America which flows in the south-west direction. It is one of the most important plain rivers in the world and it is able to develop all the biological complexes that the environment presents. However, due to its powerful water flow, it also drags garbage and toxic products with it. The principal cause of the contamination is human activity, which affects one of the most vital and important resources for the development of the species. The purpose of this project is to maximize the amount of awareness of the relevance of the rivers that are used for potable water and to minimize the effect of the pollution and different kinds of damage caused to the environment the river is part of. In order to achieve this aim, strategies connected with political, legal and engineering actions to clean up the Paraná river are presented.

Keywords: water, pollution, poisoning, environmental awareness, river, garbage

Resumen:

El río Paraná es un río enorme en el este medio de Sud América el cual fluye en la dirección sur oeste. Es uno de los más importantes ríos llanos en el mundo y en él es posible desarrollar todos los complejos biológicos que el ambiente presente. Sin embargo, dado su potente flujo de agua, este arrastra basura y productos tóxicos con él. La principal causa de la contaminación es la actividad humana, la cual afecta a uno de los más vitales e importantes recursos para el desarrollo de las especies. El propósito de este proyecto es maximizar la cantidad de conciencia de la relevancia de los ríos que son usados para el agua potable y minimizar el efecto de la contaminación y los distintos tipos de daño que son causados al ambiente donde el río es parte. Para lograr este objetivo, se presentan estrategias relacionadas con la política, lo legal y acciones ingenieriles para la limpieza de los ríos.

Palabras Clave: agua, contaminación, envenenamiento, conciencia ambiental, río, basura

I. Introduction

A. Introduction to the problem.

As a human species, we are sacrificing our natural environment and ourselves in the long term for physical convenience and ease of living in the short term. Measures like gradual elimination of plastic straws or single use plastic shopping bags from our daily use could be very helpful. The problem is that all of us never stop producing this kind of contamination, so continuing picking up plastic trash without ever stopping or reducing the source of disposable

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plastics is analogous to mopping up the flooded area around an overflowing bathtub, without turning off the water flow. Both are useless.



Fig 1. Work of art of the Paraná River, from Rosario, Santa Fé

B. Purpose of the presentation

The problem that is presented in this project is the contamination of the river caused by human beings. Chemicals and plastic waste harm the environment. The pollution of rivers is an urgent problem that happens everywhere and few people know how to value the great resource that is water. Clearly those who are harmed are all living species, since water is a very important resource for life on Earth. The purpose of this project is to maximize the amount of awareness about the relevance of the rivers that are used for potable water and to minimize the effect of the pollution and different kinds of damage caused to the environment the river is part of.

C. Map of the presentation

The clean-up approach in this project is about the Paraná River, which is so long that it travels across many countries. This map shows the route that the river takes.

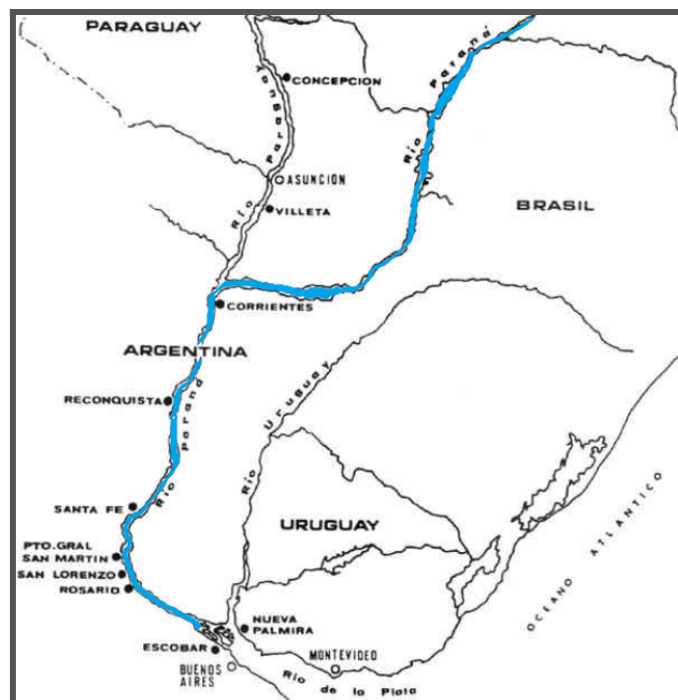


Fig 2. Paraná river map

In order to achieve the above-stated purpose, this is the way that this presentation is organized. First, there is going to be a description of the problem followed by contextual images of the geographic area. Then, the problem is going to be stated, analyzing its causes and consequences. After this, a possible solution is presented to help reduce the problem. Finally, the strengths and weaknesses of the proposal are going to be stated.

II. Problem Definition and Analysis

A. Description of the Problem

The Paraná river is a massive river in the mid-east of south America which flows in the south-west direction, passing through the countries of Brazil, Paraguay and Argentina. This river originates in Brazil in the cities of São Paulo, Minas Gerais and Mato Grosso do Sul. It has four thousand and eighty kilometers (4880km) and it is placed fourth in the rank of the longest rivers of South America. In our country, Argentina, it takes a path passing through several cities. Some of them are Posadas, Resistencia and Rosario in Santa Fé, and Paraná in Entre Ríos (our location).

As well as this, the Paraná river has a water flow of about sixteen thousand cubic meters per second (16000 m³/s). It is one of the most important plain rivers in the world and it is able to develop all the biological complexes that the environment presents.

The Paraná river has three well-defined parts:

- The High Paraná: It runs along the first one thousand and five hundred fifty kilometers (1550km) from where it is born until the union with the Paraguay-river. Along this track there are bedrock zones, river banks and a big number of waterfalls and rapids.
- The Middle Paraná: In the middle of the course there are 772 kilometers from the Paraguay River in the north up to the city of Diamante in the south, where the Predelta begins. When joining the Paraguay, the course of the river turns sharply to the south, where the course is slow and its waters carry a large amount of sediment.
- The Low Paraná: the lower course, it extends from the city of Diamante to the intersection with the Uruguay River. The track travels into the province of Entre Rios, where it flows to the Gualeguay river.

The geographic location and context of the Paraná river:



Fig 3. Map of the Paraná river from where it originates to the end

The geographic local location of the Paraná river, near our living area.

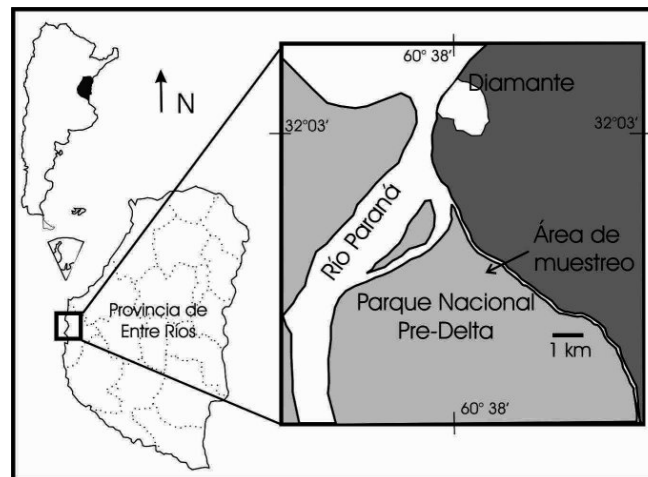


Fig 4. Map of the Paraná river in the vicinity of the city of Paraná [1]

B. *Problem Statement:*

The issue of the contamination of the rivers is very important in every corner of the world but in this case the focus is on the local river that represents a big natural source for our country and our development looking forward to the future. Several cities use the water of the Parana river for their supply.

The river is getting more contaminated by different plastics and fluids and the issue about this situation is directly related to their average life and their impact. The average life of plastics is between a hundred and a thousand years. This is going to be more or less depending on the conditions, the type of plastic and where they are placed while time runs. When the type of plastics are microplastics, which are little pieces under 5 millimeters, the level of contamination grows in a considerable way.

The other contaminating element that we mentioned before are the fluids that appear in the river. The fluids that are released into the river may contain Arsenic, which is a chemical component highly toxic or Mercurium, which is another toxic chemical component. This last aspect about fluids is way less visible in the river than the plastics at the moment but it is not less important.

C. *Description of scenes that help picture the problematic situation*

River contamination becomes visible in many contexts, as we can see next:

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Fig 5. Garbage on the coast of the Paraná river

This picture shows a lot of plastics and waste along the river coast. There seems to be different kinds of waste from plastics to metals and this waste is accumulated in the coastal area.



Fig 6. Turtle on a garbage bag

This other picture shows that species of animals are involved in the problem of the excess amount of waste generated by human beings. In this case, there is a turtle using a bag filled with waste for transportation assuming that is a “camalote” or a water hyacinth, which is the means of transport usually used by turtles to float in the river.



Fig 7. Industrial remains on the river

This picture shows the industrial remains that come from the north of the river from the Brazilian direction and are accumulated in stagnant water areas of the river. As it is visible, there is a fisherman who is fishing in this contaminated area.



Fig 8. Two person on a boat cleaning the river

This last photo is similar to the first one but in a different scene. In this case, there are two men on a boat which is used for navigation in water clearly contaminated by plastic and waste. These two men look as if they are making an effort to clear the water with sticks to remove all that waste.

D. *Causes and factors*

There are different factors that have a negative impact on this situation. On the one hand, the presence of private spas (such as clubs), or public space makes people come to the river, and they do what humans have been doing since their existence, degrading the earth with no care. This means that they throw candy wrappers, papers, cans, bottles and other non-biodegradable

objects. On the other hand, there are precarious settlements on the coast of the river and usually the people who live in those areas are not aware of the damage that discarding their personal waste (garbage from the home derived from daily life), and unused items (such as old appliances, plates, wood and others) in the river generate.

Apart from human-driven causes, the Industrial effluents are responsible for major pollution problems in the water supply of the Paraná River upstream of Rosario, which has seriously affected the operation of the water treatment plant of the city. Some of the companies located in coastal areas that throw their waste into the river provoke irreversible changes in the water composition. Refrigerator factories dispose of toxic substances like detergent; paper mills spew mercaptans, resins, and acids; mosaic factories discard anilines; cereal and oil factories, discard caustic soda; Soap factories throw detergents, acids, caustic soda; the shipping industry accidentally discharges hydrocarbons.

Last but not least, microplastics are another type of human driven contamination that come from the discarded plastics. This means that the potable water obtained from the river contains plastic in small particles measuring less than five millimeters. Microplastics and plastics are a big part of the causes of river contamination although the chemicals can cause disasters and they are being released with other fluids with no care. These kinds of disasters are going to be developed below.

E. Consequences

There are several consequences connected with river contamination. The poisoning of the river produced by chemicals is one of the major consequences. The paper industries and the chemicals used by them pollute the water. They use mercury in the paper manufacturing process, for which it needs large amounts of water. Mercury is a heavy metal, neurotoxic, responsible for a large number of effects on the health of animals and humans. This kind of contamination in the water can affect women in the pregnancy stage or fertile women and children, who are the population most at risk. Mercury can cross the placenta and cause irreparable neurological disease in the fetus. This metal is a powerful neurotoxicant that can cause neurodevelopmental problems, affect the spinal cord, kidneys and liver.

Another consequence is connected with the food obtained from contaminated sources. Studies show the effects of contaminated water on food. According to these studies, there is a much higher number of episodes of diseases transmitted by the food intake (foodborne diseases) produced by home-made than by industrialized food products. Half of foodborne disease episodes reported in the cities of Buenos Aires, Rosario, Santa Fe and Paraná, are related to foods of animal origin: meats, dairy products, eggs and their derivatives. As well as this, according to French statistics that can be extrapolated to the situation in Argentina, the three bacteria that lead the ranking of food contaminating microorganisms that are distributed in the water and in animals, are Salmonella, Clostridium perfringens and Staphylococcus aureus. In fact 70% of the cases of foodborne diseases are as a result of the mentioned bacteria. Those three bacteria can be transmitted in two ways: by foods of animal origin or by polluted water that favors concentration of these microorganisms.

A further consequence is related to the death of fish caused by plastics. Fish mistake plastic debris for food because it smells the same as their actual food. Over time, the debris will accumulate in the fish's stomach, which will make it impossible for the fish to feed itself. This

ingestion of plastic is deadly to fish, as well as dangerous for the whole food chain and, therefore, for humans.



Fig 9. Dead fish floating in the river

III. The Way Forward

A. Problem Approach:

The objective of this project, as it was mentioned, is the clean up of the river in a part of it or its entirety. To do this, it is possible to implement certain actions that should improve living conditions, health and the environment.

This actions proposed are:

Awareness raising actions: The people who live on the coasts need to become aware of the problems that the plastics and garbage bring to the river and the environment. This can be done by third parties who can lead to a change in the way people think in relation to caring for the environment. Two kinds of awareness campaigns are needed:

- Household chemicals disposal: This campaign will raise awareness about the proper disposal of household chemicals and unused medications. It is based on explaining the relevance of disposing of them as the instructions in the package say or by taking the old medications to specific drop off locations. Also if the drop off locations do not exist, they should be created in strategic places if it is possible.



Fig 10. Product instructions

- Recycling of waste: This campaign will raise awareness about keeping trash and recyclables separate. It is based on fixing a rule on the use of different kinds of bags for easier recognition of the waste type. This means, for example, using clear bags for recyclable waste and black bags for things that need to go to a landfill.

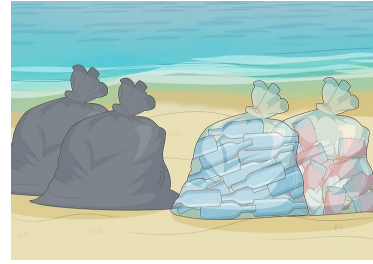


Fig 11. Garbage bag[2]

Political actions: The presence of the state is needed by means of incentives to recycle, separate and discard waste correctly. These incentives can be monetary, such as a “reward” by which the person who takes care of the environment is given a certain sum of money. Also, the state may invest more in the recycling area, public waste management and the development of new clean-up methods for the river. Some examples are setting more waste disposal spots or using machines designed for recycling.

Legal policies: This is connected with the implementation and development of regulations for citizens and the factories in relation to the amount of waste produced. This means using laws with a monetary penalty as a control medium. By imposing heavier taxes on garbage disposal and fines on excess garbage or wrong garbage disposal, governments can collect money to be used to implement other kinds of technology that require more budget.

Engineering developments: engineers are able to solve a problem, they can create machines or devices to clean up the garbage found in the river. Obviously there are cheap and expensive solutions that depend on how much governments can or are willing to invest.

- Solar powered automatic river cleaner: it is a trash collector which has a conveyor belt driven by solar power that lifts the debris into a skip bin ready for removal. This system simply involves floating the full skip bin out and floating an empty one in. Then, the collected garbage is taken to shore, where it can be lifted onto a truck and taken for processing. When the debris is removed from the water the garbage can be dried quickly, also reducing the weight. If it does break apart in the skip bin, it is still encapsulated. The addition of floating booms will enable capture from a larger area. As well as this, the solar system will be backed up by an automatic generator system so when the batteries go low, the generator kicks in. [3]

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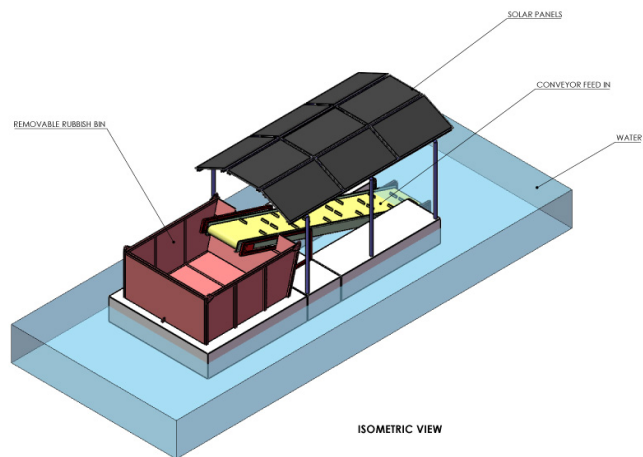


Fig 12. Solar powered automatic river cleaner

- Mr. Trash Wheel: It is a trash collector which is used in areas near harbors or water channels that are not so wide. It is designed to be in a static position and to use renewable energies that can make it work 24 hours the seven days of the week. This machine involves a big wheel acting like a water mill on its side which moves a pulley system with the flow of the river which in turn moves a conveyor belt to collect the garbage on the surface of the water. Also, when the river flow is not very strong the machine uses water pumps to “rotate” the water mill mentioned before and these water pumps are powered by electricity that comes from solar panels on the top of the machine. Mr. Thash Wheel stacks up the trash on the area where it is installed by using two trash containment booms anchored to the coastal sites. [4]

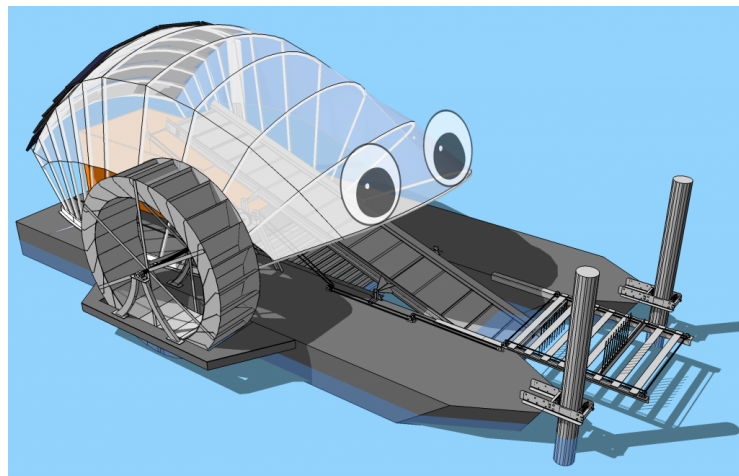


Fig 13. Mr. Trash Wheel

B. *Strengths and Weaknesses of the Proposal*

Strengths:

The strengths of this project are the possibilities of change with few long-term individual actions that do not necessarily have a high cost. These changes can be through minimal habits that come from the campaigns that are proposed.

Weaknesses:

The weaknesses of this project are easily greater in number than the strengths if we consider the cost factor as important, the state aid and the low interest that people can show when it comes to raising awareness. The first weakness is related to the significant cost that must be addressed for the implementation of recycling machinery, water cleaning, as well as the increase in recycling centers and specific places according to the type of garbage that is disposed of. The second disadvantage refers to the fact that it is of vital importance that there is a present state willing to collaborate with the proposals and thus alleviate the previous point or in certain cases absorb it completely. And the last weakness, but not the least important at all, is low awareness if the aforementioned campaigns are not carried out correctly and a change is not really achieved.

IV. Conclusion

Final Statement

People are unkind to the natural world and they keep throwing plastics and all their garbage directly to the river. We know that changing this is not a simple task as everything takes a long time. The results will not be seen in a couple of days. Therefore, we must be patient but awareness is needed by talking to friends, family or neighbors. We can create an environment where we can understand that protecting our river is necessary.

This project searches for a practical and efficient solution to address the contamination of the Paraná river produced by plastics. The aim is to approach the problem so as to clean, protect, and provide a safer water supply to the people and wildlife in the many cities and towns that rely heavily on a treasured natural resource for drinking water, the Paraná River. Our river is alive, and a lot of species live there. We use the river for our needs. So we should understand the importance of this by taking good care of it.

References

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The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at gyugdar@frp.utn.edu.ar.