# IMPROVING WASTE REMOVAL & REDUCTION ON PLAYA PACUARE

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# IMPROVING WASTE REMOVAL & REDUCTION ON PLAYA PACUARE

An Interactive Qualifying Project Submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE



in partial fulfillment of the requirements for the Degree of Bachelor of Science

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This report represents the work of five WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, please see <a href="http://www.wpi.edu/Academics/Projects">http://www.wpi.edu/Academics/Projects</a>

# Acknowledgements

We would like to express our sincere gratitude to Worcester Polytechnic Institute and Melissa Belz for giving us this opportunity, our sponsor, Latin American Sea Turtles, especially Nicki Wheeler, for all the guidance and support, and all our interviewees for their time and information. This project would not have been successful without the guidance and advising of Seth Tuler and Fabienne Miller over the past 14 weeks. Finally, thank you to the Hotel Tairona staff for making our stay possible.





### Abstract

Coastal debris poses a threat to nesting sea turtles and negatively impacts the environment of Playa Pacuare, Costa Rica. Working with our sponsor, Latin American Sea Turtles (LAST), and recognizing community needs, our goal was to develop strategies for improved trash removal and reduction in Pacuare. Using observations and interviews, we concluded that LAST and the community lack an effective trash storage system and knowledge of environmentally friendly habits. We aided LAST by developing sorting protocols to mitigate trash accumulation by involving the community's children in repurposing initiatives. By giving LAST the tools and information to become a catalyst for change, we furthered their mission in realize a future where humans and sea turtles live together in balance.





# **Executive Summary**

Since 1990, approximately 145 million pounds of coastal debris have been removed from beaches during international coastal cleanups (Ocean Conservancy, 2016). Coastal debris has negative impacts on different forms of wildlife, including sea turtles that ingest plastics or become entangled (Derraik, 2002). In addition, coastal debris generates problems for coastal communities, which must manage, remove, and dispose of trash that originates from other locations.

On the Caribbean side of Costa Rica, the small community and turtle nesting ground of Playa Pacuare is surrounded by river canals and the Caribbean Sea. The constantly changing tides deposit waste at the river mouth and wash large volumes of trash onto the beach. The coastal debris negatively impacts Playa Pacuare, the region in which our project sponsor, Latin American Sea Turtles (LAST), runs one of their turtle research stations. The trash puts the turtles at risk and has become a burden for LAST because of both the volume of trash and the small community, consisting of only 45 people, rarely participates in cleanup efforts. Currently, LAST relies on volunteers to conduct beach cleanups and remove trash from the beach. Although some community members have expressed to our sponsor how trash accumulation is a problem for the community, LAST has found it difficult to motivate the entirety of the community to clean outside their own property and face the trash problem at hand. In short, the magnitude of the trash problem in Pacuare was the result of two major problems:

- 1. A lack of an established waste management system
- 2. A lack of knowledge about environment friendly behaviors both within LAST and the community of Pacuare

#### Methodology

To overcome the problem facing Pacuare, we researched several strategies that have been successful in communities faced with similar circumstances. We researched different initiatives related to recycling, repurposing, and education. Recycling can help reduce the overall impact of trash on the environment, and promotes environmental sustainability within communities. Additionally, repurposing can raise awareness by teaching environmentally friendly habits through creative do-it-yourself crafts. Finally, educational initiatives can teach children the importance of becoming more environmentally responsible in the future. The goal of this project was to improve removal and reduction methods for the trash produced in Pacuare, by both LAST and the community, as well as the trash collected from the beach. To accomplish our goal, we:

- 1. Analyzed the effect of the trash problem on Playa Pacuare
- 2. Determined the removal and sorting requirements that LAST must fulfill for their recycling partners
- 3. Determined appropriate means to educate the staff at LAST about proper waste disposal
- 4. Researched and assessed repurposing methods beneficial for educating and raising awareness in the community
- 5. Researched engaging methods to raise awareness about environmentally friendly habits in the local Pacuare school







Our background research informed our objectives and enabled us to make educated recommendations. Additionally, the information gained through interviews and observations supported our recommendations' applicability to Pacuare. We interviewed LAST's staff about the current waste management system, as well as two of LAST's recycling partners, to find areas for improvement in the process. We identified a lack of knowledge and motivation of LAST staff and volunteers to properly dispose of their own waste. Finally, through our interviews with five community members, we learned of a lack of knowledge about environmentally friendly behaviors within the community. We also researched methods to engage the students of the Pacuare school in repurposing activities. A detailed list of our key findings has been outlined in the following sections.

#### Results

After analyzing the information gathered from our observations and interviews, we were able to better understand the overarching problem in Pacuare. We found:

1. The majority of coastal debris on Playa Pacuare is driftwood: Our observations and quantitative data analysis determined the different materials present on the beach. We noted that driftwood was the largest portion of coastal debris with scattered pieces of man-made plastics, glass, and metal seen in Figure 1. We determined the average materials found in three separate piles along the length of the beach, approximately 400 meters apart, to be 85% driftwood, 14% plastics and 1% glass.



Figure 1: Pile of the Coastal Debris on Playa Pacuare

- 2. A lack of knowledge and motivation leads to improper waste disposal both within LAST and the community: There is the lack of guidance and instruction on LAST's project site about proper waste disposal practices. When we interviewed LAST's prior biologist, the head of all beach cleaning and trash sorting efforts during her time in Pacuare, she highlighted the lack of guidelines and instructions for a recycling program. Although we observed labeled bins outside the kitchen, it was evident that the majority of the staff did not use these receptacles. As a result, various forms of trash were thrown into a box that was later sorted by the volunteer coordinator, as she took the initiative to follow recycling guidelines. Similarly, we found a lack of knowledge among residents in the community. Community members typically bury or burn their trash, or even dump it in the river; limited knowledge on environmentally friendly habits is one contributing factor to these behaviors. We also found in our interviews a lack of motivation within the community. As Pacuare's treasurer expressed, the lack of community motivation to clean their trash and other debris on the beach has hindered the success of past recycling initiatives.
- 3. Repurposing initiatives are a means to raise awareness: We found that other remote, seaside communities have used repurposing methods as a way to increase community involvement. Associación de Voluntarios para el Servicio en Áreas Protegidas de Costa Rica (ASVO), a non-governmental organization (NGO) in Gandoca, helped the women become more involved in the community through repurposing projects, raising awareness among the community members (ASVO, 2017).





- 4. To remove waste from Pacuare, plastics must be sorted by color and type and meet the weight requirement of 500 kilograms, while metals can be removed at any time, unsorted: In our interviews with the head of Centro de Reciclaje Florida Bebidas, the recycling center for La Florida Bebidas, and Chatarrera de Bataan, the centro de acopio, or collection center, in Bataan, we found that LAST must meet specific sorting requirements to collaborate with each of their recycling partners. The interviews confirmed the information the volunteer coordinator provided to us about the sorting requirements for the two contacts. We then established the following breakdown of how the materials must be sorted:
  - 1. HDPE (White & Translucent)
  - 2. HDPE (Color)
  - 3. PET (Transparent)
  - 4. PET (Color)
  - 5. Metal/Aluminum

The head of Centro de Reciclaje Florida Bebidas clarified the need for a specific sorting process; if the plastics are not properly sorted, the recycling process is disrupted. We further discussed in the interview that proper sorting is crucial in maintaining the relationship with La Florida Bebidas.

#### Recommendations

Based on our findings of the sorting requirements and observations at the facility, we found that LAST did not have an organized waste management system that was consistently followed by volunteers and staff. We recommend LAST improve their waste management system for coastal debris found on the beach, as well as trash produced internally, with the following actions:

- 1. Utilize the detailed instruction manual, volunteer protocol guide, and posters designed by the team: The instruction manual includes detailed guidelines on recycling, burning and composting for use by the biologist. It goes into further detail than the volunteer protocol quide, as the volunteer protocol only includes information about recycling. The previous biologist and the volunteer coordinator suggested the manual could be an important tool in ensuring the proper waste sorting process is followed. The simplified volunteer protocol guide specifies guidelines for collecting and sorting the trash. The previous biologist and other staff members suggested the use of a sorting guide could be helpful on-site in creating an easy to follow method of sorting, as well as bringing "a fresh eye" to the processes of post-cleanup sorting. The posters identify the areas in which each type of trash should be placed, including metal, burnable, plastic, and organic waste. During our interviews, we found it is also necessary to sort the plastic by material and color. We also observed, while on-site, that the "organics bin" contained plastics and other non-organic forms of waste. The use of the educational material (guides, manuals and posters) improves retention in environmental learning and can be useful to enforce the separation of different waste streams (Missouri Botanical Garden, 2012).
- 2. Utilize the sorting location as a centralized waste disposal area within the science center: The volunteer coordinator suggested removing the smaller trash receptacles from the various buildings on-site to remove the temptation and convenience of disposing all waste streams in a single bin, setting a better example for the community. If







LAST utilizes the newly constructed sorting station we built, seen in Figure 2, to dispose their internal trash and the coastal debris from the beach, there could be less additional effort required to maintain trash in the science center. From our research, we found that other locations have had success in managing coastal debris by utilizing a similar system; for example, the community in Tortuguero houses one central recycling station (Sherwood, 2007). Additionally, there was a study done on



Figure 2: Constructed Sorting Station

improving waste management in the developing region of Gujranwala, Pakistan. The study revealed that establishing a central location for trash disposal eliminated the presence of waste in the streets and sewers throughout the city (Altaf & Deshazo, 1996). Once the internal waste disposal system is established, LAST can better manage the coastal debris.

Based on our findings of a lack of knowledge about environmentally friendly habits and a poor sense of community, we recommend that LAST implement the following strategies to increase awareness and environmentally friendly behaviors:

- Continue a partnership with the Pacuare school:
   Per the teacher's suggestion, LAST should
   continue to foster a relationship with the students,
   seen in Figure 3, in hopes to continue to spark
   motivation among families and other community
   members. LAST should work with the school at
   least once a year to reinforce the initial teachings
   of repurposing and environmentally friendly
   behavior.
- 2. Increase community involvement with repurposing programs: LAST should continue their repurposing efforts, as seen in Figure 4, with a community outreach program to make repurposed pieces of art or small trinkets. LAST should use a similar strategy as a means to educate the community and possibly generate revenues for individuals. The president of LAST reported that he has seen effective repurposing artwork projects in other locations. For example, in Gandoca, another community facing similar trash accumulation problems, women used plastic bags



Figure 3: Pacuare School Children



Figure 4: Repurposing Plastic Bottles into Toilet Paper Dispensers

to weave hand bags that they then sold online (D. Chacon, personal communication, January 24, 2017). For rural, impoverished communities, this is beneficial as it generates a source of income for the involved community members. Repurposing methods have also been seen in Montezuma through the work of Reciclarte, an organization that markets the jewelry women create out of recyclables (D. Chacon, personal communication, January 24, 2017). For initiatives like these to be possible in Pacuare, the community must be educated on ways in which plastics and other trash can be repurposed into pieces of art or small trinkets.





3. Become a community recycling center: The location of the science center is accessible to all community members as it borders the community's main pathway. The community could bring the collected trash and deposit it at the fence of the site. A volunteer or staff member should then transfer the trash to its respective bin. As discussed by the Pacuare treasurer and other community members, the use of a centralized system such as this would be beneficial for them to properly dispose of their trash. The lack of resources hindered the initiative in the past, but through LAST, it is more feasible as shown in other NGOs in other locations that face similar problems.

#### Conclusion

The Latin American Sea Turtles Association works to mitigate the accumulation of trash in the remote, coastal community of Pacuare, Costa Rica. The remote geography and poor sense of community limit the efforts of LAST. Additionally, the trash in Pacuare originates from various stakeholders within the community as well as from sources outside of the area, providing additional challenges to the organization in their cleanup efforts.

To reduce the large quantity of coastal debris in Pacuare, we established a sorting and storage system, designating sections for each waste stream, to further the efforts of LAST and uphold their recycling partner's guidelines. By utilizing this resource as a waste removal system for both LAST and the community, LAST has the opportunity to produce a cleaner environment and improve the community's waste management behaviors in everyday life. Providing the community with a convenient trash disposal system aligns with LAST's mission to realize a future where humans and sea turtles can live together in balance.

In addition, to improve the lack of knowledge about environmentally friendly behaviors both within LAST and the community, we produced materials for the project site to teach and motivate staff members to take on these habits. We also began repurposing and education initiatives with the local school. We provided LAST with tools and information to continue motivating their staff and the community to be more environmentally responsible, and become a catalyst for the entire community in improving "green" behaviors and habits.

With these initiatives, we hope to steer LAST and the community towards a better understanding of how to properly dispose of waste, reduce the overall impact on the environment, and build a cleaner ecosystem for the people and wildlife alike.





# Authorship











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# CHAPTER

### Introduction

Since 1990, approximately 145 million pounds of coastal debris have been removed from beaches during international coastal cleanups (Ocean Conservancy, 2016). The majority of debris collected during beach cleanups were plastics (Santos, Friedrich, Ivar do Sul, 2009). For example, plastics account for 76% of the sampled items across roughly 150 kilometers of the Northeast Brazilian beach (Santos, Friedrich, Ivar do Sul, 2009). Coastal debris has negative impacts, such as ingestion and entanglement, on different forms of wildlife, and can pollute different ecosystems (Derraik, 2002). In addition, coastal debris can ruin the scenic potential of beaches and pose a risk to the health of beach users (Santos, Friedrich, Ivar do Sul, 2009). Coastal debris generates problems for coastal communities, leading them to remove and dispose of the trash.

Coastal debris is a significant problem in the Caribbean region, especially in Costa Rica. For example, the beach within the Gandoca-Manzanillo National Wildlife Refuge on the Caribbean side is covered with debris and a wide variety of plastic (ASVO, 2017). The coastal debris poses a threat to the wildlife found there, requiring it to be removed from the government-protected area. Similarly, the Tortuguero National Park suffers from excessive coastal debris, which has a negative effect on both tourism and sea turtles (Sherwood, 2007). Coastal debris can cause problems for seaside communities and organizations. With limited resources, coastal debris is more problematic due to the challenges in preventing and managing the trash. Areas such as Gandoca and Tortuguero solved these problems by initiating a sustainable waste management system for their own respective areas.

Coastal communities and organizations have managed coastal debris through different removal and reduction techniques. For example, in Tortuguero, trash is removed through a recycling center that was organized by the government and funded by the community, creating a cleaner environment (Sherwood, 2007). Due to limited resources and geographical constraints, some communities are unable to utilize government or community organized resources, and have depended on reducing plastics through repurposing. *The Tico Times News* 



reported of a Canadian man who used plastic water bottles to create bricks for small houses (Dyer, 2014). His creativity has shown promise for repurposing initiatives in other locations. However, due to a lack of education on proper waste removal or reduction, some communities bury, burn, or dump their trash in or near local rivers (D. Chacon, personal communication, January 24, 2017). When tides come in, the water can pull the waste along the rivers and into the ocean, later carrying it up onto the coast.

Much like the regions surrounding Gandoca and Tortuguero, coastal debris has similar effects on Playa Pacuare, the region where our project sponsor, Latin American Sea Turtles (LAST), runs one of their science centers. Pacuare is a remote area with an abundance of coastal debris; our project sponsor takes responsibility for removing the debris, as it affects the environment and complicates their turtle research. Removing the debris, however, has posed challenges for the organization. The remoteness of the beach makes it difficult to properly collect, sort, and dispose of the trash. LAST requires a boat and multiple vehicles for nearly a two-hour transport of the waste to Bataan where the Chatarrera de Bataan, a centro de acopio, or collection center, handles the disposal of metals. LAST currently relies on volunteers to conduct beach cleanups and remove debris from the beach. Cleanups occur eight months out of the year; however, the small community, consisting of only 45 people, rarely participates in cleanup efforts (N. Wheeler, personal communication, November 18, 2016).

Working alongside LAST and taking into account the needs of the community, our goal was to improve trash removal and reduction methods for the trash produced in Pacuare, by both LAST and the community, as well as the trash collected from the beach. To accomplish our goal, we completed five objectives:

- 1. Understood the effect of the trash on Playa Pacuare
- 2. Determined the removal and sorting requirements LAST must fulfill for their recycling partners
- 3. Determined appropriate means to educate the staff and volunteers of LAST about proper waste disposal
- 4. Researched and assessed repurposing methods beneficial for educating and raising awareness in the community
- 5. Researched engaging methods to raise awareness about environmentally friendly habits in Pacuare's school

With knowledge gained from our background research, we completed each of these objectives by observing the region and interviewing involved stakeholders. While assessing LAST and the community's waste management efforts, we found LAST's staff was not sorting the collected coastal debris, nor the trash produced in the science center. We also found that a limited sense of community makes it difficult to unify residents to remove the debris. From these findings, we developed a detailed recycling instruction manual for the biologist, a sorting protocol for LAST's volunteers, and posters for LAST to utilize at its science center. We also designed a lesson plan to implement in the community's elementary school. We recommend that LAST first use the manual, protocol guide and posters to help educate staff and volunteers. increasing internal efforts on proper sorting methods of both coastal debris and the center's waste. Once they have successfully maintained their waste management system, we recommend LAST continues their partnership with the local school, to further educate the students about removal and reduction methods. In completion of the project and its objectives, we expect LAST to have a clearer understanding of ways to handle coastal debris, a standardized removal process, and an educational program within the community through their younger generations.



# CHAPTER

# Background

People in rural and isolated areas of Costa Rica struggle to remove and recycle trash that accumulates in their community. Although a community's waste streams contribute to the buildup of trash, there are other sources that contribute as well. The following sections discuss the impacts of coastal debris in rural and remote communities, existing solutions to manage, remove and repurpose trash, and education methods that spread awareness about waste management and environmental accountability.

#### 2.1 Origins and Impact of Debris in Rural Seaside Communities

#### 2.1.1 Impact and Origin of Coastal Debris

Large quantities of trash cause problems for communities and the environment, as it reduces the quality of life for people and endangers animals (McDermid & McMullen, 2004). While remote seaside communities produce their own trash, the leading sources of waste are inland areas and oceans. Trash is carried to coastal communities by surrounding bodies of water and tides, resulting in the influx of debris. For example, several studies of Islands in the Southern Pacific Ocean reported large amounts of debris washing on the shores of small seaside communities that originated from surrounding regions, leaving those communities with the burden of handling the trash (Uneputty & Evans, 1997; Benton, 1995). The debris washing into these seaside communities negatively affects the people and wildlife living there.

Despite Costa Rica's efforts to improve environmental sustainability, research shows that the country still suffers from the negative impacts of pollution; trash produced in the country's inland communities ends up in the oceans and consequently washes up onto its own shores (Ben-Haddej, 2011). The Caleta Beach in San Francisco de Coyote, Costa Rica, is greatly affected by coastal debris. In fact, more than 6,000 pieces of trash were collected during a study, 98.2% of which were plastics (Ramos et al., 2012). Coastal debris, especially plastics,



also affects other seaside communities. For example, a study in the Hawaiian Archipelago reported that 72% of collected wastes were plastics (McDermid & McMullen, 2004). Although these studies reflect the collection of man-made waste, they do not take into account naturally occurring debris, such as driftwood, that may also be an obstruction found on beaches (National Oceanic and Atmospheric Administration, 2017).

Similar problems with coastal debris have negatively impacted the rural community surrounding Playa Pacuare, a remote sea turtle nesting beach located on the Caribbean side of Costa Rica. Playa Pacuare stretches about eight kilometers in length and the Pacuare river mouth meets the Caribbean Sea along the beach. A majority of coastal debris originates from nearby cities such as Bataan and other locations along the river (D. Chacon, personal communication, January 24, 2017).

#### 2.1.2 Waste Management Challenges in Remote Communities

Worldwide, waste management has caused problems within communities, particularly on islands or in isolated villages. One important problem remote communities face is a lack of external funding. Smaller communities do not have the local tax raising capacity to fund the full range of infrastructure such as collection services, receptacles, and recycling centers (WMW, 2013). For example, rural towns in Spain struggle to manage their waste because the waste collection programs are located too far for the collection routes. Without an established collection program or the necessary funds to export waste, the trash accumulates in the rural communities (Hildalgo, Corona, & Martin-Marroquin, 2016). Similarly, on Caleta Beach, volunteers visited the region with the intention of cleaning and collecting data about the trash on the beach. However, the volunteers were unable to remove the waste after the study due to the remoteness of the region and the absence of a waste removal system (Ramos et al., 2012).

The rural community surrounding Playa Pacuare faces similar waste removal problems. Pacuare is only accessible from the outskirts of Bataan via boat. The remote location of Pacuare and its access route can be seen in Figure 1. The orange line denotes the trip by taxi and the blue line denotes the trip by boat. The process to remove waste from Pacuare is difficult due to its remote location and the resultant high cost of required transportation (N. Wheeler, personal communication, November 18, 2016). As a result, individuals manage their trash by burning or burying it, or even by dumping it in local bodies of water (D. Chacon, personal communication, January 24, 2017). Although burning methods eliminate the trash, this form of management is harmful to the environment (N. Wheeler, personal communication, November 18, 2016).





Figure 1: Pacuare Beach Location

#### 2.2 Removal Initiatives for Waste Management

Despite the challenges of managing waste in rural seaside communities, governmental and non-governmental organizations (NGOs) have conducted successful removal initiatives.

#### 2.2.1 Governmental Programs and Removal Initiatives in Costa Rica

In 2010, the government of Costa Rica passed Ley 8839, encouraging people to reduce, reuse, and recycle. Lev 8839 guidelines intended to move the country towards a municipal system that would better manage the waste of Costa Rica and keep trash out of rivers and oceans. In more developed cities, there are more resources available for waste management; recycling centers and truck collections such as the Center of Recycling Municipality or Recycler La Calma are common in more developed cities (Magera, 2006). As a result of Ley 8839, recycling centers enable developed areas to be more energy efficient. Recycling one ton of paper saves 4,000 kilowatt-hours of energy, consuming 30%-55% less energy than producing paper from scratch (The Costa Rica News, 2015). Another example of a governmental initiative exists in Tortuguero, a national park and turtle nesting ground located on the Caribbean side. Until 2005, the trash produced throughout tourist season "wound up on the beach, got burned, or was tossed in the neighborhood soccer field which had become an impromptu town dump" (Sherwood, 2007). As a result, the government established a recycling center that is funded by charging residents ¢2,500 (about \$5) every month for the service. If it is not paid, the resident's water is shut off. Through this program, the beaches and fields are maintained and the threats to the environment, community, tourists, or nesting turtles are eliminated (Sherwood, 2007).



#### 2.2.2 Non-Governmental Organization Waste Management Initiatives

When governmental support is lacking, the help of NGOs can be a useful solution to coastal debris. Specifically in Costa Rica, NGOs have taken the initiative to combat the problem. For example, La Asociación Empresarial Para El Desarrollo (AED) launched the "Bandera Azul Ecologica", or Blue Flag Ecological Program, with the goal of protecting the nation's diverse and fragile coastal ecosystems (Raub, 2013). Obtaining the Blue Flag Ecological Status has become a well-known incentive for cities and towns to clear and maintain their coasts (Raub, 2013). In an effort to achieve the Blue Flag Ecological Status, the businesses that line the Costa Rican beaches of Santa Teresa began collecting and removing coastal debris that washed up (Farley, 2013). In addition, removal initiatives have proven to be successful in other parts of the world. The community of Gujranwala, Pakistan established a centralized waste disposal system for individual households in the region. The removal initiative proved to be beneficial as it reduced the amount of trash in the streets and sewage systems. Overall, the burden of collecting public trash from the area was minimized for the waste removal municipalities in Gujranwala (Altaf & Deshazo, 1996).

Cleanup initiatives using volunteers have also been established by NGOs. The Georgia Sea Turtle Center (GSTC) in Jekyll Island, Georgia, recruits volunteers for removing waste from their beaches. In 460 hours, volunteers removed 6,000 pieces of trash from the area (Martin, 2013). Similarly, there are NGOs throughout Costa Rica that also utilize volunteers in cleanup initiatives. The Asociación de Voluntarios para el Servicio en Áreas Protegidas de Costa Rica (ASVO), the Asociación Salvemos las Tortugas de Parismina (ASTOP), and Ecology Project International (EPI) have project sites on the Caribbean side of Costa Rica working to protect and conserve sea turtles (ASTOP, 2017; ASVO, 2017; EPI, 2015). The project sites vary in approach to their own work, but they are faced with the same trash problem as LAST.

Although there are initiatives to manage trash properly, there are often instances where trash is still managed improperly. NGOs in developing areas of India improperly dumped their solid waste as a result of unregulated landfills and an unestablished waste management program, leading to environmental and public health risks to the surrounding area (Ahsan, Alamgir, Imteaz, Nik Daud, & Islam, 2012). Examples of NGO initiatives seen by AED and Santa Teresa are better alternatives to removing trash, as they do not pose risks to the environment or the health of the surrounding communities.

#### 2.2.3 Business Waste Management Initiatives

Beyond government and NGO initiatives, there are businesses that provide recycling and waste management programs. The largest drink distributor in Costa Rica, La Florida Bebidas, has worked to reduce waste through a recycling program, minimizing its environmental and social footprints. Since 1995, La Florida Bebidas has maintained the most established and sustainable recycling programs in Costa Rica by offering collection services at eight different national collection centers (La Florida Bebidas, 2015). Other companies worldwide participate in similar recycling initiatives. Coca-Cola supports the collection and recycling of post-consumer packaging to reduce the need for new material for their products. Coca-Cola has over 40 years of involvement in local deposit return systems (Journey Staff, 2017). As a result, their programs help reduce plastics and other packaged material that may otherwise add to the coastal debris.

Deposit centers are more convenient and accessible for rural communities than the limited number of recycling centers distributed around the country. Centros de acopios, or collection centers, have been known to initiate waste removal in smaller cities. In Bataan, Costa Rica, the largest city near Pacuare, a local member has started his own centro de acopio, known as Chatarrera de Bataan. Chatarrera de Bataan collects metal waste from the city and



then sells the materials to larger companies (N. Wheeler, personal communication, November 18, 2016). In Barranquilla, Colombia, the Universidad Del Norte helped build a centro de acopio that the local community would manage to reduce health problems and unwanted odors (Universidad Del Norte, 2015). The centro de acopio improved the overall quality of life in the Caribbean region, which was susceptible to waste buildups and coastal debris (Universidad Del Norte, 2015).

#### 2.3 Repurposing Initiatives for Waste Management

Another solution to coastal debris accumulation, especially in low-income communities, is to reuse and repurpose. Repurposing programs can simultaneously reduce the volume of waste as well as spread awareness through creative do-it-yourself solutions.

#### 2.3.1 Repurposing Plastics into Structures

There are multiple examples from developing communities where solutions were engineered to produce useful materials from plastic trash. For example, Engineers Without Borders spent time in Nicaragua, teaching the local community to use plastic bottles to build walls needed for houses (Engineering for Change, 2011). Similarly, the company Expotour turns used water bottles into tiles to benefit low-income homeowners, as seen in Figure 2 (Dyer, 2014). Repurposing plastics and other materials can benefit both the environment and people living in affected areas.



Figure 2: Plastic Tiles Created by Expotour

#### 2.3.2 Repurposing Plastic into Artwork

Another method of repurposing waste throughout Costa Rica is turning recycled materials into jewelry or artwork. The "Chunches de Mar" (Things of the Sea) Festival is held annually on Playa Grande, located on the Pacific side of Costa Rica, where artists gather to collect trash found on the beach and use what they find to design different forms of artwork; their work often represents the impacts of marine and coastal debris in similar areas, such as the sculpture in Figure 3 (A. Williams, 2011).

Similarly, the organization Reciclarte works throughout Costa Rica to help women repurpose trash collected from their communities into art or jewelry; the women can then sell their art to tourists and community members as a means to make an income for their families (Reciclarte, 2017).



Figure 3: Artistic Sculpture at Chunches de Mar Festival

In addition to these artist initiatives, children have become involved in repurposing trash in their communities throughout Costa Rica (A. Williams, 2010). For example, weekend

workshops are held in Montezuma, where children build small-scale projects out of the debris that washes onto the beach, such as kaleidoscopes from plastic water bottles (A. Williams, 2010). In Tortuguero, the school systems believe that involving children in environmental activities stresses the importance of recycling; as the children learn, they will hopefully change the habits of the community (Sherwood, 2007).

#### 2.4 Spread Awareness of Waste Management through Education

Education can be used to motivate and raise awareness of proper waste management and other environmentally friendly habits within groups of people (Wortman, Cooke, Tilbury, & Tilbury, 2006). To relay information to a community, it is common to target either the younger generation or specific members of the community, especially in regards to environmental education (Wortman, Cooke, Tilbury, & Tilbury, 2006). A summary of the different educational methods we researched can be found in Table 1.

Targeted Group	Educational Method Utilized
Staff	Coaching and a resource guide
Staff	Developing a recycling team with other staff or students
Children	Educational lesson plans implemented within a school system
Children	Activities that encourage engagement and garner excitement
Community	Volunteers to train trusted Community members that will educate others
Community	Volunteers to train trusted Community members that will educate others with tests on their knowledge

Table 1: Summary of Effective Educational Methods for Targeted Group

#### 2.4.1. Reaching the Staff by Increasing Internal Education

Based on a study conducted by Missouri Botanical Garden, an NGO focused on environmental education, the most successful educators for new recycling systems are directly trained with the help of a guide (Missouri Botanical Garden, 2012). In the study, educators were trained to follow the sorting process of a local elementary school's waste management system before teaching their students. Over the course of a week, they significantly lowered the school's carbon footprint by managing their own waste (Missouri Botanical Garden, 2012). Similarly, in Brooklyn, New York, the work of a public school teacher and the American Federation of Teachers Union (ATF) gave 800 local schools an educational plan for teachers, staff, and students alike to sort their waste for disposal. The small team of teachers, staff, and students that started the initiative successfully implemented a recycling program in each of the local schools (American Federation of Teachers, 2012). Therefore, educators and representatives of an organization looking to promote certain recycling initiatives can be successful with training and educational material.

#### 2.4.2 Reaching the Community by Educating Children in Schools

One method to educate a community is to target the younger generation especially through schools, as attempted in locations throughout Costa Rica such as Gandoca and Parismina (ASTOP, 2017). Lesson plans can be incorporated into local schools to increase





awareness and spark interest surrounding a particular topic (Wortman, Cooke, Tilbury, & Tilbury, 2006). Gandoca and Parismina work to include environmental education programs into their school systems to teach students about recycling and other proper waste disposal habits (ASTOP, 2017). Environmental education has been particularly successful in Parismina, where a group of children, educated on the negative impacts of trash, founded a local organization now known as ASTOP (ASTOP, 2017). These children were tired of the dangers trash and poachers posed to the turtles. As a result, in 2001, they decided to form a program that works with volunteers to help the local environment (ASTOP, 2017). Incorporating environmental education into local communities can initiate change.

A study done on different environmental education techniques found that each generation is better informed than the last. To ensure that each generation is better informed, it is critical to begin discussion at home and with peers about specific environmental problems (Ballantyne, Connell, & Fien, 1998). Although working with children helps educate a community, there are often many challenges that arise. Research shows, to overcome these challenges, it is important to engage and garner excitement. For, example, the Missouri Botanical Garden encourages students exposed to real-life problems involving waste to find solutions in their classroom, home and community (Missouri Botanical Garden, 2012). Similar interactive activities are often beneficial in motivating children to recycle through newly instated recycling programs (Missouri Botanical Garden, 2012).

#### 2.4.3 Reaching a Community by Utilizing Community Volunteers

Another means to educate a community is by utilizing community volunteers for peer education. Gallegos Sanitations (GSI), a waste diversion company in Colorado, is an example of educating the community through the use of volunteers. The volunteers teach community members practices such as recycling and composting to decrease the amount of waste that is disposed in a landfill (GSI, 2017). Peer education allows for a more long-term solution, as participants serve as messengers to the rest of the community; it has proven effective in larger groups because members of a given community are more comfortable with receiving education from fellow community members (Christopher, Gidley, Letiecq, Smith, & McCormick, 2008). The willingness of people to become involved in various initiatives, especially those supporting proenvironmental behavior, is greatly affected by the costs of involvement. A study on proenvironmental behavior determinants concluded that environmental concern, frugality, and the perceived ease of implementation were among the top contributing factors to a person's likelihood to practice pro-environmental behavior (Fujii, 2006). Therefore, participation in environmental initiatives increases as the costs of involvement decrease.

There are, however, obstacles to overcome when using volunteers as a means to educate a community. First, it is often difficult to gain volunteers if the time commitment is too high, especially in smaller communities (Christopher, Gidley, Letiecq, Smith, & McCormick, 2008). Another problem that may arise is the inability to properly educate the community members on the subject. Without a means to test adequate knowledge on the subject, the information relayed to peers may lack the proper message (Liebman, Juarez, Claudia, & Corona, 2007).



To successfully educate a community through volunteers, studies have implemented different techniques. One way to ensure the successful use of volunteers in educating their peers is the incorporation of a pre-test to see how much the volunteers know on the subject and a post-test to see how much they learned in the training (Liebman, Juarez, Claudia, & Corona, 2007). A study was then performed in two separate rural communities to test this form of education. The participants in both cases took the tests to compare their subject knowledge before and after educating others. Generally, the results showed an increase in overall knowledge on the given subject matters in both teachers and students (Liebman, Juarez, Claudia, & Corona, 2007).

#### 2.5 Summary

In Pacuare, a few of the strategies for removing, repurposing, and educating solutions may be applicable to LAST and the community. Remote communities have attempted to combat the problem by reducing and removing the trash as well as through the development of educational activities. Previous examples in literature point to several strategies that must be understood before a removal, repurposing, or education program can be successfully designed and implemented. The following chapter will explain how we will develop this information for the Pacuare community.





# Methodology

Many remote seaside communities, such as Pacuare, face challenges that arise when large volumes of plastic wash onto their beaches. Due to the remote location of Pacuare, the community faces challenges when disposing of the debris and waste. Working alongside LAST and taking into account the needs of the community, our goal was to improve trash removal and reduction methods for the trash produced in Pacuare, by both LAST and the community, as well as the coastal debris collected from the beach. To accomplish our goal, we completed five objectives:

- 1. Understood the effect of the trash on Playa Pacuare
- 2. Determined the removal and sorting requirements LAST must fulfill for their recycling partners
- Determined appropriate means to educate the staff and volunteers of LAST about proper waste disposal
- 4. Researched and assessed repurposing methods beneficial for educating and raising awareness in the community
- 5. Researched engaging methods to raise awareness about environmentally friendly habits in Pacuare's school



#### 3.1 Began to Understand the Effect of the Trash

To learn about the different waste streams, we first walked the length of the beach. We observed and noted the amount of each waste stream dispersed throughout the beach. Next, to better understand the waste streams, we conducted a small quantitative data collection. We measured out three different one-meter squared areas to calculate the percentages of different waste streams in the respective areas. The distance between each square was about 400 meters, and is represented by the red dots in Figure 4. Finally, we took pictures of the trash found along the beach to better detail the magnitude of the problem across the beach.

Additionally, we interviewed multiple individuals from the community to understand how the trash affects them on a



Figure 4: Locations for Data Collection

daily basis. The interviews were then coded, or highlighted with specific themes, to determine the frequency of problems brought up in each interview. Table 2 provides a detailed overview of the interviews conducted and also includes their objective. The detailed interview questions can be found in Appendix A.

Employer/Position	Туре	Objective
Boat Driver and Maintenance worker for LAST	People On-Site	Learn about living in Pacuare and his views on the trash on the beach.
Treasurer of The Environmental Dependency Association of New Pacuare	People On-Site	Learn about the Blue Flag Program, the community, and the trash problem that she sees in Pacuare
Night Patrol Organizer for LAST	People On-Site	To learn about the community and his views on the trash as well as his opinion on o recycling projects
Licensed individuals that work on the other side of the river mouth to help the turtles	People On-Site	Gain information as to the trash on the other side of the river and how it affects their organization

Table 2: Interviews Conducted with People of Pacuare

# 3.2 Determined the Trash Removal and Sorting Requirements of Waste for LAST

We conducted interviews to assess the recycling requirements that LAST must fulfill to recycle with their recycling partners as well as to determine a clear waste sorting protocol guide. We drafted a short protocol guide that specified the initial sorting requirements given to us. We

**E**LAST



then presented the waste sorting protocol guide we developed to Centro de Reciclaje Florida Bebidas to gain feedback and ensure it followed their requirements. The protocol guide was then updated in response to their feedback. The final version of the protocol guide can be found in Appendix B. Table 3 provides a detailed overview of the interviews conducted and includes their objectives. Detailed interview questions can be found in Appendix A.

Employer/Position	Туре	Objective
Recycling Coordinator for Centro de Reciclaje Florida Bebidas	Recycling Partner	Confirm the requirements for recycling and establish a partnership
Local Recycling Contact in Bataan	Recycling Partner	Learn about the requirements for recycling aluminum and other non-plastics

Table 3: Recycling Partners Interviews

# 3.3 Determined Means to Improve Internal Efforts for Waste Disposal at LAST

We determined a means to improve internal efforts for waste disposal by interviewing LAST's staff and observing their efforts of proper waste disposal in the science center. The interviews were then coded, or highlighted with specific themes, to determine the frequency of problems brought up in each interview. We also researched the internal efforts of other NGOs. The NGOs we contacted are also located on the Caribbean side of Costa Rica and perform turtle research. The interviews were used to compare their communities and how the coastal debris affects their research grounds with LAST's location in Pacuare. Table 4 provides a detailed overview of the interviews conducted and includes their objectives. The location of the detailed interview questions can be found in the Appendix A.

Employer/Position	Туре	Objective
National Coordinator of WIDECAST and president of LAST	LAST	Obtain the goals of LAST and gauge past efforts of LAST and staff to deal with trash
Former Pacuare biologist of LAST, current biologist of OSA site for LAST	LAST	Gain information on beach cleanups and the way the trash impacts scientific research
Organizations working towards the same goal as LAST in a similar location	Other NGOs	Gain insight on how they solve the trash problem and how they involve the community

Table 4: LAST Staff and other NGO Interviews

#### 3.4 Assessed Repurposing Methods to Raise Awareness in Pacuare

We researched and assessed beneficial repurposing methods for educating and bringing awareness to the community. First, we researched potential projects to brainstorm ideas such as plastic building blocks and other projects seen in Table 5.





Repurposing Project	Materials Required	Advantages
Toilet Paper Dispenser	Twine Round HDPE Jug	Increase repurposing awareness in Science Center Reduce amount of storage need for plastic waste
Bottle-Cap Mural	Abundance of bottle camps Form of adhesive	Creates an aesthetic artwork for the students Promotes environmental Awareness
Building Blocks	Identical plastic bottles Sand Material to hold together	Reduce amount of storage needed for plastic waste

Table 5: Explored Repurposing Projects

To select the most appropriate method, we reviewed the interviews with the director of LAST, the biologist and the members of the community. The interviews were then coded, or highlighted with specific themes, to determine the frequency of responses discussing problems or recommendations for potential repurposing projects. We then determined what materials were on-site to begin the explored repurposing projects. Table 6 provides a detailed overview of the interviews conducted and includes their objectives. The location of the detailed interview questions can be found in the Appendix A.

Employer/Position	Туре	Objective
National Coordinator of WIDECAST and president of LAST	LAST	Gauge opinion of potential repurposing projects
Former Pacuare biologist of LAST, current biologist of OSA site for LAST	LAST	Learn about materials on-site and gauge opinion of potential repurposing projects
Boat Driver and Maintenance worker for LAST	People On-Site	Dynamic within the community
Treasurer of The Environmental Dependency Association of New Pacuare	People On-Site	Learn about knowledge of repurposing materials and if interested in projects moving forward
Organizes Night Patrols for LAST	People On-Site	Learn about knowledge of repurposing materials and if interested in projects moving forward

Table 6: LAST Staff and People On-Site Interviews

#### 3.5 Researched Methods to Raise Awareness in Pacuare School

Working alongside the school teacher of Pacuare, we delivered a repurposing activity to inform the students and raise awareness about environmentally friendly habits. We began by first researching educational lesson plans that would best interest children. Next, we conducted a phone interview with the Pacuare school teacher. The objective of this interview was to learn about the students' current knowledge about the environment as well as the best method to engage them in the classroom; this interview is outlined in Appendix A. We designed the activity





to suit the students' learning styles and spent time with the local students relaying information regarding environmentally friendly habits through creative repurposing activities.

To evaluate the effectiveness of the lesson plan, we asked the students informal questions about what they learned as well and if they enjoyed the activities. We also observed their reactions and engagement in the activities.

#### 3.6 Deliverables from the Project

Our three main project deliverables were accomplished by the completion of our methods. We conducted this project to positively improve the waste management system of Pacuare and mitigate the problem of coastal debris in the area. The project deliverables are:

- 1. A simplified protocol guide for LAST's volunteers regarding the sorting process (Spanish and English versions) shown in Appendix B
- 2. A detailed instruction manual for the next biologist to inform volunteers and staff members on proper disposal of different forms of trash and ensure they are following these guidelines shown in Appendix C
- 3. Posters to place on recycling bins and to be used as on-site reminders of proper waste disposal shown in Appendix D





# CHAPTER

### Results

By analyzing the information gathered from our observations and interviews, we better understood the overarching problem in Pacuare. Our main findings were:

- 1. The majority of the coastal debris washed up on the beach was driftwood
- 2. There is a lack of knowledge about proper waste management and a poor sense of community in Pacuare which makes recycling programs difficult
- 3. LAST does not currently have a method to sort the trash on the beach or properly manage the trash produced by staff and volunteers
- 4. To remove waste from Pacuare, plastics must be sorted by color and type and meet the weight requirement of 500 kilograms, while metals can be removed at any time, unsorted
- 5. Both repurposing projects and education initiatives are effective ways to raise awareness within Pacuare

#### 4.1 Findings about Coastal Debris

While walking the beach in Pacuare, we gained an initial understanding of the magnitude of the coastal debris. After speaking with several community members, we gained more insight on the effects of the trash on the community, environment, and LAST. We also characterized the coastal debris on the beach by waste stream. The following section discusses the overall findings about coastal debris following our visits to Pacuare and LAST's science center.

#### 4.1.1 Characteristics of Different Waste Streams

Of the coastal debris observed on the beach during two visits, the majority was driftwood, while plastic products were the second most common waste stream. As seen





in Figure 5, plastic debris and other miscellaneous items are sparsely distributed among piles of driftwood on the beach of Pacuare. The images taken illustrated the relative amounts of driftwood and plastics found on the beach.

To better understand the quantity of driftwood and plastics along the beach, we conducted a small quantitative study of the different waste streams. As discussed in the methods, we measured regions one

square meter in area, each about 400 meters apart, and calculated the percent of each waste stream. The location of each of these points can be referenced in Figure 4. The percentages of the sampled trash for the study conducted are presented in Table 7. The data shows the percentages of driftwood and other types of coastal debris in piles studied on the beach along with the averages of all the piles.

By using this approach, we understood the coastal debris in different regions along the beach; however, a major limitation with this approach was the narrow scope of the data. The study failed to account for the coastal debris along the entirety of the beach due to limited resources and time.



Figure 5: Buildup of Coastal Debris and Driftwood on Playa Pacuare

Pile	% Driftwood	% Plastic	% Glass
1	80	18	2
2	90	10	0
3	85	14	1
Average	85	14	1

Table 7: Percentages of Sampled Trash

#### 4.1.2 Effect of Coastal Debris

The trash has a negative effect on LAST, making their efforts to keep the turtles safe more difficult. We observed that trash both collected from the beach and produced in the science center was kept in a large pile on LAST's property. The accumulated trash at the science center is presented in Figure 6. The large volume of trash remained at the science center for many months of the year and posed health risks to the staff. The volunteer coordinator emphasized the



Figure 6: Current Waste Storage Area for LAST



importance of a roof over the trash to keep out disease-carrying bugs. As seen in Figure 6, the current area had no roof, making the risk of bugs a concern for LAST's staff.

In our interviews with the previous LAST biologist and other staff members, they highlighted the large efforts LAST has put into removing the coastal debris from the beach and eventually the science center. Currently, the organization conducts several beach cleanups a year. With the use of many volunteers, coastal debris is collected from the beach and stored at the science center, until the materials can be transported to the organization's local recycling contact. The volunteer coordinator of LAST clarified that the organization fills approximately 20 bags of trash in every large beach cleanup and the biologist stressed that the large volume of trash leads to both a costly and cumbersome removal process for the organization.

Additionally, the coastal debris negatively impacts the environment by disrupting turtle nesting grounds. The volunteer coordinator informed us that in addition to collecting coastal debris from the beach, LAST must also sweep the driftwood into piles to make room for turtles to lay their eggs, as driftwood is about 85% of the coastal debris present on the beach. Although driftwood is naturally occurring and decomposes over time, it is obstructive to sea turtles and needs to be piled up by LAST. Otherwise, turtles will struggle to find an unobstructed area to lay their eggs and will return to the ocean. As plastics do not decompose over time, it is increasingly difficult to reduce the negative effects this trash has on the environment.

Finally, coastal debris that washes up on the beach negatively affects the community, especially those working to increase environmental efforts. Community members working towards environmental efforts expressed their concerns with the amount of plastics and other trash on the beach. In particular, the treasurer stated, "I hate the trash on the beach. I talk about it all the time and get upset." Since it has been difficult for involved community members to receive help in removing and reducing the trash on the beach, community members have expressed a feeling of helplessness when attempting to alleviate the problem. Plastics also pose health risks for the community, as presented in the background.

#### 4.2 Findings about Causes of Improper Waste Management

To gain an understanding of the most prevalent causes of improper waste management in the community and the science center, we spoke with community members and LAST's staff. This section discusses major causes for improper waste management and how they contribute to the overall trash problem.

4.2.1 Lack of Motivation Leads to Improper Waste Disposal both within LAST and the Community

LAST's staff and volunteers failed to properly use the existing disposal system. Despite the labeled bins outside the kitchen, seen in Figure 7, it was evident that the staff did not use the receptacles. During the week we visited Pacuare, there were four other people onsite aside from the volunteer coordinator and the team: the maintenance worker, a general volunteer, and two volunteers from other NGOs. Throughout the week, none of the bins were used; all of LAST's waste was instead disposed of in a cardboard box meant for organics. As a result, the box containing a mix of organic food, plastics and other forms of trash needed to be sorted so its contents could be recycled at the end of the day. The process was completed by the volunteer coordinator alone, as she took the initiative to follow clear recycling guidelines.



After speaking with the volunteer coordinator, she expressed that she initiated much of the internal efforts to recycle. However, when other volunteers or staff were on-site without the volunteer coordinator present, proper disposal practices were not enforced.

Similarly, one concern discussed in the interviews was the lack of motivation within the community. Table 8 reveals that both Pacuare's treasurer and LAST's maintenance worker found it difficult to work with the community on recycling initiatives; additionally, every community member we spoke with expressed the same concern. For example, LAST's maintenance worker believed that the community is very difficult and would be unlikely to participate in any



Figure 7: Existing Trash Receptacles at LAST

recycling or repurposing initiatives, unless they could be compensated for their efforts. In addition, the treasurer tried to push initiatives within the community to become Blue Flag certified. The lack of community motivation to clean their trash and the debris on the beach hindered the success of the program.

Narrative	Interviewee
I told my neighbors how to properly get rid of their trash but they told me to mind my own business and they don't care	Pacuare treasurer
The people here would participate in a [repurposing/recycling project] if they could earn money from it, but the community is very difficult here	LAST's Maintenance Worker

Table 8: Concerns Expressed about a Lack of Motivation in the Community

#### 4.2.2 Lack of Resources Leads to Improper Waste Disposal

There is a lack of guidance and instruction on LAST's project site about proper waste disposal practices. When we interviewed LAST's prior biologist, the head of all beach cleaning and trash sorting efforts during her time in Pacuare, informed us of the lack of guidelines and instructions for a recycling program. Specifically, the science center was missing information about how the volunteers should sort their trash and the details of proper composting. Based on our observations of unused recycling bins and improperly sorted materials, we noticed that the current trash receptacles, seen in Figure 7, were labeled improperly according to the new sorting requirements. The three categories (plastics, metals, and burnables) did not reflect the desired sorting procedure outlined by LAST's recycling partners and would create additional work for volunteers before the recycling partner collected the trash. The biologist did not have someone to specifically coach or train her in the area, resulting in the lack of knowledge of best practices. From our interview with the biologist, we learned that a protocol guide, including information about sorting trash, would be useful for volunteers who are unfamiliar with the process. She suggested that a clear, easy-to-use guide would be helpful for the sorting of the recyclables.

We also found that a lack of knowledge on recycling and reusing plastics has led to improper waste disposal of trash produced by individuals in the community. We asked community members and staff at LAST to reflect on some of the major social concerns that they





believed resulted in improper waste disposal within the community. The problems leading to improper waste management can be found in Table 9 below.

Narrative	Interviewee
The people there [Pacuare] have a lot of free time to help if they wanted to, but they don't know what to do	Other Pacuare NGO Volunteers
It's hard because other people don't even know about recycling. This is probably due to lack of knowledge and the culture here in general	Pacuare treasurer
The people burn [trash], or put it in a hole in the ground, put it in the river, then it floods in June and December and floods wash away plastics and end up back in the ocean. [] They have no education [on environmentally friendly habits] and if [they] make trash disappear and they think it's gone	president of LAST

Table 9: Concerns Expressed about a Lack of Knowledge in the Community

A major concern discussed was the lack of knowledge among residents in the community. As previously discussed, community members bury or burn their trash, or even dump their trash in the river; limited knowledge on environmentally friendly habits is one contributing factor to the overall problem (D. Chacon, personal communication, January 24, 2017). For example, we learned from the volunteers of other NGOs, that community members often dump their trash in the river because when it is out of sight they believe it is no longer a problem. We also learned many people in the community are unfamiliar with reusing or recycling as illustrated in the interview with Pacuare's treasurer. However, she also suggested that without proper education, community members do not correctly remove their trash, leading to improper disposal methods as previously discussed.

### 4.2.3 Lack of Resources Leads to Improper Waste Disposal both within LAST and the Community

We observed that LAST does not currently have a large enough area to properly separate and store the plastics and other waste streams. As seen previously in Figure 6, the waste collected from the beach ended up in a single pile. The unsorted pile led to more work for the staff and volunteers to properly separate it before collection by recycling partners. In addition, the area designated by LAST for coastal debris is relatively small, creating another challenge for the staff and volunteers.

The community lacks public trash bins and a collection program, making it difficult for individuals to dispose of their waste. Another contributing factor that leads community members to bury, burn, or dump their trash is a lack of resources within the community for proper waste disposal. We asked community members to reflect on some of the major causes they believe resulted in improper waste disposal. Problems relating to improper waste management can be found in Table 10.



Causes of Improper Waste Management	Narrative	Interviewee
No Trash Bins	The community needs more bins to sort their trash. I suggest bins with holes in them to prevent people from stealing them	Pacuare Citizen
No Trash Bins	I had signs to spread awareness about the blue flags, and bins set up in the community, but the bins were stolen and she couldn't write the annual report on her own. The big problem for the community is the people	Pacuare treasurer
No Trash Bins	It is a good idea to have somewhere where the community can bring their trash	Pacuare treasurer
No Collection Program	It is difficult because once they collect the trash from the beach, there is no one to come collect it	Other Pacuare NGO Volunteers

Table 10: Trash Problems Presented in Pacuare Community Interviews

As seen in Table 10, the lack of community trash receptacles and organized waste collection program has led to the improper disposal of waste in Pacuare. The interview with Pacuare's treasurer revealed a previous attempt to include public bins in the community. The treasurer explained, "I had bins set up in the community, but the bins were stolen," and there has been a lack of trash bins ever since.

Although multiple individuals encourage the use of public trash bins, it is important that we consider other key factors for the problem. A major limitation in taking community suggestions to improve waste disposal resources in Pacuare is the disregard for other possible factors in poor disposal. Since the team was unable to speak with less involved community members, there could be other reasons for improper trash disposal that have not been discussed.

#### 4.3 Findings about Specific Requirements from Recycling Partners

To address the lack of a clear waste management system in Pacuare, for both LAST and the community, the science center formed a partnership with the Centro de Reciclaje Florida Bebidas, the recycling center for La Florida Bebidas. Additionally, LAST has been working with Chatarrera de Bataan, a collection center in Bataan, to recycle metals. Through interviews with the recycling partners, Chatarrera de Bataan and Centro de Reciclaje Florida Bebidas, we determined the removal and sorting requirements that LAST must meet. The following sections discuss specific criteria for the collection of the trash by both recycling partners.

#### 4.3.1 Specific Requirements for Waste Collection

In our interviews with the Centro de Reciclaje Florida Bebidas, and the recycling contact at the Chatarrera de Bataan, we found that LAST must meet specific sorting requirements for each of the recycling partners. The interviews confirmed the information the volunteer coordinator provided to us about the sorting requirements for the two partners. We then established the following breakdown of how the materials must be sorted:





- 1. HDPE (White & Translucent)
- 2. HDPE (Color)
- 3. PET (Transparent)
- 4. PET (Color)
- 5. Metal/Aluminum

The head of Centro de Reciclaje Florida Bebidas clarified the need for a specific sorting process; if the plastics are not properly sorted, the recycling process is disrupted. Additionally, Centro de Reciclaje Florida Bebidas requires a minimum weight of 500 kilograms of plastics before a truck can be sent for plastic removal. **Therefore, to maintain the relationship with Centro de Reciclaje Florida Bebidas, proper sorting and weight requirements must be followed to prevent disruption of the recycling process.** The head of the Recycling Center reviewed a rough draft of the protocol guide and suggested using unbranded products so volunteers sort by color and type rather than the brands observed in the picture. After reviewing the protocol guide he allowed us to use La Florida Bebidas' logo as a stamp of approval. The final draft of the protocol guide can be found in Appendix B.

After visiting Chatarrera de Bataan, we learned they are willing to take all forms of metals and do not need the waste to be sorted in any particular way or meet a specific weight requirement. In addition, since the area designated by LAST for the storage of coastal debris is relatively small, the volunteer coordinator asked if the centro de acopio could help store some of the plastics in his recycling center. Chatarrera de Bataan agreed to allot space for LAST to store their accumulated plastics until Centro de Reciclaje Florida Bebidas can collect the plastics. An additional external storage space could alleviate the need for a large internal storage facility at the science center.

# 4.4 Findings about Raising Awareness in the Community through Education

We learned that certain education initiatives are effective in raising awareness on proper waste management and recycling. Our findings on spreading awareness through educational practices can be found in the following sections.

#### 4.4.1 Raising Awareness through Repurposing Projects

We found that other remote, seaside communities have used repurposing methods to increase community involvement. We called various NGOs, but many of them did not answer their phones or respond. As a result, we were only able to speak with a limited amount of outside organizations. One NGO we were able to speak with, ASVO, works with the community in Gandoca. In the past, they began a basket weaving program to help repurpose the trash bags found on the beach and generate revenue for women in the community. The president of LAST worked with the women on this project years ago and expressed how excited the women were about the initiative. After interviewing the president of ASVO about their practices, we learned that the project helped the women become more involved in the community. Some of the women currently work for an organization known as La Casa de Las Mujeres. These women house volunteers for ASVO and have gotten involved in environmental efforts through this program. The repurposing projects in Gandoca helped raise awareness among community members.





We learned that the students in Pacuare have done repurposing projects before and are educated about the environment. The school in Pacuare consisted of one teacher and four students ranging from first to sixth grade. In the classroom, the students have worked with plastics from the ocean, as well as participated in beach cleanups. The school has previously worked with local organizations and college students to help conserve sea turtles, as well as incorporate repurposed beach plastics in their school (D. J. Arrietta, personal communication, February 15, 2017). The Pacuare school teacher involves environmental education in their daily subjects, along with math, reading, etc. by counting and sorting waste from their beach cleanups and reading about environmental subjects. He aims to give the students positive thoughts about the environment and teach them about preserving the environment.

We learned from our interview with the Pacuare school teacher that the Pacuare students are visual learners. He explained that "[learning] is like food, if it looks nice, they will eat it". From this we gathered that the students would better retain information if the activity was more exciting and hands-on. Furthermore, the teacher stated that the students relate to things they can touch. For example, the students are empathetic to the environment if they see a turtle egg or have contact with another form of nature. By utilizing their learning techniques and expanding upon their previous knowledge, additional interest and concern for the well-being of the environment could be established.

Working with the students, we developed a lesson plan, found in Appendix E, to teach them about the environment. We first asked them questions to gauge what they knew on environmental topics and helped them learn more through an interactive activity. We then had them find bottles on the beach and create repurposed planters from the materials. Finally, they completed a bottle cap mural to hang up in their school. After working with the students in Pacuare, it was evident that they were interested in the environment. They answered all the questions we asked, as seen in Appendix E and knew a lot about the topics. We evaluated their interest in each of the activities by asking if they had fun and observing their engagement in each activity. We observed that the students had more interest in making planters out of water bottles. Making planters incorporated a large variety of tasks (finding the water bottles, cleaning, cutting, and planting) and kept the interest of the students. All of the students brought the planters home to show to their families. It would have been beneficial to review the initial questions with the students to determine what they learned, but after sitting for a while, the students started losing interest in the activities. Although we prepared for different learning styles, it would have been more constructive to prepare for children who enjoy being more hyperactive as opposed to stationary.



# Recommendations

Based on the information collected through interviews and observations, as well as supportive information from our background research, we have determined the following recommendations for LAST to increase their internal waste management efforts as well as their external efforts in the community. During our research, we found a lack of an established waste management system, as well as a lack of knowledge about proper waste disposal and recycling practices both within LAST and the community. Our recommendations suggest a means to improve the current waste management system at LAST and are separated by problems LAST should handle immediately and in the future.

# 5.1 Recommendations for Internal Efforts of LAST

We recommend LAST immediately increase their internal efforts to recycle and sort their waste. It is essential that the staff and volunteers within the science center consciously improve their efforts to properly recycle and sort their waste, as it is very difficult to make a change in the community without established support.

# 5.1.1 Immediate

Based on our observations while on-site at LAST, we determined that there was a lack of effort by the staff and volunteers to sort their self-produced waste as well as the collected coastal debris. As a result of these observations, we recommend LAST immediately utilize the following materials to educate their staff and volunteers:

- 1. A detailed instruction manual for the incoming biologist to use while instructing others on-site, found in Appendix C
- 2. A simplified protocol guide for volunteers and other staff members to reference when sorting trash, found in Appendix B



Posters to label recycling bins in our newly constructed storage area, found in Appendix D

We recommend LAST use a detailed instruction manual for the biologist on-site at Pacuare. The manual includes detailed guidelines on recycling, burning and composting and can be found in Appendix C. The previous biologist and the volunteer coordinator suggested the manual as an important tool in ensuring the proper waste sorting process is followed. The volunteer coordinator was confident that the manual could be followed if all the information and instructions were presented in a detailed manner to the incoming biologist. We learned through our research that staff members are more likely to learn from their peers and the use of a guide, creating a more collaborative environment within the organization (Missouri Botanical Garden, 2012). With the detailed manual, the head biologist will be able to lead waste sorting initiatives in the science center. The instruction manual should serve as a reference for the biologist during the on-site volunteer training period.

We recommend LAST use a simplified protocol guide to ensure that both staff and volunteers can readily understand how each type of material needs to be sorted. Research shows that the perceived ease of implementation of an environmentally friendly behavior is one of the most decisive factors in executing environmental efforts (Fujii, 2006). It was further shown in our interviews that the easy to use guide will help educate the volunteers and staff. The previous biologist and other staff members suggested the use of a sorting guide could develop a cohesive way of sorting the trash, and bring "a fresh eye" to the processes of post-cleanup sorting. We believe our simplified protocol guide contributes to the perceived ease of properly sorting and recycling trash, thus increasing the probability of LAST staff and volunteers implementing recycling initiatives. The protocol guide can be found in Appendix B. If properly disposing trash at the science center is portrayed in a simplified manner, it is likely that waste disposal and other pro-environmental behaviors will be continued. The information should be presented to the volunteers when they first arrive on-site in Pacuare. As a nonprofit organization, it is critical that LAST sorts trash according to the protocol guide to foster their business relationship with Centro de Reciclaje Florida Bebidas. Maintaining their relationship with Centro de Reciclaje Florida Bebidas will financially assist with the cost of transportation to remove the coastal debris from the beach and trash from the science center.

We recommend LAST hang posters around their site as a constant reminder of proper sorting. In our interview with Centro de Reciclaje Florida Bebidas, we found it is necessary to sort the trash by type of plastic; sorting the trash from the beginning reduces the burden of correctly organizing these plastics. We recommend that LAST utilizes posters because during interviews with Centro de Reciclaje Florida Bebidas and the previous biologist, we found posters could serve as constant reminders for people on-site to properly dispose of their trash. Our observations of unsorted waste disposed of in a single cardboard box reaffirmed the need for constant reminders to properly sort. Additionally, the posters designate areas for the new sorting



Figure 9: Example of Separated Sorting Area
Designated by Posters

procedure that will serve as a replacement for the old bin separation system. The posters depict the area in which each type of trash should be placed; this includes the different types of plastics, metals, burnable waste, and organics. An example of one of our completed sorting areas depicted with our poster is shown in Figure 9.





We recommend LAST centralize the disposal of the trash produced within the science center. The volunteer coordinator suggested removing the smaller trash receptacles from the various buildings on-site. By eliminating trash bins in the office, bedrooms, and other areas, it removes the temptation and convenience of disposing all waste streams in a single bin. From our research, we found that the community in Tortuguero houses one central recycling station (Sherwood, 2007). Additionally, there was a study done on improving waste management in the developing region of Gujranwala, Pakistan. The study revealed that establishing a central location for trash disposal eliminated the presence of waste in the streets and sewers throughout the city. The waste removal municipalities in Gujranwala also noted that controlled waste disposal lessened the burden of collecting public waste from the surrounding area (Altaf & Deshazo, 1996). If LAST utilizes the newly constructed sorting station we built to dispose their internal trash and the coastal debris collected from the beach, there could be less additional effort required to maintain trash in the science center. Based on the success of centralized waste disposal initiatives in similar locations, we believe that eliminating smaller trash receptacles in the science center coupled with the use of the detailed sorting protocol will result in a more effective waste management system.

# 5.1.2 Future

Based on our findings and accomplishments during our time in Pacuare, we found other areas of focus for LAST's future environmental efforts. We recommend the following initiatives to focus on LAST's waste management for the future:

- 1. Contact the local veterinary office for biohazard wastes
- 2. Include waste management system questions on the provided volunteer feedback form

We recommend LAST contact the local veterinary office of Bataan to properly dispose of their hazardous waste. To address the biomedical waste produced by LAST's biologist and research assistants, we recommend that LAST contacts Bataan's veterinary office. Currently, the science center lacks a specific system for disposing bio-hazardous materials and consequently disposes used latex gloves in the general trash. As we were not in Pacuare during peak turtle nesting season (March - November), we are unsure of the magnitude of the biohazard waste that accumulates on-site. If LAST finds that the amount of used gloves and other research equipment exceeds their waste disposal capabilities, the organization should seek help to establish a specific removal process for hazardous waste. By creating a relationship with this animal clinic, LAST may be able to bring their hazardous waste to the clinic for proper disposal.

We recommend LAST incorporate questions on the new waste disposal process on their yearly feedback form sent to volunteers. To continually improve the new waste management system within the science center, it is important to collect feedback. According to our background research, it is beneficial to provide tests to determine retained knowledge after teaching an environmentally friendly habit (Liebman, Juarez, Claudia, & Corona, 2007). The volunteer coordinator requests that the volunteers fill out a formal recommendation form at the end of every turtle season; the form could now include a few questions on the waste management system to gain feedback and to learn potential ideas for future improvements.

# 5.2 Recommendations for Community Efforts of LAST

Once LAST has established and maintained a waste management system within the science center, they should consider extending some of these efforts to the community to assist them in disposing of the trash produced in Pacuare.





#### 5.2.1 Immediate

From interviews with community members, as shown in Table 9, we found a lack of knowledge on environmental awareness in the community. Based on research about environmental education in remote areas and our findings while on-site in Pacuare, we recommend LAST immediately furthers educational programs for the community as follows:

- 1. Continue partnership with the local school through educating about repurposing methods
- 2. Increase community involvement through community outreach programs

We recommend LAST continue the partnership with the school through education about repurposing methods. Per the school teacher's suggestion, LAST should continue to foster a relationship with the students in hopes they spread their knowledge to their families and the rest of the community. In a similar manner, ASVO provides environmental education programs for children in the surrounding community to become more involved in the recycling initiatives in the region. ASVO's education programs contributed to an overall increase in environmental awareness throughout the Gandoca region (ASVO 2017). Continued partnership with the Pacuare school could enable LAST to develop stronger community ties, thus furthering their efforts to increase community involvement in their recycling initiatives. LAST should work with the school at least once a year to reinforce the initial teachings of repurposing and environmentally friendly behavior. LAST should continue to incorporate hands-on activities, as we found that the students responded to hands-on learning with enthusiasm. Concluding our activities with the school, the students gave us informal feedback in which we learned they enjoyed the activities and were enthusiastic about what they learned. LAST's participation in future repurposing activities with the school should continue to spark motivation among families and other community members.

We also recommend LAST increase community involvement in repurposing and proper waste disposal through community outreach programs. LAST should continue their repurposing efforts with a community outreach program. The president of LAST reported that he has seen effective repurposing artwork projects in other locations. For example, in Gandoca, another community facing similar trash accumulation problems, women used plastic bags to weave hand bags that they then sold online (D. Chacon, personal communication, January 24, 2017). For rural, impoverished communities, this is beneficial as it generates a source of income for the involved community members. Reciclarte uses this method in Montezuma to market jewelry women create out of recyclables (Reciclarte, 2017). For initiatives like these to be possible in Pacuare, the community must be educated on ways plastics and other trash can be repurposed into pieces of art or small trinkets.

We encourage LAST to begin similar repurposing projects among the willing members of the community in Pacuare. Through our interviews, we found it may be difficult to gain community participation, as the community is difficult to motivate. Additionally, the demographic is predominantly men, which may cause further difficulties when gaining interest in craft projects. However, this obstacle may be overcome with time. Some community members currently create jewelry to sell to volunteers; however, it is difficult, especially outside of turtle season, as there are fewer volunteers on-site. A way to overcome this obstacle could be to use LAST's website to advertise and sell these souvenirs. By introducing various ways community members can make money, the efforts of LAST and other NGOs in the region may be better recognized. It may also be beneficial for LAST to partner with NGOs in the area to offer additional opportunities for community members. We believe that the similar goals of the organizations could contribute to the success of the recycling and repurposing initiatives in Pacuare.





# 5.2.2 Future

Based on the lack of trash receptacles and waste management system found in Pacuare, we recommend the following initiatives to improve the disposal of community trash in the future:

- 1. LAST become a community recycling center
- 2. Encourage other local NGOs to provide public bins for recyclable materials

We recommend LAST become a community recycling center by allowing members of the community to recycle their trash at the science center. The location of the science center is accessible to all community members as it borders the community's main pathway. Individuals in the community could bring the trash they collect and deposit it at the fence of the science center. During turtle nesting season, a volunteer or staff member should transfer the trash to its respective bin. During the off-season, the maintenance worker could be responsible for maintaining the disposal system. A system such as this could be beneficial to the community of Pacuare because they do not have the resources to properly dispose of their trash. Similar places like Tortuguero utilize a single recycling center location for the community, which has been successful in reducing the overall volume of trash in the region, as explained in the background chapter. The community in Tortuguero has fostered their waste disposal system and has consequently alleviated the complications of disposing trash from their homes (Sherwood, 2007). We believe that if a similar resource is offered in Pacuare, community members could be willing to dispose of their trash in this way, as it reduces the amount of work (burying or burning) necessary to dispose of it; disposing of trash at LAST could reduce improper waste disposal in community households. By providing the community with the recycling center, they should have a proper location to remove their waste, as well as a resource to ask questions to knowledgeable staff about the process as a whole.

We recommend LAST encourage other NGOs to consider the placement of trash receptacles in other areas throughout the community for recyclable materials. We suggest LAST encourage other NGOs to place trash receptacles in the area where their sites are located to increase the convenience of collecting waste along the entirety of Pacuare. These bins could be clearly marked to differentiate between plastics and metals, further promoting proper recycling practices within the community. The bins should be previously altered in some fashion to minimize the likelihood of theft. Possible solutions in preventing theft could be to tie down the bins, weigh them to the ground, or cut a hole in the bottom. Additionally, by involving other NGOs in this process, the bins could be located at various points throughout the entire beach, including the other side of the river mouth. Figure 9 portrays the separation of the lengths of Playa Pacuare by the river mouth.

Several other nonprofit sea turtle organizations are located on the opposite side of the river mouth as LAST. Placing bins along the beach close to these organizations' properties could help spread LAST's initiatives to other areas of the beach and potentially lead to future recycling projects in the surrounding areas.



Figure 9: Playa Pacuare Beach and River

# CHAPTER

# Conclusions

The magnitude of the trash problem in Pacuare is the result of two major problems:

- 1. A lack of an established waste management system in the community and within LAST's facility
- 2. A lack of knowledge about environmentally friendly behaviors both within LAST and the community

To address the lack of an established waste management system, we aimed to utilize the relationships between LAST and their recycling partners. Furthermore, we established a waste sorting and storage system to further efforts in following the sorting requirements given by Centro de Reciclaje Florida Bebidas and Chatarrera de Bataan. By utilizing these relationships to establish a waste removal system for both LAST and the community, LAST has the opportunity to produce a cleaner environment and promote proper waste management in the community's everyday life. Providing the community with a convenient way to dispose of their trash will align with LAST's mission to realize a future where humans and sea turtles can live together in balance.

In addition, to increase knowledge about environmentally friendly behaviors both within LAST and the community, we designed posters and protocol guides for the project site. These educational materials teach and motivate staff members to take on proper waste removal habits. We also began repurposing and education initiatives with the local school. We recommend LAST continues these efforts by motivating their staff to build upon the relationship with the school and act as an example for environmentally friendly habits. Through empowerment and exchanges in knowledge, LAST has the ability to instill changes in the lives of children, enabling them to be a catalyst for the community to initiate "green" behaviors and habits.

With these initiatives, we hope to steer LAST and the community towards a better understanding of how to properly dispose of waste, reduce the overall impact on the environment, and build a cleaner ecosystem for the people and wildlife alike.



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# Appendices

# Appendix A: Interview Questions

# LAST Maintenance Worker

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily. We speak Spanish more or less, so we are going to conduct the interview together to help with translation.

We are very excited to learn more about your work with LAST both in Pacuare and at other locations. Nicki told us you have worked for LAST for about 30 years and know a lot about the organization and different repurposing projects.

- 1) What inspired you to first start working for LAST?
- 2) What has been the most rewarding part of working for LAST?
- 3) Have you ever worked for any other NGOs?
  - a) (if yes) Can you tell us more about ways they dealt with the trash problem?
- 4) Nicki said you were involved with repurposing projects, helping women to weave bags out of plastic bags. How was your experience participating and working on projects like this?
- 5) How did it affect the women of the community and the community as a whole?
- 6) Do you think something similar is possible for Pacuare?
  - a) Can you think of any projects that might be of interest to the men of Pacuare?
- 7) What does your work with LAST entail? What do other members of the community do for a living?
- 8) Do you think other community members of Pacuare might want to work with LAST during the turtle season? What about off season?

#### Conclusion

Do you have any more questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us.

# Pacuare's Treasurer

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Emily and this is Alexa.





Before we begin, we have a question. Would it be okay if we took notes during the interview so we can reference them later and more easily translate the information?

We are very excited to learn more about your community and your efforts to create a more environmentally friendly program!

# Community Background

- 1) How long have you lived in Pacuare?
- 2) Has the community changed at all throughout your time in Pacuare? How has it changed?
- 3) (If applicable) How is it different from other communities you have lived in?
- 4) How long have you served on *The Environmental Dependency Association of New Pacuare?*

# Blue Flag Program

- 1) We heard that you have worked in past years to obtain Blue Flag Certification for Pacuare. How can the Blue Flag Program affect Pacuare?
- 2) To our knowledge, there are certain requirements to obtain the Blue Flag Certification. Which requirements are the easiest for Pacuare to fulfill? Which requirements present the biggest challenge?
- 3) Are you pleased with the progress the community has made toward obtaining Blue Flag Certification?
- 4) How have you worked with LAST regarding the trash on the beach?
  - a) (If so) Can you tell us about the experience? How does this help with obtaining Blue Flag Certification?

# **Current Disposal Methods**

- 1) As the treasurer of the Environmental Association, we think you will have a great insight into the environmental awareness within the community. Can you tell us about how does the beach waste affect the environment and community?
- 2) What do the people in Pacuare do with both their own trash and the trash that builds up from the beach?
- 3) What resources are lacking to address the trash?
- 4) What is the most commonly used method of disposing of waste by those in the community?
- 5) What do you feel works well with this process? What do you think could be improved?
  - a) In the future, do you think the community would be interested in repurposing plastic for other possible uses? For example:
  - b) Making products out of plastic bottles or bags?
  - c) Building storage and gardens from recycled materials?
  - d) Do you have any other ideas that you believe would work well for Pacuare?
- 6) Overall, what can we do to help with the trash problem on Pacuare?

#### Conclusions

Do you have any questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us. We look forward to working with the community to address the trash issue in Pacuare!





# Community Member/Neighbor

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily.

Before we begin, we have a question. Would it be okay if we took notes during the interview so we can reference them later and more easily translate the information?

We are very excited to learn more about your community and your involvement with LAST!

# Community Background

- 1) How long have you lived in Pacuare?
- 2) Has the community changed at all throughout your time in Pacuare? How has it changed?
- 3) (If applicable) How is it different from other communities you have lived in?

# Relationship with LAST

- 1) Nicki told us you have had a relationship with LAST for some time now. How do you currently work with LAST? Why did you get involved with them?
  - a) (depending on answer) What do you like most about helping with the sea turtle initiative?
- 2) As you probably know, LAST has been working to reduce the trash on the beach. How do you feel about the trash on the beach? Do other people feel the same way?
- 3) Where do you think the trash is coming from and does it affect the community?
  - a) (if so) in what ways?
- 4) What is the most commonly used method of disposing of waste by those in the community?
- 5) Have you ever repurposed waste for day to day tasks? For example, have you ever used plastics as planters, to build walls or structures, to create products for sale?
  - a) (If so) for what?
  - b) (If not) would you consider it?
  - c) Do you have any additional ideas for repurposing? In particular, activities that men may be interested in?
- 6) Overall, what can we do to help with the trash problem on Pacuare?

#### Conclusions

Do you have any questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us. We look forward to working with the community to address the trash issue in Pacuare!

# Other NGO Volunteers

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. LAST, or the Latin American Sea Turtles, works





to help protect the turtles on the Pacific side from trash from the ocean. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily. We speak Spanish more or less, so we are going to conduct the interview together to help with translation.

Before we begin, we have a question, can we record the interview so we can reference it later and more easily translate the information?

We are very excited to learn more about your work!

#### Trash at the Other Project

- 1) How have you helped to reduce the trash on the beach? How have you helped to reduce the trash in the community?
- 2) Can you tell us about the trash on the other side of the river? How does it compare?
- 3) How do you reduce plastics on that side of the river?

# Work with the Community

- 1) Do you have help from the community?
  - a) (if yes) in what ways?
- 2) Can you tell us about the community on that side of the river?
- 3) What do you like about your work? What has been most rewarding?

#### Conclusions

Do you have any questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us.

# La Florida Bebidas

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily, and Kelly. We speak Spanish more or less, but in order to help the conversation run more smoothly Emily and I are going to conduct the interview while Kelly takes notes.

Before we begin, we have a couple questions. First, can we record the interview so we can reference it later and more easily translate the information? Also can we use your name as a source after this interview and in the future?

We are very excited to learn more about your recycling processes and your efforts to improve the trash problem in Costa Rica!

# La Florida Background

- 1) We heard about your plastic recycling initiative to help the environment and make a positive impact on the community. Why did you become interested in taking on this role?
- 2) What are some major accomplishments of La Florida Bebidas regarding your recycling initiative?
- 3) Have you worked with other NGOs like LAST before? How do organizations like this fit into your mission?
- 4) What are the benefits or costs from your plastics recycling program to the company?
  - a) To Costa Rica?





b) To society?

# Confirming Our Understanding

We have talked with Nicki about your requirements for recycling plastics and how you are willing to work with the organization. To the best of our understanding, you are able to recycle any PET and HDPE plastics at your facilities. Is this correct?

1. We have drafted a protocol for the collecting/sorting process for LAST. This protocol includes sorting the plastics by color and type of plastic to the specifications you provided to Nicki. Can you please look it over and confirm the information we have provided?

# **Recycling Plastics**

- 1) Can you tell us a little bit more about the process once we provide you with the recyclable plastics?
- 2) Is it difficult to go through the process of recycling plastics?
  - a) (if so) Why has recycling plastics been such a challenge?
- 3) Are there other companies taking on the same initiative?
  - a) (if not) Why not?
  - b) (if so) Which companies are taking on this initiative and how are they doing this?
- 4) From our knowledge, bottle caps have a lower grade than the rest of the bottle and cannot be recycled. Is this true?
  - a) (If so) What are the steps to dispose of these?
  - b) (if not) How do you recycle them?
  - c) Would it be helpful if LAST removed the bottle caps during collection?
- 5) Is there anything else that LAST can do to help make the recycling process easier for you?

#### Conclusions

Do you have any questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us. Could we get your contact information for the future so if we have any more questions we could contact you again? Thank you again for your time!

# Manager of Chatarrera

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We understand you help LAST with the aluminum recycling and we were wondering if we could ask you a few more questions on your relationship with LAST. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily, and Kelly. We speak Spanish more or less, but in order to help the conversation run more smoothly Emily and I are going to conduct the interview while Kelly takes notes.

Before we begin, can we record the interview so we can reference it later and more easily translate the information? Also can we use your name as a source after this interview and in the future?

We are very excited to learn more about your recycling processes and your efforts to improve the trash problem in Bataan!





# Background

- 1) How long have you been working to recycle in Bataan? Do you recycle full time or work exclusively with LAST?
- 2) Why is recycling important to you? (optional)

# **Recycling Processes**

- 1) How long have you worked with the organization (LAST) to recycle metals?
- 2) Nicki has told us some of your requirements for the collection of metals. Can we confirm those requirements with you now? (optional) Is there a minimum quantity needed for collection of the metals?
- 3) Why is aluminum more valuable than other metals?
- 4) Do you only accept aluminum or would you consider accepting other metals?
- 5) Once we pass of the metals to you, what are the next steps to recycle it?
- 6) What do you do with these recycled materials?
- 7) We know you have been working with LAST for a while but is there anything else that the organization can do when sorting and preparing the metals that will help you in the recycling process?
- 8) LAST now has a partnership with La Florida Bebidas to recycle plastics, but needs accumulate a large volume for pick up and lacks the space to store so many plastics. Would you be willing to help store some of the plastics if La Florida Bebidas could pick them up from your recycling center?

#### Conclusions

Do you have any more questions for us?

Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us. Thank you again for your time.

# Director of WIDECAST

Hello! We are students from the United States, excited to work with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Emily, and Kelly. We speak Spanish more or less, but in order to help the conversation run more smoothly Emily and I are going to conduct the interview while Kelly takes notes. Next to Kelly is Ron and Taylor, who are also members of our team.

Before we begin, can we record the interview so we can reference it later and more easily translate the information? Also can we use your name as a source after this interview and in the future?

# LAST Background

- Can you tell us how LAST fits into WIDECAST and the mission for WIDECAST?
- 2) How does waste affect the mission of LAST? More specifically, how does it affect Pacuare?
- 3) Are there any other organizations in Costa Rica also working to address the trash problem, and how are they addressing it?
- 4) What are the major impacts the waste has on the community?
- 5) Have you visited Pacuare before? What examples of community involvement have you had in the past?

# **Current Disposal Methods**

1) How familiar are you with the recycling process on Pacuare?





- 2) What are other sites in WIDECAST doing to address this problem?
- 3) Are any of the sites similar Pacuare, geographically, socially, or in any way?
- 4) If so, how are they specifically dealing with the problem? (if applicable)
- 5) What are some things that stand out to you that you would want to change for the future?

# Moving Forward

- 1) What are your major goals for this project?
- 2) How can our team specifically help you reach these goals?

# LAST's Biologist

# LAST Background

- 1) Can you tell us about your previous relationship with LAST and some of your major accomplishments with the organization?
- 2) How does waste affect the mission of LAST? More specifically, how does it affect Pacuare?
- 3) What are the major impacts the waste has on the community?
- 4) What recycling resources exist for the facility on-site?
- 5) How long were you with LAST? What examples of community involvement have you had in the past?

# **Current Disposal Methods**

- 1) In a step-by-step process, what was the current method of sorting and disposing of coastal debris on the beach?
- 2) What resources exist for recycling at the science center?
- 3) What are the costs that arise in your current recycling process?
- 4) What works well with the current process or what are some things you would want to remain the same? What are some things that stand out to you that you would want to change for the future?
- 5) To our knowledge, there are many latex gloves that are used at the science center. How do you dispose of the biohazard waste or the waste from work with the turtles?
- 6) Do you see some ways in which your current biohazard methods can be improved?

# **Current Volunteer Training Protocol**

- 1) Did you help train volunteers during your time at LAST?
- 2) How are the volunteers informed on proper sorting and disposal techniques for beach cleanups? Is there a guide LAST currently uses to train volunteers on your sorting process for recyclables?
- 3) How much involvement do the volunteers have in the sorting process?
- 4) (if not) Who does?
- 5) What do you think is the best method for communicating with the volunteers on the sorting methods? (pictures, step by step directions, etc.)

# Repurposing Methods

- 1) We have talked with Nicki about repurposing plastics to build a wall, recycling bins, or a mural, what are your opinions on these projects?
- 2) Are there any other projects you would like to see using the repurposed plastics?

#### Our Plans





- 1) We are considering working with the school to do a trash cleanup and awareness day. Do you require any specific protection for trash cleanups that we should be aware of?
- 2) If you use plastic gloves or any other disposable equipment for cleanups, how are they disposed of?
- 3) Even though you are leaving LAST, what things would you like to see change or improve in the organization?

# NGOs (Sea Turtle Conservancy - Tortuguero, ASVO - Gandoca, ASTOP - Parismina, EPI)

#### Introduction

Hello, we are students studying the effect of trash on remote, ocean-side locations. Your organization has specific experience with removal/repurposing of the trash on the beach. Can we talk to the director of the program? (Can we speak with someone who might have more information about maintaining the beach/cleaning the trash?) Can we ask you a few questions about how you address this problem?

# Background on Trash

- 1) How much of an issue is the trash on the beach at your project site?
- 2) How do you address the trash that washes up?
  - a) What programs have been successful?
  - b) Which have not?
  - c) We heard you have your own way to recycle the plastics. Can you tell us more about this? (Cost, effectiveness, ease of use)
- 1) What are some obstacles that you have faced in trying to solve this problem?
  - a) How have you overcome these obstacles?
- 2) Have you tried to involve the surrounding community in the cleanup efforts?
  - a) How so?
  - b) What has been successful about this process?
  - c) What has not?

# Repurposing (if applicable)

- 1) Have you repurposing plastics before to reduce the trash on the beach?
- 2) How have you repurposed plastics?
- 3) Did you find this to be effective?

### Conclusion

Thank you very much for your time! Your insight was very helpful!

# Pacuare School Teacher

#### Introduction

Hello! We are students from the United States, working with LAST to find a solution to manage the coastal debris problem on Playa Pacuare. LAST, or the Latin American Sea Turtles, works to help protect the turtles on the Pacific side from trash from the ocean. We are hoping to find ways to make the beach a cleaner place to live and a safer home for the sea turtles.

My name is Alexa and this is Kelly. I speak Spanish more or less, so I am going to conduct the interview together to help with translation, while Kelly will be taking notes.



Before we begin, we have a question, can we record the interview so we can reference it later and more easily translate the information?

We are very excited to learn more about your community and your involvement with educating Pacuare!

# Background

- 1) Do you live in Pacuare?
  - a) (if not) where?
  - b) How long have you been teaching in Pacuare?
  - c) Can you describe the dynamic of the school? (Typical number of students, average age of the students, day to day activities, etc.)

# **Teaching Methods**

- 1) As a teacher, what kind of teaching methods do you find to be the most effective? What methods have not been effective?
- 2) How have you taught students about material about the environment?
  - a) Why have you chosen these methods to teach them?
  - b) What do you think they could learn more of?
- 3) What kinds of trash do the students generate on a daily basis? Does the school teach students to eliminate trash from the classrooms?
- 4) Are there any activities that you think may be the most fun and engaging for students?
- 5) What part can LAST play in educating the children about the environment?

# Suggesting Ideas

- 1) What do you think of bringing students on field trips to LAST science center in order to take part in repurposing plastic as an interactive way to educate them?
- 2) Do you know of any other schools that have worked to increase environmental awareness in the classroom?
- 3) Would it be possible to teach the students on February 20th and lead activities?

#### Conclusions

Do you have any questions for us?

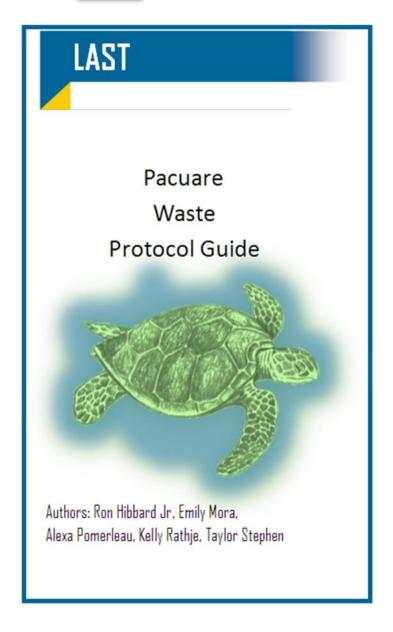
Thank you for your time! We understand how busy you are and really appreciate that you were able to meet with us. We will take all your input into account when creating a lesson plan and activities for the students!





# Appendix B: Basic Protocol Guide

English





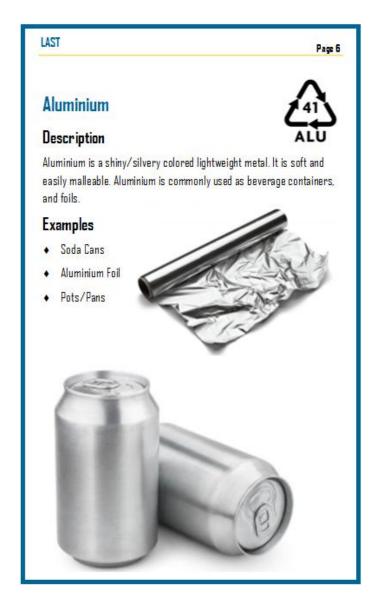








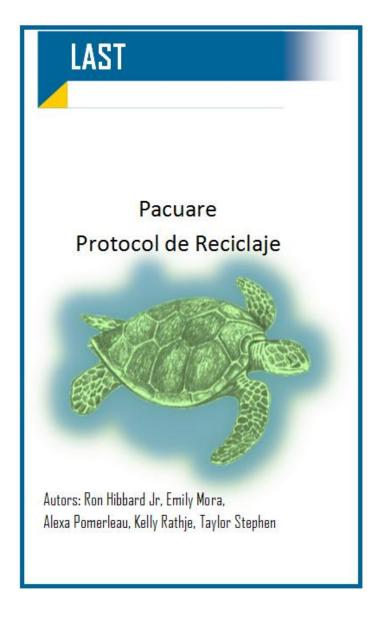








Spanish



















# Appendix C: Instruction Manual for Biologist

# English

# Aluminium

Aluminium is a silvery/white colored lightweight metal that is soft and easily malleable. Most common items found are aluminium cans and aluminium foil.

Aluminium is collected and stored in the designated recycling area near the river entrance to the station, the same area as the plastic waste collected.

# Combustible/Burnable

Burnable items are considered to be:

- ◆ Paper
- ◆ Trees/Driftwood/Sticks
- Cardboard
- ◆ Toilet paper
- ◆ Paper towels

These items are to be safely burned in an open area, away from any trees, cabins, or anything that is able to catch fire from the burning waste.

# **Electrical Waste**

Electrical waste is anything that either utilizes or provides power for operation. These include any type of used battery, TVs, washers/dryers, etc.

For items that contain metals (aluminium) that will be accepted by the nearby recycling center, they will be organized and stored near the designated recycling area on the station. Once the aluminium and metals are to be transported, these units will also be brought with them.

For items that will not be accepted, such as batteries, they are to be stored in a sealed container if possible and isolated from other electrical devices. Once there have been enough collected, they will be transported to be properly disposed somewhere offsite.



# **Plastics**

Plastic waste is broken up into four categories.

#### ◆ HDPE Transparent/White Plastic

HDPE Transparent containers are considered to have a color within the range of being perfectly transparent to near opaque. HDPE White containers have a solid white color. They are commonly used to contain household cleaners, detergents, Juices, shampoos/soaps, and milk.

#### ◆ HDPE Colored Plastic

HDPE colored containers are considered to be any container that is — neither white nor transparent (Red, Blue, Green, etc.). They are mostly commonly found detergent or soap/shampoo bottles.

#### ◆ PET Transparent Plastic

Transparent PET containers are most commonly water and beverage bottles. They are completely clear and have no color tint to them.

#### ◆ PET Colored Plastic

PET colored bottles have a slight colored tint, often to match the color of the liquid contained in the hottle

After the plastic has been collected, the plastic is to then be stored in their respective bag found in the designated recycling area near the river entrance to the station.

# Biohazardous Waste

Any material that has the potential of containing any form of infectious diseases through contact of blood, body fluids is considered to be Biohazardous waste. The most common forms of biohazardous waste include:

- Latex gloves
- Scalpels
- Needles
- Any item used to handle people or animals

These items are to not be reused under any circumstances and be disposed of properly. The waste must be placed in a contained system and stored, isolated. Once it is necessary to remove it, it will be transported to the nearest facility that will accept the biohazardous material.





# Compostable

Waste that is compostable is anything that is organic. However, anything that is **meat, milk, fat, or oil** based **must not** be composted. These wastes will create odors as they break down and attract un-welcomed animals

to the station.

The process of composting is broken up into five steps.

#### Step 1: Setup

The compost pile should set up in a dry area in the property with little sunlight. Make the of the compost pile approximately .75 - 1.0 cubic meters for optimal composting.

## Step 2: Ingredients

There are two base forms of waste that must be in a compost pile, Green and Brown.

Green Waste - Green waste is any organic waste that is high in Nitrogen

Brown Waste - Brown waste is any organic waste that is high in Carbon.

A list of different types of Green and Brown wastes are shown on the right. For efficient composting, there should be a Carbon: Nitrogen ratio of either 3:1.

#### Step 3: Turning

At least once a week, the compost pile should be mixed and turned so that oxygen is able to evenly effect the entire decomposing pile, not just the surface.

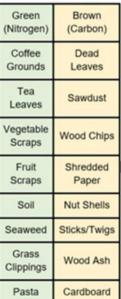
# Step 4: Patience

There is not always a definite time that decomposing waste will turn into compost. Often times it can be between six weeks and 4 months. Composting is completed when it is dark and has a somewhat fine feel to it.

Furthermore, it will have a natural odor to it.

# Step 5: Reuse

There are often times where pieces waste does not completely decompose into compost. This could be a result due to the pieces size, amount of oxygen it received throughout the process, or what that waste is. These chunks can be placed in the pile to continue composting until they have completed the process.





# Spanish

# Aluminio

Aluminio es una matalla brillante, plateada y ligero. Es blando y dúctil. Aluminio está usado por latas y papel de aluminio.

Aluminio se recoge en la zona de reciclaje cerca del río, la misma zona de los plásticos.

# Quemables

Cosas quemables son:

- ◆ Papel
- Árboles y leña
- Cartulina
- Papel del baño
- Toallas de papel

Estas cosas deben quemarse sin accidente, afuera de los árboles, las cabinas, o otras cosas que pueden quemarse.

# Basura Electrónica

Basura electrónica son algunas cosas que usan o hacen energía. Estas cosas se incluyen baterías, televisiones, lavadoras, y similares.

Si el centro de reciclaje acepta basura electrónica con partes de aluminio, estarán organizado cerca de la zona de reciclaje en LAST. Estas cosas viajarán con aluminio y otras metallas al centro de reciclaje.

Si el centro de reciclaje no acepta basura electrónica, como baterías, ponlas en un contenedor sellado y ponlo afuera de otras cosas electrónicas. Con bastantes cosas, la basura electrónica transportará afuera de LAST para su disposición.



# **Plásticos**

Hay cuatro (4) tipos de plásticos para reciclar:

#### ♦ HDPE Transparente/Plástico Blanco

HDPE Transparente contenedores son considerados tener un color entre transparente perfecto y casi opaco. HDPE Blanco contenedores tienen un color blanco y opaco. En general, están llenado con limpiadores domésticos, detergentes, jugos, y leche.

#### HDPE Plástico de Color

HDPE contenedores colorados no son transparentes o blancos. Hacen de colores como rojo, azul, y verde. En general, están llenado con detergentes o champú.

# ◆ PET Plástico Transparente

En general, PET contenedores transparentes son botellas de agua o otras bebidas. Están transparentes y no tienen algún color.

#### ◆ PET Plástico de Color

PET botellas de color tienen un poco color para parecen como la bebida entre la botella.

Después de recoger los plásticos, ponlos en su bolsa apropiada cerca del río en LAST.

# Basura de Riesgo Biológico

Algún material que tiene la posibilidad de contener alguna forma de enfermedades infecciosas por sangre o fluidos cuerpos. En general, basura de riesgo biológico es:

- Guantes de látex
- Escalpelos
- ◆ Agujas
- Otras cosas que tocan animales o personas

Estas cosas no deben estar reutilizados. La basura de riesgo biológico debe ponerse en un sistema contenido y separado de toda la basura general.



# Compostables

Compostables son organicos. Pero, **carne**, **leche**, **grasa**, o **aceite** *no* **son** compostables. Estas cosas hacen olores malos y traen animals diferentes a la estación.

El proceso de compastables tiene cinco pasos:

#### Paso 1: Preparar

La pila compostable debe ser en una zona seca con minima luz del sol. Haz la pila aproximadamente .75 – 1.0 metros cubicos.

# Paso 2: Ingredientes

Hay dos formas de basura en una pila de compostables, Verde y Morano.

Basura Verde - Basura verde tiene mucho nitrógeno.

Basura Morano - Basura morano tiene mucho carbón.

Debe ser una proproción de Carbón: Nitrógeno de 3:1.

#### Paso 3: Convertir

Una vez por semana, la pila debe ser mezclado para distribuir el oxygéno por todo la pila.

#### Paso 4: Paciencia

No hay un tiemp definite para hacer compostables. En general está entre seis semanas y cuatro meses. Es final cuando las compostables son oscuro y tienen on olor natural.

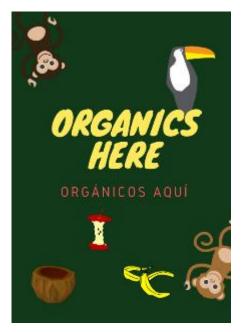
#### Paso 5: Reusar

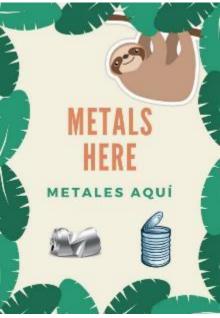
Si unas piezas no son compostables en el mismo tiempo, pueden quedarse en la pila para continuar el proceso.



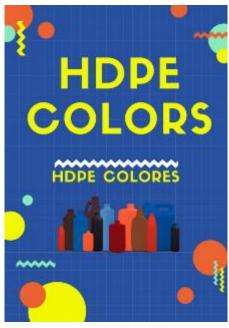


# Appendix D: Posters























# Appendix E: Elementary Lesson Plan

irst i	ning (~15/20 min)
	Hola!!  Me llamo Alexa y me llamo Emily y me llamo (Whoever else is there for this)!!  Cómo te llaman? (Let each answer)  Gracias por mostrarnos su escuela!  Somos estudiantes como ustedes (pero somos más viejos de ustedes)! Vivimos en los estados unidos. Dónde están los estados unidos? (Give prize for whoever answers)  O Y de dónde son ustedes? (Give prize for whoever answers)  O Y cual es su parte favorita de Pacuare? Los animales? La playa?
J	Cuales animales diferentes viven en Pacuare con ustedes? (Keep giving prizes until everyone has one)
J	<ul> <li>When they get to turtles Ah nos gustan mucho a las tortugas!!</li> <li>Donde viven las tortugas?</li> <li>Y qué hacen las tortugas?</li> </ul>
	<ul> <li>(If that doesn't work) Que hacen las tortugas en la playa?</li> <li>Han visto las tortugas en la playa?</li> <li>Las tortugas estan grandes o pequenas?</li> </ul>
	<ul><li>Y que color son las tortugas?</li></ul>
	Las tortugas se anidan en la playa, verdad? (Si!!)
ı	<ul> <li>Y que les ponen en la playa? (Huevos!!)</li> <li>Pero</li> </ul>
)	<ul><li>Donde van las tortugas si hay basura en la playa??</li><li>Uh oh!! Que pasa??</li></ul>
J	Las tortugas no les gustan basura en la playa. Ustedes les gusta la basura en la playa?? (Noo!)
	<ul> <li>Donde debe ser la basura? Be silly (En sus bocas? (NO!) En sus pantalones? (NO!) En sus casas? (NO!)) Donde?!</li> <li>Si nosotros no nos gusta la basura en nuestras bocas o casas, los animales no la les gusta!</li> </ul>
J	Los animales no les gustan los plásticos en el océano o en la playa. Cómo podemos ayudarles?
	<ul> <li>Podemos reciclar los plasticos!!!</li> <li>Ustedes reciclan?</li> <li>Que es el reciclaje??</li> <li>El reciclaje es cuando nosotros reusamos los plásticos! O cuando nosotros sacamos los plásticos en las cajas correctas.</li> <li>Cuando reciclamos, no hay basura en la playa y las tortugas están felices!!</li> </ul>
J	Estan listos para reciclar y reusar plasticos?? Vamos!!!



#### **Scavenger Hunt**

Necesitamos encontrar cosas!!

1.	Primer, necesitamos una mapa del tesoro!!! Aquí es su consejo primero: "Soy un animal verde y anido mis huevos en la playa, pero NO me gusta la basura en la playa. Encuentrame!"
	<ul> <li>Que es un facto sobre tortugas?</li> <li>Qué ocurre cuando los plasticos estan en el océano?</li> <li>Similar questions</li> </ul>
2.	Ahora, necesitamos encontrar algunas cosas! Aquí es su consejo segundo: "Tengo mucho calor y el océano es mi mejor amigo. Encuéntrame!"
	<ul> <li>Les gusta basura en la playa?</li> <li>Donde poner la basura que no está en la playa?</li> <li>Similar questions</li> </ul>
3.	Es tiempo de un concurso! Necesito unas tapas de botellas: uno de verde, uno de rojo, uno de azul, uno de amarillo (Adjust based on how many kids). El primer chico con su color tendrá un premio!! Tres, dos, uno, va!!
4.	Okay, el consejo final!  "Necesitamos encontrar cosas en una bolsa que está marcado con un aquis rojo!  La bolsa esta cerca del baño. Vamos!"
	<ul><li>Qué podemos hacer con estas cosas??</li><li>Vamos hacer un mural!!</li></ul>
Instru	ctions for the Mural
) ) )	Vamos a hacer un mural para su escuela!! Vamos a usar las tapas de botellas! Y con este pegamento, vamos a poner las tapas en la pared para hacer el mural! Vamos!!
	**Words to Know:
	<ul> <li>Wall = pared</li> <li>Glue = pegamento</li> <li>Caps = tapas</li> <li>Turtle = Tortuga</li> </ul>

## **Instructions for Repurposing/ Planting**

- 1) Están listos para hacer un jardín de esta botella?? Vamos!!
- 2) Primer, necesitamos preparar a nuestras botellas. Nosotros vamos a cortar sus botellas con el cuchillo porque es muy peligroso.
- 3) Después, ustedes van a pintar sus botellas!
- 4) Luego, vamos a plantar nuestras semillas!
  - a) Pon el suelo en sus botellas.
  - b) Haz un hueco en su suelo. (Como este... show them)
  - c) Pon su semilla en el hueco.
  - d) Cubra su hueco.
  - e) Riega su semilla!





#### \*\*Words to Know:

```
    Soil = suelo
    Seed = semilla
    Water = agua
    Bottle = botella
    Put = pon (poner)
    Hole = hueco
    Cover = cubra (cubrir)
```

#### **Instructions for Beach Cleanup**

- Vamos a limpiar la playa!Pero esto es un CONCURSO!!!
- El primer persona que encuentra una tapa ROJO va a recibir un precio! Tres, dos, uno, VA!!
  - Similar ones until everyone has a prize. All while picking things up from the beach!

