

**Eco-Guide Realization, Design and Distribution for Proyecto Ecológico
Azuero**

ENVR 451 Research in Panama Final Report

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1. EXECUTIVE SUMMARY

A. ENGLISH VERSION

Deforestation and forest fragmentation throughout Mesoamerica threaten biodiversity and rural livelihoods in many forest types, but the dry tropical forest is especially susceptible to these trends. Tropical dry forests are a critically endangered habitat, with only 2% of Central American dry forests remaining. In the Azuero peninsula, a region previously characterized by extensive dry tropical forests, cattle ranching and conversion to pastureland has caused a significant decrease in the amount of these unique forests. These ecosystems provide vital habitats to endemic species of the region, such as the Azuero Spider Monkey, many of which are critically endangered. Dry forests have the potential to influence regional hydrologic and climatic patterns; mitigating floods, landslides and prolonging the supply of water in the dry season are all recognized benefits. The ecological services provided by forests, including water and soil retention, are vitally important, especially in the arid region of Azuero. On a larger scale, forests sequester carbon better than cropland, thus reducing the amount of carbon in the atmosphere. Lastly, forests provide a plethora of timber and non-timber products to the farmers of the region, a component that cannot be ignored.

Trash burns, especially in the hot, dry climate of Azuero, can propagate rapidly if not properly monitored, destroying trees in the very few patches of tropical dry forest that remain. Not only that, bringing awareness to the issue of waste management will hopefully increase public consciousness around this critical environmental issue that damages both terrestrial and marine ecosystems.

The purpose of our project was to create six “eco-guides” intended to encourage reforestation, sustainable land management practices, and the creation of a biological corridor throughout the peninsula, while simultaneously sustaining local livelihoods and supporting farmers. Misconceptions surrounding these topics, as well as a general lack of information, are the main motivations for the guides. The guides are intended to encourage sustainable practices both on farms and within towns. Through multiple forms of tree cover, in riparian zones, live fences, and other forested patches, the habitats, resources, and landscape connectivity necessary to conserve biodiversity can be maintained without causing any further

threat to local livelihoods. To reach this end, the concept of conservation and farming as opposing forces needs to be reconciled.

Our project was conducted for the Azuero Earth Project located in Pedasí, Los Santos. The six themes that were determined by our host to be most pressing in the Azuero region were: conservation of riparian zones, tree planting, live fences, forest gardens, fire control, and recycling. To gather information concerning these topics we conducted fourteen semi-structured interviews with government officials and community members alike, in Pedasí, Las Tablas, and Panama City. The information we collected was then sorted, prioritized, and phrased in an accessible way. The guides were translated to Spanish. Both the English and Spanish versions were formatted into a pamphlet, printed and laminated, as well as added to the Azuero Earth Project's website.

The results of our project are the six physical and online eco-guides in both languages. For the guide on riparian zones, the most important result is the legal framework surrounding the reforestation and protection of riparian zones. For tree planting, the key piece of information is the difference between registered and non-registered plantations with the main difference being financial benefits for farmers who enter the MiAmbiente registry. In the guide on live fences, the essential information is how to plant live fences and what species are most useful in this practice. The forest gardens of Azuero brochure details the benefits to having a forest garden and the potential design and species for creating one's own. The eco-guide on fire control discusses the process of prosecuting a neighbor for wrongful damages. Lastly, the recycling guide includes centers of collection in the Azuero peninsula and Panama city, as well as tips for reducing, reusing and recycling.

The guides are part of a larger attempt at involving all actors in earnest, and we hope that, as one small piece of a greater picture, these guides will help to spread awareness and inspire small scale reforestation projects across the Azuero. In an ecological sense, the services the guides discuss are vital to local communities and the world alike.

B. SPANISH VERSION

La deforestación y la fragmentación forestal en toda Mesoamérica amenazan la biodiversidad y los medios de subsistencia rurales en muchos tipos de bosques, pero el bosque tropical seco es especialmente susceptible a estas tendencias. Los bosques secos tropicales son un hábitat críticamente amenazado, con solamente el 2% de los bosques secos centroamericanos restantes. En la península de Azuero, región anteriormente caracterizada por extensos bosques tropicales secos, la ganadería y la conversión en pastizales ha provocado una disminución significativa en la cantidad de estos bosques únicos. Estos ecosistemas proporcionan un hábitat vital a las especies endémicas de la región, como el Mono Araña de Azuero, muchos de los cuales están en peligro crítico. Los bosques secos tienen el potencial de influir en los patrones hidrológicos y climáticos regionales; la mitigación de las inundaciones, los deslizamientos de tierra y la prolongación del suministro de agua en la época seca son beneficios reconocidos. Los servicios ecológicos proporcionados por los bosques, incluyendo el agua y la retención del suelo, son de vital importancia, especialmente en una región tan seca como Azuero. A mayor escala, se ha demostrado que los bosques secuestran mejor el carbono que las tierras de cultivo, reduciendo la cantidad del carbono en la atmósfera. Por último, los bosques proporcionan una gran cantidad de madera y productos no madereros a los agricultores de la región, un componente que no se puede ignorar.

Las quemadas de basura, especialmente en el clima caliente y seco de Azuero, pueden propagarse rápidamente si no se controlan adecuadamente, destruyendo los árboles en los pocos parches de bosque que quedan. También, con tiempo, esperamos concientizar al público sobre el manejo de residuos y este problema medioambiental crítico que daña a los ecosistemas terrestres y marinos.

El propósito de nuestro proyecto fue crear seis "eco-guías" destinadas a fomentar la reforestación, las prácticas de manejo sostenible de la tierra y la creación de un corredor biológico en toda la península, al mismo tiempo que sustentan los medios de vida locales y apoyan a los agricultores. Las ideas erróneas que rodean estos temas, así como una falta general de información, son las principales motivaciones de las guías. Las guías están dedicadas a promover prácticas sostenibles tanto para las zonas agrícolas como en las zonas urbanas. A través de múltiples formas de cobertura arbórea en zonas ribereñas, cercas vivas y

otros parches forestales, los hábitats, recursos y la conectividad del paisaje necesarios para conservar la biodiversidad pueden mantenerse sin amenazar a los medios locales de subsistencia. Para alcanzar este objetivo, es necesario reconciliar el concepto de conservación y agricultura como fuerzas opuestas.

Nuestro proyecto fue realizado para el Proyecto Ecológico Azuero ubicado en Pedasí, Los Santos. Los seis temas determinados por nuestro anfitrión que se consideran más urgentes en la región de Azuero fueron: la conservación de zonas ribereñas, la plantación de árboles, cercas vivas, huertos forestales, control de incendios y el reciclaje. Para obtener información sobre estos temas, realizamos catorce entrevistas semiestructuradas con funcionarios del gobierno y miembros de la comunidad, en Pedasí, Las Tablas y Ciudad de Panamá. La información que recogimos fue ordenada, priorizada y redactada de manera accesible. Las guías fueron traducidas al español. Tanto las versiones en inglés como en español fueron formateadas en un folleto, impreso y laminado, así como añadido al sitio web del Proyecto Ecológico Azuero.

El resultado de nuestro proyecto son las seis eco-guías físicas y en línea en ambos idiomas. Para la guía sobre las zonas ribereñas, el resultado más importante son las consideraciones legales que rodea la reforestación y protege las zonas ribereñas. Para la plantación de árboles, la información clave es la diferencia entre plantaciones registradas y no registradas. La principal diferencia siendo los beneficios económicos para los agricultores que ingresan al registro MiAmbiente. En la guía sobre cercas vivas, la información esencial es cómo plantar cercas vivas y qué especies son más útiles en esta práctica. El folleto de los huertos forestales de Azuero detalla los beneficios de tener un huerto forestal y el diseño potencial y especies para crear uno propio. La eco-guía sobre control de incendios discute el proceso de enjuiciar a alguien que ha quemado sin el consentimiento del vecino. Por último, la guía de reciclaje incluye centros de recolecta en la península de Azuero y ciudad de Panamá, así como consejos para reducir, reutilizar y reciclar.

Las guías son parte de un intento más grande de involucrar a todos los actores y esperamos que, como un pequeño fragmento de un cuadro mayor, estas guías ayudarán a difundir el conocimiento e

inspirar proyectos de reforestación a pequeña escala a través de Azuero. En un sentido ecológico, los servicios que describen las guías son vitales para las comunidades locales y para el mundo.

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3. INTRODUCTION

A. GENERAL CONTEXT AND BACKGROUND INFORMATION

In the Azuero peninsula of Panama (Figure 1), where large areas of land have been deforested and converted to cattle production, most landscapes formerly containing exclusively tropical dry forest presently consist of mosaics of small forest plots scattered within pastures and crop fields. The remaining forest patches represent part of one of the most critically endangered forest types world-wide with only 2% of Central American tropical dry forests remain, where in Panama it has almost been entirely eliminated (Miles et al., 2006). Out of 58% of Panama's land occupied by forestry, 20.6% of it is terrestrial protected area where most of these areas are located within agricultural matrices and are

vulnerable to impacts (The World Bank, 2017; 2011). Around 30% of Panama's land is used for agriculture (23% for pasture and 7% for cultivation) where forest is scattered throughout, left outside of formal protected areas, and hence exposed to further degradation (Brooks et al., 2004; The World Bank, 2017). The remnants of Panama's tropical dry forest that exist outside protected areas are there primarily due to the fact they are valued by the local people (Barrance, Schreckenber & Gordon, 2009).



Figure 1. Map of Azuero Peninsula in Panama (Forward Turtle Panama, 2005)

Highly appealing for human exploitation and colonization, Los Santos province has been one of the most heavily deforested and nutrient-poor provinces in the country. Although these agricultural landscapes are often seen as biological wastelands, they usually retain an abundant tree cover in small forest patches, riparian areas, live fences and dispersed trees in fields (Harvey et al. 2005). Conserving this landscape connectivity is a key strategy for the Azuero peninsula to protect biodiversity, maintain viable ecosystems, wildlife populations and to facilitate adaptation for wildlife species in the face of climate change (Meiklejohn, Ament & Tabor, 2010). According to the Global Forest Watch (2017), 27.5% of GHG emissions in Panama came from land-use change and forestry in 2011. Land use has a direct effect on forest carbon stocks, according to the Global Forest Watch Panama (2017) has 569 million metric tons of carbon stocks in living forest biomass. Forest carbon stocks following shifting cultivation supports the view that forest and land uses can maintain important ecosystem services, while they also fulfill a fundamental activity in the economy of local communities as a multi-use system (Noble & Dirzo, 1997).

The importance of tropical dry forests has led to experimental studies which have proven the ability that natural species have for regeneration: “remnant trees in field and riparian zones provide seeds and moderate edge environment for seed germination and seedling establishment” (Griscom & Ashton, 2011). While this may be the case, research shows that on sites that have long been deforested, such as those of the Azuero region, require active management in order to restore the fecundity and connectivity of the landscape. The two biggest “barriers to regeneration in dry tropical forests are (1) a fire disturbance regime and (2) lack of a diversity of arboreal elements and forested riparian zones in some pastures” (Griscom & Ashton, 2011).

Riparian Zones

Introducing trees into pastures is an important production and conservation objective (Long & Nair, 1999). Theoretical benefits include diversified production and income; increased total productivity; maintenance of tree diversity; provision of shade and browse for livestock; and the provision of refuge for biodiversity (Love, Bork & Spaner, 2009). Riparian zones are areas of critical concern worldwide as they border bodies of water in the watershed with vital functions such as filtering agricultural contaminants, buffer landscapes against erosion, and providing habitat (Sabo et al., 2005). Riparian deforestation leads to a degradation of water, soil and habitat quality as well as causing channel narrowing, which reduces the total amount of stream habitat and ecosystem per unit channel length and compromises in-stream processing of pollutants (Sweeney et al., 2004). Not only do forest buffers prevent nonpoint source pollutants from entering small streams, they also enhance the in-stream processing of both nonpoint and point source pollutants, reducing their impact on downstream rivers and estuaries (Sweeney et al, 2004). Figure 2 illustrates a recommended riparian zone system that could be established along streambanks (Hawes & Smith, 2005).

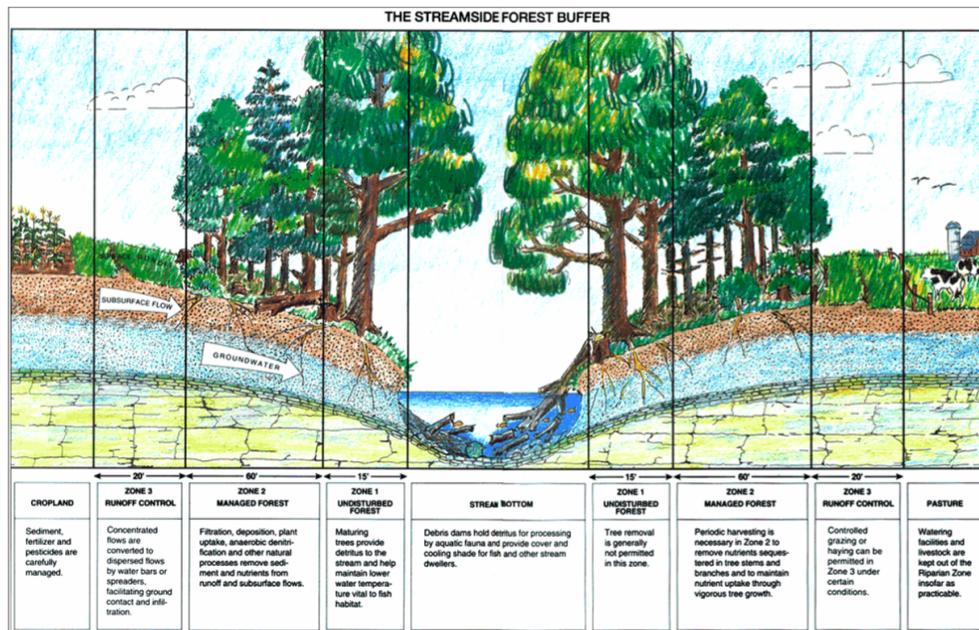


Figure 2. Riparian Forest Buffers: Function and Design For Protection and Enhancement of Water Resources (Hawes & Smith, 2005).

Efforts are emerging to conserve these diverse landscapes that retain significant tree cover including riparian zones, forest fragments and live fences. Initiatives to promote natural regeneration should align their strategies with farmer’s water concerns to expand these riparian corridors and increase awareness on ecological processes through which riparian habitat restoration influences water quality and evapotranspiration in pastoral areas (Sweeney et al, 2004). Conservation goals can be reached by supporting and promoting the reforestation and legal guidelines towards buffer zones.

Tree Planting

Contrary to the pervasive belief that tree planting and protecting interferes with agricultural interests, E.J Garen et. al (2011) found in a study in Panama that “most respondents at both Rio Hato and Los Santos leave trees in their agricultural fields, as well as lands not under agricultural production, primarily as a source of wood for construction purposes and furniture, but also to provide ecosystem services, such as improving water and soil quality, and as a source of food and shade for cattle” (Garen et. al 2011). Research cohorts both in Honduras and in Panama reached the same conclusion as Garen et al.

(2011) pointing to the invaluable capacity of farmers in terms of managing natural regeneration in a manner conducive to land restoration programs. Rather than fault the rural farmers for habitat and landscape destruction, “a shift in perception regarding the relationship between rural landholders and trees, from one that ignores a history of tree planting and protecting to one that recognizes the diversity of ways that trees and forests support rural livelihoods, could open the door to the development of tree planting initiatives that reflect the interests and practices of rural landholders and that complement traditional livelihood practices, such as cattle ranching” (Garen et. al, 2011).

Research shows that the inclusion of trees into agricultural landscapes is far from a foreign concept. Indeed, Panamanian farmers have been planting, utilizing and protecting both native and exotic species for decades and, according to Garen et. al (2011) an effective reforestation strategy “can be designed, implemented, and managed with farmer input to both increase native forest cover while supporting the livelihood practices of local people”. In an effort to increase the amount of forest cover in the country, strict regulations have been put in place to ensure proper reforestation techniques are practiced, especially within riparian zones and protected forests. As a result, a certain stigma exists around tree planting, with some farmers believing that if they reforest with the help of MiAmbiente or register their trees in the MiAmbiente Forest Registry they will later be unable to harvest these trees.

In 2002 according to Billings & Schmidtke, a major success story in Panama is its reforestation program. Public land concessions are granted for 20 years and all expenses associated with reforestation are tax deductible. Corporation and individuals interested in reforesting their own property or leasing government owned lands for reforestation are allowed to deduct up to 100% of their expenses on seeds, preparation of land, fertilizer, fire protection, pest control, and other silvicultural treatments. Likewise a program currently exists to encourage the reforestation of tropical forests called un Alianza por un Millón de Hectáreas which aims to reforest one million hectares in Panama in a twenty year time span (2015-2035).

Live Fences

Live fences are a common feature throughout the Azuero peninsula and Central America. Live fences consist of closely-spaced strips of trees that delimit a field boundary to which fencing material, usually barbed wire, may be attached (Budowski, 1993). Although live fences may originally consist of one or a few planted species, natural dispersal leads other plant species to colonise the fence understory (Metzel & Montagnini, 2014). Not only do live fences occur across areas that are biophysically diverse, with different elevations, ecological life zones, and soil types, but they also occur in areas with distinct cultures, land use histories and agricultural production (Sauer, 1979; Budowski, 1987). In some agricultural regions, such as the Azuero peninsula, where deforestation and conversion to agriculture has been high, live fences constitute one of the most prevalent form of tree cover remaining in the landscape (Harvey et al., 2005).

Although live fences cover a small physical area, they have a disproportionate effect on the structure, composition and connectivity of landscapes, as they increase total tree cover, divide pastures into smaller areas, create structural connectivity and provide direct physical connections to forest patches, thereby potentially facilitating the movement of some animal species (Harvey et al., 2005). Therefore the main productive and ecological roles of live fences is acting as barriers to cattle movement whilst providing habitats and resources for other animal species and act as corridors for wildlife conservation as well as a source of fodder, firewood, timber and fruit (Harvey et al., 2005).

Live fences also provide a durable and renewable source of fencing on farms, they reduce the need for farmers to harvest fence posts from the few remaining forested areas. Established and managed by farmers, challenges to cooperative fence management include the potential for planting to initially disrupt fire-breaks, the costs of protecting young trees from cattle, the maintenance of cooperative neighborly relationships, the upkeep and alteration of tree growth by cattle grazing (Metzel & Montagnini, 2014). However their decisions to use live fences, in part, stem from the difficulty and high cost of obtaining dead wooden fence posts, due to the limited forested resources on their farms and in the surrounding agricultural landscape (Harvey et al., 2005). Thus legal and economic incentives may be

needed to overcome the upfront costs of planting economically valuable species and of protecting trees to improve ecosystem services on farms. According to Metzler and Montagnini (2014) three key areas may greatly influence the success of conservation in this region: the burden on tree planting projects to demonstrate the tangible economic benefit to the farmer; water as a priority for natural regeneration projects; and cooperative live fence management as a way to increase landscape connectivity. Increasing tree cover near live fences in the Azuero peninsula can significantly expand much needed forest cover and allow animal species to migrate between the few isolated forest patches that remain (Metzler & Montagnini, 2014). Live fences play a key role in the agricultural regions and merit much greater consideration in sustainable land management strategies, agricultural policies and conservation efforts designed to enhance ecological cohesion and landscape connectivity of rural agricultural landscapes in the Azuero peninsula.

Forest Gardens

Forest gardens are part of a longstanding practice throughout many parts of Panama and have traditionally carried out an important function in terms of ensuring a basic and nutritious food supply for the family (Montagnini, 2006). Forest Gardens often utilize native tree species, contributing to ongoing reforestation programs in Azuero. Home gardens employ a plethora of sustainable land techniques and contribute numerous benefits to the household and to the land.

One such benefit is the sequestration of carbon; the “perceived potential [of forest gardens] is based on the premise that the greater efficiency of integrated systems in resource (nutrients, light, and water) capture and utilization than single-species systems will result in greater net C sequestration” (Nair et. al, 2009). Studies indicate that agroforestry systems have a higher potential to store C long term as compared to conventional pastures. This is because C storage in agroforestry systems, includes the aboveground plant mass, roots, soil microorganisms, and the relatively stable forms of organic and inorganic C in soils, and the durable products derived from the wood (Nair et. al, 2009).

Moving forward, as more and more attention is paid to reforestation, forest gardens could serve a critical role in creating and preserving forest cover as they have the potential to produce food and raw materials while simultaneously providing forest cover and conserving biodiversity. Forest gardens are more dynamic than typical agroforestry systems that only contain a limited number of “a more or less stable combination of selected trees and crops” (Wiersum, 2004). On the other hand, the dynamism of Forest Garden purports a level of flexibility to the farmer which allows them to adapt to fluxes in livelihood and market conditions (Wiersum, 2004).

Fire control

Naturally occurring fires are considered to be an essential part of forest disturbance dynamics. It is well documented that wildfires have always occurred and have long-term patterns related to large-scale and long-term climate and vegetation changes (Eales et al., 2016). Fire regimes vary in their frequency, extent and intensity, furthermore a lack of fires historically leads to a lack of specific habitats, resources or living substrates (Eales et al., 2016). Prescribed controlled burning, swidden or slash-and-burn are practices to clear and burn forests for shifting agriculture, burning the field stubble in preparation for planting, and to rejuvenate pastures for cattle grazing (Billings & Schmidtke, 2002). Not only is it used in agricultural settings but also as a management tool to enhance and maintain habitats for biodiversity outcomes and mitigating wildfire risk.

Wildfires are of concern across Central America during the dry season due to the increased likelihood of catching fire. As seen from Figure 3, the average distribution of major natural hazards in Panama droughts take up 54% and wildfires 5%.

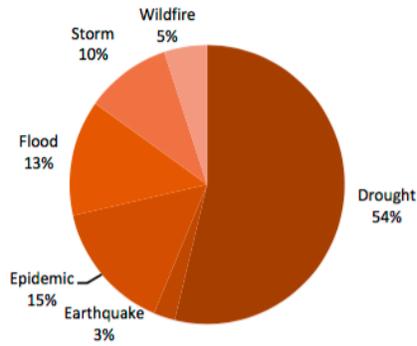


Figure 3. Average distribution of major natural hazards in Panama (The World Bank, 2011)

While wildfires can begin from natural causes, by far the majority of these fires are caused by agricultural practices. Due to a lack of education and environmental consciousness on behalf of some farmers we see examples of these wildfires throughout the peninsula of Azuero. In 2016 more than 700 hectares was destroyed in Los Santos as a result of wrongful practices of burning and persistent felling in protected areas (Flores, 2016). As a hot and dry region of Panama, as seen as in Figure 4, limited water resources during this period puts a strong strain was put on the community. However it is important to note that a strong management plan and infrastructure is in place provided by the Panamanian National Environmental Authority with a better foundation for forest and protected area management than other Central American countries (Billings & Schmidtke, 2002).

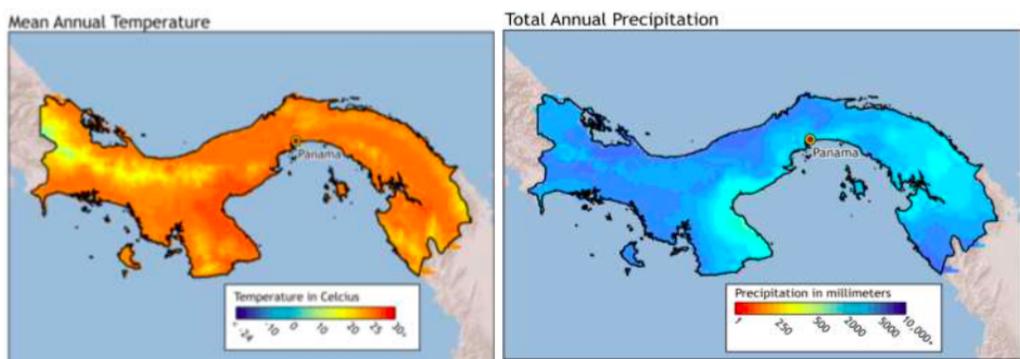


Figure 4. Climate baseline for Panama (The World Bank, 2011).

Shifting cultivation is an integral part of tropical forest landscapes that are crucial to biodiversity conservation. However it is, without a doubt, a complex management system that is difficult to pin down,

categorize, measure, and monitor but is also an important and proven source of livelihood and generator of diversity (Padoch & Pinedo-Vasquez, 2010). In the Azuero peninsula slash-and-burn has its benefits however the wildfire risks and hazards are especially problematic. Swidden may not well be an ideal solution but can have a place within a conservation paradigm with serious supervision and research working for and not against it (Padoch & Pinedo-Vasquez, 2010).

Waste Management

Trash burning is prevalent throughout all of Panama, with the Azuero peninsula being no exception. On the peninsula, trash is subjected to open air burns, even in dumps. This practice damages human and ecological health. Since trash is composed of approximately 50% carbon by mass, burning releases enormous amounts of carbon into the air in regions where this practice is commonplace. Although on the whole the amount of carbon released through trash is minimal as compared to other emission sources, it can be a “significant source in some countries and regions, and it is one not reflected in the official greenhouse gas inventories for those places” (Thompson, 2014).

Another alarming truth about the consequences of open air trash burns are detrimental and potentially life threatening health conditions that result from exposure to the toxins released when burning occurs. Dioxins, particulate matter, polycyclic aromatic hydrocarbons, volatile organic compounds, carbon monoxide, hexachlorobenzene and ash are released when trash, especially plastic, is burned. The side effects range from bad (headache, fatigue, nausea, and vomiting) to worse (damage to reproductive and central nervous systems, kidney and liver issues, exacerbation of respiratory conditions and skin irritation) and studies show many of these toxins have proven to be cancer causing (US EPA web archive).

Recycling centers in Panama are in very initial phases and so the biggest challenge to the recycling predicament is simply the lack of infrastructure. Due to a lack of formal recycling efforts in Panama, an informal approach has been adopted. Street and landfill scavengers make up part of this informal system (Linowes and Hupert, 2006). Despite the legal requirement for municipalities to provide sufficient waste management systems to their inhabitants, a large gap exists as many cities and towns have

failed to implement modern practices. Consequently, landfills are commonly unmonitored and unregulated sites outside of city limits (Linowes and Hupert, 2006).

B. INTRODUCTION TO HOST ORGANISATION

The Azuero Earth Project, or the Proyecto Ecologico Azuero in Spanish, is an NGO located in Pedasí, Los Santos established in 2008. The mission of the project is to “to preserve the earth’s ecosystems, protect biodiversity, and promote healthy communities by helping people to make informed decisions, take sustainable actions, and share knowledge” (Proyecto Ecológico Azuero, 2017). The four main tenets of the program are creating a biological corridor, promoting organic agriculture, providing education programs and engaging in community outreach. The project fosters goals through a variety of activities, from Earth Day celebrations, to workshops and activities for kids, to hosting visiting researchers from Panama and beyond.

C. RESEARCH QUESTION AND OBJECTIVES

The research question we explored was: “what methods can be used to effectively spread awareness regarding environmental problems most prevalent in the Azuero Peninsula?” which is answered through our ecological guides. The overarching issue is that limited access to legal and educational resources has led to misconceptions and an overall lack of information regarding these critical environmental issues. Our host institution recommended the creation of a set of eco-guides, both in Spanish and English, to be available in print and on the web to address certain fallacies and this absence of accessible information. Our objective, therefore, is the realisation, design and distribution of six eco-guides; riparian zones, tree planting, live fences, forest gardens, fire control and recycling. The goal of each eco-guides is to disseminate knowledge, encourage environmental education and proper administration of lands, and make practical information readily available to the community.

Azuero Earth Project recognizes that widespread change can only be brought about if the community is aware of the problems and engaged in the solution. Therefore, in an attempt to mitigate the

effects of widespread deforestation and pollution, local actors need to be integrated into the solution framework. Rather than implementing techniques from the outside with no regards for the local context, “researchers and land managers should seek to understand traditions and local knowledge and employ interdisciplinary techniques to project planning related to reforestation and restoration” (Hall et. al, 2011). Ergo, the eco-guides use language that is accessible to a wide array of individuals.

4. METHODOLOGY

A. RESEARCH DESIGN, TECHNIQUES & APPROACHES

Our study site was the Azuero Peninsula (Figure 5) with the additional days in the MiAmbiente office in Panama city.



Figure 5. Map of the Azuero Peninsula (Proyecto Ecológico Azuero, 2017)

The themes of our eco-guides were put forward by our host institution. The first step in the design of our project, therefore, was to determine which components of these topics were most important and pertinent to the inhabitants of the Azuero region. We formulated the questions based on previous research done by the host project, research obtained through interviews and on our literature review. Our design included

semi-structured interviews in Las Tablas and Pedasí, the Azuero Peninsula, as well as Panama city at the head office of the ministry of environment. In addition, we collected online information regarding a wide array of topics, including national laws and recycling centers. We also searched and verified contacts, a crucial part of all the eco-guides, but most essential on the guide to recycling as these institutions are frequently changing due to the informal nature of recycling in Panama.

The format of the guides follows a clear structure of information so that the reader can understand the sections in sequential order; for example, laws were explained before the steps to prosecute someone who burned without the neighbouring landowners consent. Our approach towards the guides was to make accessible as possible we made our best effort to avoid jargon that an average citizen would not understand. To ensure our eco-guides were in fact easy to read and understand, we tested the vocabulary using the readability statistics function on Word. All of our eco-guides read close to a grade 9 reading level.

Once the guides were complete to the best of our ability, we translated the guides from English to Spanish, checking the Spanish used with an employee of the project to ensure that the Spanish we used in the guide was typical for, and understood by, Panamanians. The guides are available in both languages due to the sizeable expat population that lives in Pedasí and surrounding region. Next we completed the design of our eco-guides using an online program called lucidpress. The last steps were to print and laminate the six guides so that they can be used in the day to day activities of our host. It is important to clarify that it is an active document, meaning the information will change over time, due to changes over time in laws and recycling centers, and because comments, corrections or clarifications may want to be added or changed. Similarly, the guides are available both in print form as well as online to ensure access to this information for those with limited or no access to computer or internet.

B. DATA COLLECTION METHODS

The majority of the information contained in the guides comes from fourteen semi-structured interviews of an azuero earth project employee, three people from the corregiduría and personería, a

firefighter and a local from Pedasí as well as eight MiAmbiente officials were interviewed throughout Pedasí, Las Tablas and Panama city. The interviews ranged from fifteen minutes to an hour and a half. Time constraints were noted however all interviewees never cut the interview short nor showed any reluctance to continue any further, on the contrary they were all thoroughly pleased in our interest and sharing their knowledge with us. Two of the respondents were in repeated contact through WhatsApp messenger answering quick questions we had and providing us with additional resources. This information was also recorded. On multiple occasions, especially MiAmbiente offices, an interview would include more than one participant from the same department which we treated as a single interview adding additional details.

Past eco-guides informed our project a great deal, but due to changing regulations, verifying the information contained in previous guides was imperative to the accuracy of our six guides. For the tree planting, riparian zones, and fire control national and regional laws were verified and updated. We expect that are host institution will use on the ground knowledge methods for distribution means and locations, such as an in an upcoming workshop with landowners.

For the recycling guide, we visited the local recycling center in the Ciudad del Saber (Centro de Acopio y Manejo (CAM) de desechos sólidos FCDS/FAS PANAMÁ) to interview the personnel there and investigate the materials they accept. We also asked if they were aware of any other recycling options in Panama City and they suggested we look into the “puntos limpios” that the city government has established at various locations throughout the city, like in Betania y Panama del Este, for example.

For the guide on Fire Control, we explored the process of denouncing one’s neighbor for wrongful burning, which led us from Corregiduría to Personería and finally to the Centro de Mediación. The guides on tree planting, riparian zones and live fences also led us to collect data from a range of MiAmbiente offices to obtain information and verify what previously received was consistent. Therefore all these visits were imperative allowing us to gather new contacts for the eco-guides.

C. QUALITATIVE AND ANALYTICAL METHODS

Data was solely qualitative where each semi-structured interview performed followed an eco-guide theme and oriented itself along a list of questions we had. As interviews were conducted they were written out on the spot and transcribed later for further analysis according to their theme. No statistical functions or analyses were performed on quantitative data as they were not deemed to be relevant or necessary for our eco-guides.

D. LIMITATIONS

Knowledge was plentiful and we were fortunate in that people did not hesitate to share their expertise with us. However, we frequently encountered gaps in the information we collected which made it necessary to revisit the offices multiple times to confirm details. Many times we interviewed someone with the intent of confirming information but instead received diverging or new information. While at times frustrating, the new lead helped us gain a complete narrative, especially with the more complex eco-guides such as tree planting and fire control.

Since the aim of our interviews was to garner as much relevant information as possible regarding these six topics, we had no set interview format. As a result, we obtained information that we would not have known to ask, but a downfall to our semi-structured interviews was that people often went off track and described extraneous information that while interesting, was irrelevant to our project.

The largest limitation encountered was a lack of complete information on laws and complex nature of environmental laws. There would often be a discrepancy between information and decisions within different MiAmbiente offices in Panama city, Las Tablas and Pedasí. For example, when discussing the process of obtaining permits to conduct a controlled burn on one's property different levels of government gave contradicting allowances and instructions.

Lastly our current eco-guides were based on previous five year-old information. This could have potentially lead to a bias and misdirection on data gathering. There was also a time constraint for the distribution of the eco-guides as translating and editing took longer than expected. We were not able to

hand out our products to our contacts in the relevant departments. However the eco-guides will be used in future workshops for the Azuero Earth Project, for example they were distributed during the Earth Day activities in Pedasí.

E. COMPLIANCE TO THE CODE OF ETHICS OF MCGILL UNIVERSITY

Our research was carried out following the code of ethics of McGill University. It required the collaboration through interviews and previous research of governmental officials, firefighters, community members and Azuero Earth Project employees where we presented ourselves, our affiliations, stated our intentions and work. The participant interviewed or requesting information from could opt out at any time if they did not understand our work or unwilling to cooperate. Verbal consent and confidentiality was given when beginning an interview or sharing information. Whilst speaking to individuals we made certain to respect opinions, decisions and cultural understanding as well as no translators were needed throughout the course of the project. Additionally we have completed the online training on Human Subject Research as part of the Tri-Council Policy Statement tutorial on ethical conduct for research involving humans (<http://www.pre.ethics.gc.ca/eng/education/tutorial-didacticiel/>, **Appendix 1**).

5. RESULTS

A. RIPARIAN ZONE CONSERVATION (Appendix 2)

Our guide to understand and protect riparian zones defines these areas as bordering bodies of surface water such as lakes, ponds, rivers or streams. The eco-guide explains its significance in Azuero as some of the last patches of tree cover and the important services they provide, such as providing vegetation cover, protecting water and soil quality by preventing erosion and agrochemical runoff, harboring diversity by providing a seed bank and fruits, habitat zones and providing steady supplies of high quality potable water. The eco-guide highlights the importance that by increasing the integrity of these areas one has to reforest riparian zones using trees that grow well around bodies of water. The

Azuero Earth Project provides a database of list of these species seen in figure 6.

18 PLANTS FOUND	
tree	Anacardium excelsum español, jabillo, comezuelo
tree	Andira inermis harino, quira, almendro de río, cabbagebark tree
tree	Calophyllum brasiliense maría
tree	Castilla elastica caucho, mastate blanco, hule, Panama rubber tree
tree	Cavanillesia platanifolia culpo
tree	Chrysophyllum cainito carmito, star apple
tree	Copaifera aromatica cabimo
tree	Enterolobium cyclocarpum covió, elephant ear
tree	Ficus insipida higuador
tree	Hieronyma alchorneoides zapatero, pilon, palo chanco, piedra, pantano
tree	Hura crepitans tronador, ruano, haviño, ceibo
tree	Hymenaea courbaril algarobo, algarobia, guapinol
tree	Manilkara zapota nispero
shrub	Pithecellobium hymenaeifolium guabito de río
tree	Prioria copaifera cattivo
tree	Spondias mombin jobito, jobo
tree	Sterculia apetala panamá
tree	Zygia longifolia guabito de río

Figure 6. Plant database on Azuero Earth Project website on plant species appropriate for planting in the Azuero Peninsula for riparian zone reforestation (Proyecto Ecológico Azuero, 2017).

Conserving riparian zones on cattle farms is an issue as cattle with access to a riparian zone often negatively affect soil, water and vegetation destroying the banks of the rivers by trampling, defecating and urinating in the water. This limits natural regeneration of the plants resulting in areas void of vegetation. In order protect the integrity of the water, soil, and vegetation the guide advises bringing the water to the cattle instead of having the cattle seek the water. The guide provides guidelines for how to protect riparian zones when cattle are present:

1. Fence both sides of a riparian zone to limit cattle from entering, especially in the early years after planting.
2. Once the riparian zone has been fenced, install water troughs that can be made from old tires, containers, buoys or other recycled items. Bring water to the trough using a hose that comes from the creek or river. Use lighter materials if the troughs will be mobile to follow the cattle's rotation.

Lastly the guide provides contacts for further advice and legal considerations for riparian zones where articles 23 and 24 from the 1st law of February 3 1994 (Autoridad Nacional del Ambiente), seen in figure 7, prohibits the logging or destruction of any trees in the following areas:

<p>Article 23 protects natural vegetation that borders bodies of water. It protects:</p> <ol style="list-style-type: none"> 1. Areas that border springs originating from the forest. <ol style="list-style-type: none"> a. 200 meter radius of tree cover must be maintained. b. 100 meter radius if the area is flat. 2. Around rivers and streams. <ol style="list-style-type: none"> a. Both sides must be forested at a level equal or greater to the width of the river or stream with a width no less than 10 meters. 3. Around natural lakes and reservoirs. <ol style="list-style-type: none"> c. 100 meters from the shore. 4. Forest on the banks of aquifer areas that are for human consumption cannot be cut under any argument and are considered special forests in national protected areas. 	<p>Article 24 protects areas of planted forest bordering bodies of water.</p> <ol style="list-style-type: none"> 1. Areas that border springs originating from the forest. <ol style="list-style-type: none"> a. 100 meter radius of tree cover must be maintained. b. 50 meter radius if the area is flat. 2. Around rivers and streams. <ol style="list-style-type: none"> a. Both sides must be forested at a level equal or greater to the width of the river or stream with a width no less than 10 meters. 3. Around springs that are for human consumption <ol style="list-style-type: none"> a. radius of 50 meters 4. Areas in natural or artificial reservoirs. <ol style="list-style-type: none"> a. 10 feet from the maximum water level.
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Figure 7. Articles 23 & 24 in the forest legislation in Panama (2014)

B. A GUIDE ON RIGHTS TO TREE PLANTING & HARVESTING (Appendix 3)

Our guide on tree planting outlines differences between trees and plantations that were registered and those that were not, attempting to highlight the financial benefits to registering one's trees. To begin, landowner's that register their trees pay a slightly higher fee, but this fee is paid only *once* upon registering and thereafter they may harvest when and how much they desire, simply by requesting to MiAmbiente which is free of charge. Additionally, there are numerous economic benefits associated with registering, such as tax reductions. On the other hand, farmers who neglected to register their plantations are required to pay a fee *each time* they chose to harvest their trees and do not benefit from the financial incentives provided by the tree registry.

The guide explains the documents necessary for registering small (areas less than 2 hectares) and large (areas greater than 2 hectares) plantations. We then explain the process for harvesting non-registered trees, which is possible in many situations although more complicated and expensive than harvesting registered trees, and the three types of permits MiAmbiente issues for cutting. These three types are: domestic, meaning the tree will be used within the home in construction, furniture making, etc.; necessary, meaning the tree poses a threat or is located where a future construction project will take place; and subsistence, meaning the wood will be sold. In the last case a fee charged per cubic meter by MiAmbiente. We conclude the eco-guide with a number of prescriptions for small landowners, such as the careful storage of proof of registry and maintaining working relations with MiAmbiente by providing them with progress reports and photos.

C. LIVE FENCES (Appendix 4)

This eco-guide is on creating and maintaining live fences, which are composed of tree cuttings that are planted and maintained as fence posts connected with barbed wire and serve the same purpose as a conventional fence. The reasoning in planting them is given through four explanations: save money (no need to buy new fence posts), conserve nature, increase soil quality (through nitrogen fixation), and offer protection to cattle from sun.

Next we go on to discuss the disadvantages such as regular maintenance. Due to their shallow roots, trees grown from cuttings are more prone to blow over than trees grown from seeds, although pruning alleviates this. There is also a 50/50 division property line responsibility to take into consideration. It is each owner's responsibility to maintain their part of the live fence, including pruning the fence bi-annually and planting new cuttings to replace bad posts. Where cattle are concerned; a property owner is held financially responsible for damage that his cattle cause in a neighboring property as a result of not maintaining his part of the live fence.

Ultimately the eco-guide gives steps on how to plant a live fence using a combination of cuttings, large existing or planted trees for added stability, and dead wood posts for fence corners, gates, and support:

1. During the dry season, one needs to collect healthy cuttings for the live fence which we describe the process to cut these posts. About 575 live posts and 60 dead ones are required for 1 km of fence.
2. Plant live fence posts every 1 or 2 meters about 20 cm in the ground, about two shovelfuls.
3. For corners, fences, or for more support, plant dead posts that have been harvested sustainably where necessary at least 30 cm deep into the ground.
4. Next are the steps on how to attach the barbed wire.
5. Maintenance: To prevent live fences from tipping and at the same time to harvest cuttings (*madrocas*) it is necessary to prune the live fence at least once every year, during the dry season and planting the harvest cuttings to replace to old posts while pruning.

D. FOREST GARDENS OF AZUERO

An explanation of forest gardens is provided towards the beginning of the guide so as to inform individuals who are unfamiliar with this concept. The guide states that forest gardens are multi-use associations of trees and shrubs with annual and/or perennial crops and animals, typically located in home lots. The eco-guide on Forest Gardens in the Azuero describes the structural design of a typical forest garden in the Azuero region. We elaborate on how trees are often planted on the outside edge of the garden acting as a wind and noise barrier. Species that are commonly used as a food source, such as fruit trees and root crops are located closer to the home. The same goes for tree species used for wood or medicinal purposes. A second component of the structure of the garden is the intentional interspersing of plants that provide ecosystem services. Certain species of legumes as well as some other plants contain symbiotic bacteria within their roots that fix nitrogen, making it readily available in the soil. Therefore, these plants are placed between other fruit trees in order to ensure nutrients are readily available. Next,

ornamental species are planted near the home or roadway so that plants appreciated for their aesthetic value are within view. Lastly, social spaces are often integrated into the design of forest gardens with benches or hammocks located under the shade and cooler air provided by trees.

One way we attempt to encourage forest gardens is through a comprehensive list of the benefits forest garden's provide, which are the following: save money, improve food security, maintain a long-term guarantee, prevent soil erosion, improve water abundance and quality, nourish and regenerate soils, add beauty through preserving nature, and conserve an Azuero tradition. The last section, and perhaps the most useful for someone wishing to begin a forest garden, is a list of trees and plants a previous McGill cohort found to be common in forest gardens, and the uses for each species.

E. FIRE CONTROL: RIGHTS & REGULATIONS

The fire controls eco-guide purpose is to protect one's farm from neighboring burns. The guide explains how controlled burns is used for the removal of trash and dead or unwanted vegetation from land, which is of concern in the Azuero peninsula as it can quickly spread out of control, damaging forests, wildlife, and agriculture as well as being detrimental to human health. Next the guide explains who to call in case of a fire. To put out a fire currently burning contact the fire department, and if the damage is ecological contact MiAmbiente. When the damage is a source of revenue less than \$250 USD visit Corregiduría in person whilst if it is more than \$250 USD and the person believes the fire was propagated with the intent of burning your property visit Personería. Finally, if the person wishes to negotiate with their neighbour, a lawyer is available at the Centro de Mediación. The guide then describes the legal guidelines for a farmer that wishes to burn (February 3, 1994 Title VI, articles 84-93, Autoridad Nacional del Ambiente):

1. Property owners need written consent from their adjacent neighbors.
2. Property owners need a permit from MiAmbiente to burn fifteen days before the anticipated burn date and should provide the following: payment of Paz y Salvo (\$3.00 USD), copy of property title or derechos posesorios, copy of official identification of landowner, firebreak around

perimeter of burn area with a minimum width of 5 meters and signature of acceptance of adjoining property owners.

3. Once a permit has been issued, neighbors must be advised at least five days in advance of the date and time the burn will take place.
4. The consequences for breaking the law are as follows and depend on the extent of the damage as determined by MiAmbiente officials: \$100 to \$500 fine for burning private property, \$1000 to \$2000 fine if that private property has a primary forest and 1 to 3 years in prison if in a protected area or special forest

Next the guide describes the preventative measures for the burning season:

1. Alert the neighbours to the fact that permission from the landowner and MiAmbiente must be obtained in order for them to burn. If the landowner does consent to the burn the neighbour must inform them fifteen days in advance, if this requirement is not met then they will be held responsible for any damages to their property.
2. Contact MiAmbiente if the landowner believes their neighbors plan to burn without their consent.
3. Construct firebreaks around the perimeter of the landowner's property, made by plough, hoe, axe, machete or any other hand tools to remove all the vegetation and underbrush in a five meter wide strip that contains only rock and soil. The person intending to burn is the one responsible for paying for this firebreak.

At the end of the guide we explain the steps to prosecute someone who burned without the landowner's consent. Contact MiAmbiente officials or the fire department as soon as possible to determine the origin of the fire. Take pictures of the site and know the name of the property owner and finally go to the MiAmbiente office and file an official complaint as after a burn the landowner has five days to present their written defence and allegation, and eight work days to present proof of the illegal burn. The eco-guide also provides the reader with contacts for fire permits and legal concerns.

F. REDUCE, REUSE, RECYCLE

The recycling guide begins with a brief description of the current waste management strategy in the Azuero peninsula and the immense hazards of trash burning to human and ecological health. In order to decrease the quantity of waste a household contributes to the waste stream there are 3 widely recognized strategies: reducing, reusing and recycling.

Reducing is the conscious decision of an individual or family to buy and use less. The guide provides a practical list of simple strategies to achieve this end. Examples include avoiding packing that is difficult or impossible to recycle (such as styrofoam), using cloth instead of plastic grocery bags when shopping, buying items in bulk, and switching from plastic to reusable water bottles with filters. Reusing is the act of repurposing an item either for the same purpose or a new purpose rather than discarding it after one use. This can be done by taking plastic bags that you received from the grocery store back with you to use again, and using food or drink containers to plant seedlings rather than buying plastic seed trays for the same purpose. Recycling is the act of collecting and reprocessing previously used household materials and recreating them into new products or containers rather than extracting raw materials to make these items. Aluminum, plastic and paper are commonly recycled through a process that breaks them down first before recreating them into new products. Glass bottles for beer and soda are another commonly recycled item. These bottles are thoroughly cleaned and disinfected and then simply refilled with the same product.

The guide briefly describes compost and vermicompost. The benefits of a backyard compost or a vermicompost bin is that the amount of trash produced is reduced as the organic components are removed. At the same time, once the organic material has decomposed the resulting mixture can be used as a garden fertilizer with a high nutrient content. A contact person in Pedasí is provided for those who wish to learn more information and obtain starter worms.

Through our research, we discovered that while no fixed point of collection exists within the town, collectors occasionally drive by, announcing they are collecting tin and aluminum via loudspeaker so we recommend that inhabitants of Pedasí hang on to their scrap metal and metal containers if possible

in anticipation of these pick ups. Lastly, the online guide contains two tables, Figure 8 and 9, one being the the recycling centers and accepted materials for the Azuero peninsula and the other containing the same information but for centers in Panama City. We make sure to include a disclaimer advising readers to the fact that accepted materials may change over time as a result of the fluxes in profitability for these institutions in terms of processing these materials.

Recycling center	Materials Recycled
Recimetal El Uverito Dump, Las Tablas/ Main street <i>Tel: 6931-1794</i>	<ul style="list-style-type: none"> ● Plastic (drink bottles) ● Plastic (Vegetable oil bottles, detergent bottles, motor oil bottles, and white plastic bottles) ● Aluminum ● Iron ● Paper (tied in bundles) ● Cardboard (tie in bundles)
Recimetal Vía Circunvalación and Vía Boca de Parita, Chitré <i>Tel: 970-1719</i>	<ul style="list-style-type: none"> ● Plastic (Separate PET from other plastic) ● Aluminum ● Cans ● Iron ● Paper (Separate color and white paper) ● Newspaper, Magazines ● Cardboard ● TetraPak ● Ink and Toner
Reciclado Los Canto Via El Agallito, Chitré <i>Tel: 6530 - 9092</i>	<ul style="list-style-type: none"> ● Paper ● Newspaper ● Aluminum ● Aluminum Cans ● Iron ● Copper ● Bronze
Reciclado Pamersa La Arena, Chitré Via tocumen, Close to the Río Juan Díaz Bridge <i>Tel: 220-4481</i>	<ul style="list-style-type: none"> ● Iron ● Cans

Figure 8. Table of centers and content recycled in Azuero Peninsula

Recycling Center	Materials Recycled
Centro de Acopio y Manejo (CAM) de desechos sólidos FCDS/FAS PANAMÁ Calle Rodolfo Benítez, Edificio 216, Ciudad del Saber, Panamá	<ul style="list-style-type: none"> ● Plastic Bottles, Types 1 and 2 ● Clean glass bottles and containers ● Clean aluminum and tin cans ● Clean Tetrapak containers

<p>Open from 8:00 am to 4:30 pm. Drop off station is open 24/7. Tel: 306-3700</p>	<ul style="list-style-type: none"> ● Paper and Cardboard
<p>Punto Limpio Betania Parque Santa Eduvigis del corregimiento de Betania (Collection box within the park)</p>	<ul style="list-style-type: none"> ● Plastic ● Metal ● Glass ● Paper and Cardboard ● Clothing and Fabric
<p>Recicla Panamá S.A. Juan Díaz, Los Pueblos, Calle A Desarrollo Los Alcázares Galeras #1 y #2 Ciudad de Panamá, Panamá +(507) 391-2376</p>	<ul style="list-style-type: none"> ● Batteries ● Cables ● Calculators ● Cell phones ● Money counters ● Copy and Fax machines ● Web and telecommunications equipment ● Printers ● Laptops ● Mainframes ● Keyboards ● Telephones ● Monitors & Televisions (LCD, Plasma, CRT) ● PC's ● Radios ● Mouse ● DVD Players ● Servers ● Others (by consultation)

Figure 9. Table of centers and content recycled in Panama city

6. CONCLUSION

Our recommendations for the future students conducting a similar project would be to have more field experience to witness first hand the content of the guide and the benefits they would provide to landowners. It is important not to be too strongly influenced by previous themes and have an open mind when researching these issues. There is a lot of potential for further development and expansion on these themes given that the scope of our study was restricted to the basics. Likewise, in depth explanations, as well as links to external resources, could be provided in the online version of the guides, although it would be difficult to include more details in the print version of the guides as there is limited space.

Our primary findings is the compilation of knowledge on complex environmental issues that the Azuero community faces for our six physical and online eco-guides, building off previous research conducted by our host institution. These findings include laws, instructions, contacts and tips we include in the pamphlets. The focal point for the guide on riparian zones is the recognition and legal framework surrounding their protection and reforestation. The most salient point of the eco-guide on tree planting is the comparison of registered and unregistered trees and steps to entering the forest registry; by clarifying regulations and confirming the possibility to harvest under the proper circumstances we believe that farmers and landowners will be more inclined to reforest. The essential information in the live fence guide are methods to plant a live fence, the types of trees used and why planting is critical to preserve Azueros ecosystem and protect biodiversity. Meanwhile working on editing the structural design and the most pertinent reasons on why to have a forest gardens hopefully encourages the practice of forest gardens. The main takeaways for the controlled burning guide were the precautionary measures during the burning season, laws on conducting a burn as well as the steps in prosecuting someone who burned without the neighbouring landowners consent. Lastly, the recycling ecoguide provides locations which, in a region where no state-run programs exists, will be useful to those in search of collection centers.

Our aim is that these eco-guides will be useful to our host organization and their overall objective, as well as to the farming and civilian populations of Pedasí and surrounding areas. We hope the information can be put into use by people who can apply these techniques and processes to their everyday life, thus realizing sustainable actions which contribute to the future of the Azuero peninsula.

On a global scale, reforestation will help to mitigate the effects of anthropogenic climate change through carbon sequestration. Likewise, a reduction in the amount of trash burned would contribute to an overall reduction in carbon emissions further contributing to the solution to climate change.

As we found limited examples of “eco-guides”, we hope that this term becomes more widely used to indicate pamphlets that deal specifically with environmental themes. In a similar way, we hope that the online availability of these guides may serve and prompt others creating a similar project in other parts of Panama and globally.

7. REFERENCES

Autoridad Nacional del Ambiente. (1994). Legislación Forestal de la República de Panamá: Ley N°1 La Cual Se Establece la Legislación Forestal En La República De Panamá Y Se Dictan Otras Disposiciones. *Autoridad Nacional del Ambiente*.

Barrance, A., Schreckenber, K., & Gordon, J. (2009). Conservation Through Use: Lessons from the Mesoamerican Dry Forest. *Overseas Development Institute, London*.

Billings, F. R., & Schmidtke, J. P. (2002). *Central America Southern Pine Beetle / Fire Management Assessment*. U.S. Agency for International Development, Guatemala-Central America Program.

Brooks, T. M., Bakarr, M. I., Boucher, T., Fonseca, G. A. B., Hilton-Taylor, C., Hoekstra, J.M., ... Stuart, S. N. (2004). Coverage provided by the global protected-area system: is it enough? *BioScience* 54,1081–1091.

Budowski, G. (1987). *Living fences in tropical America, a wide-spread agroforestry practice. Agroforestry: Realities, Possibilities and Potentials*. Martinus Nijhoff Publishers, pp 169-178.

Budowski, G. (1993). The scope and potential of agroforestry in Central America. *Agrofor Syst* 23:121-132

Eales, J., Haddaway, R. N., Bernes, C., Cooke, J. S., Johnsson, G. B., Kouki, J., & Petrokofsky, G. (2016). *What is the effect of prescribed burning in temperate and boreal forest in biodiversity, beyond tree regeneration, pyrophilous and saproxylic species? A systematic review protocol*.

Flores, L. (2016). Incendios forestales destruyeron más de 700 hectáreas en Los Santos. *La Prensa*.

Forward Turtle Panama. (2005). *Región de Azuero*.

Garen, E. J., Saltonstall, K., Ashton, M. S., Slusser, J. L., Mathias, S., & Hall, J. S. (2011). The tree planting and protecting culture of cattle ranchers and small-scale agriculturalists in rural Panama: Opportunities for reforestation and land restoration. *Forest Ecology and Management* 261(10), 1684-1695.

Garen, E. J., Slusser, J. L., Slusser, J. L., Ashton, M. S., Ashton, M. S., & Hall, J. S. (2009). An evaluation of farmers' experiences planting native trees in rural Panama: implications for reforestation with native species in agricultural landscapes. *Agroforestry Systems* 76(1), 219-236.

Global Forest Watch. (2017). Country profiles: Panama. *Global Forest Watch*. Retrieved from <http://www.globalforestwatch.org/country/PAN>

Griscom, H. P., & Ashton, M. S. (2011). Restoration of dry tropical forests in Central America: A review of pattern and process. *Forest Ecology and Management* 261(10), 1564-1579.

- Hall, J. S., Ashton, M. S., Garen, E. J., & Jose, S. (2011). The ecology and ecosystem services of native trees: Implications for reforestation and land restoration in Mesoamerica. *Forest Ecology and Management*, 261(10), 1553-1557.
- Harvey, A. C., Villanueva, C., Villacís, J., Chacón, M., Muños, D., López, M., ... Sinclair, L.F. (2005). Contribution of live fences to the ecological integrity of agricultural landscapes. *Science Direct: Agriculture, Ecosystems and Environment*.
- Hawes, E., & Smith, M. (2005). Riparian Buffer zones: Functions and Recommended Widths. *Yale School of Forestry and Environmental Studies*.
- Linowes, R., & Hupert, M. B. (2006). The tropical waste dilemma: waste management in Panama. *International Journal of Emerging Markets* 1(3), 225-234.
- Long, A. J., & Nair, P. K. R. (1999). Trees outside forests: agro-, community, and urban forestry. *New For* 17:145-174.
- Love, E. B., Bork, W. E., & Spaner, D. (2009) Tree seedling establishment in live fences: a low-cost agroforestry management practice for the tropics. *Springer Science+Business Media B.V.*
- Meiklejohn, K., Ament, R., & Gary, T. (2010) Habitat Corridors & Landscape Connectivity: Clarifying the Terminology. *Centre for large landscape conservation*
- Metzel, R., & Montagnini, F. (2014). From Farm to Forest: Factors Associated with Protecting and Planting Trees in a Panamanian Agricultural Landscape. *Bois et Forêts des Tropiques*.
- Miles, L., Newton, A. C., Defries R. S., Ravilous, C., May, I., Blyth, S., Kapos, V., & Gordon, J. E. (2006). A global overview of the conservation status of tropical dry forests. *Journal of Biogeography*, 33 (3): 491-505.
- Montagnini, F. (2006). Homegardens of Mesoamerica: Biodiversity, Food Security and Nutrient Management. In Mohan, K. B., & Nair, P. K. R. (Eds.), *Tropical homegardens: A time-tested example of sustainable agroforestry*. Retrieved from Springer LINK Biomedical and Life Sciences E-Books.
- Noble, I. R., & Dirzo, R. (1997). Forests as human-dominated ecosystems. *Science*, 277, 522-525
- Padoch, C., & Pinedo-Vasquez, M. (2010). Saving Slash-and-Burn to Save Biodiversity. *Biotropica* 42(5): 550-552
- Proyecto Ecológico Azuero. (2017). PEA Entrega Rompecabezas del Mapa de Azuero A Escuelas Locales. Retrieved from <http://proecoazuero.org/2013/06/24/pea-entrega-rompecabezas-del-mapa-de-azuero-a-escuelas-locales>

Nair, P. K. R, Mohan, K. B., & Nair, V. D. (2009). Agroforestry as a strategy for carbon sequestration. *Journal of Plant Nutrition and Soil Science* 172(1), 10-23.

Sabo, L. J., Sponseller, R., Dixon, M., Gade, K., Harms, T., Heffernan, K., ... Welter, J. (2005). Riparian Zones Increase Regional Species Richness by Harboring Different, Not More, Species. *Ecological Society of America*.

Sauer, J. D. (1979). Living fences in Costa Rican agriculture. *Turrialba (IICA)* 29(4):225-261.

Sweeney, W. B., Bott, L. T., Jackson, K. J., Kaplan, A. L., Newbold, D. J., Standley, J. L., ... Horwitz, J. R. (2004). Riparian deforestation, stream narrowing, and loss of stream ecosystem services. *Proceedings of the National Academy of Sciences of the United States of America*.

Thompson, A. (2014, September 2) Burning Trash Bad for Humans and Global Warming. *Scientific American*. Retrieved from <https://www.scientificamerican.com/article/burning-trash-bad-for-humans-and-global-warming/>

Wiersum, K. F. (2004). Forest gardens as an 'intermediate' land-use system in the nature-culture continuum: Characteristics and future potential. *Agroforestry Systems* 61, 1-3.

The World Bank. (2017). Terrestrial protected areas (% of total land area). *The World Bank Group*. Retrieved from <http://data.worldbank.org/indicator/ER.LND.PTLD.ZS?page=2>

The World Bank (2011). Climate Risk and Adaptation Country Profile. Vulnerability, Risk Reduction, and Adaptation to Climate Change: Panama. *The World Bank Group*.

U.S. Environmental Protection Agency (2016). Human Health. Backyard Burning. *U.S. Environmental Protection Agency*.

8. APPENDICES

APPENDIX I: Ethics Course Completion Certificates



Appendix II.a: Eco-guide pamphlet on Riparian Zones in English

WHAT ARE RIPARIAN ZONES

Riparian zones are areas bordering bodies of surface water such as lakes, ponds, rivers or streams.

In the Azuero peninsula these zones have been deforested, but where forests exist they represent some of the last patches of tree cover



They provide very important services because:

1. The vegetation cover protects water and soil quality by preventing erosion and agrochemicals from entering the river
2. Trees along riparian zones harbor diversity by providing a seed bank and fruit for consumption or sale
3. Trees are important habitats for animals, including the endangered subspecies Azuero Spider Monkey
4. Riparian zones absorb water and release it slowly when compared to deforested or bare zones. They provide steady supplies of drinking water. These contributions are "achieved through minimization of soil erosion on site, reduction of sediment in water bodies, and trapping or filtering of other water pollutants in the forest litter" (FAO)

CONTACTS FOR FOR RIPARIAN ZONES

Pedasí: Miguel Batista (6706-6707)

Las Tablas: (500-0921 Ext 6430)

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RIPARIAN ZONE CONSERVATION

A GUIDE TO UNDERSTAND & PROTECT RIPARIAN ZONES



REFOREST RIPARIAN ZONES

To increase the integrity of these areas, reforest riparian zones using trees that grow well around bodies of water!

CONSERVING RIPARIAN ZONES ON CATTLE FARMS

Cattle with access to a riparian zone often negatively affect its soil, water, and vegetation. Trampling, defecating and urinating in the water limit natural regeneration of plants leaving a bare area. To protect the soil, water, and vegetation bring the water to the cattle.

Guidelines for how to protect riparian zones when cattle are present:

1. Fence both sides of a riparian zone to limit cattle from entering, especially in the early years after planting.
2. Once it has been fenced, install water troughs. Bring water by using a hose that comes from the creek or river. These troughs can be made from old tires, containers, buoys or other recycled items. Consider whether or not these containers will be permanent or mobile. If you would like them to be mobile so that the trough will follow the cattle's rotation, use light materials.

LEGAL CONSIDERATIONS FOR RIPARIAN ZONES

National Laws protect riparian zones due to the importance of these areas--It is illegal to deforest them. According to articles 23 and 24 from the 1st law of February 3rd, 1994 it is prohibited to destroy or log trees in the following areas:

Article 23 Protects natural vegetation that borders bodies of water:

1. Areas that border springs originating from the forest.
 - 200m radius of tree cover must be maintained.
 - 100m radius if the area is flat.
2. Around rivers and streams.
 - Both sides must be forested at a level equal or greater to the width of the river or stream with a width no less than 10m.
3. Around natural lakes and reservoirs.
 - 100m from the shore.
4. Forest on the banks of aquifer areas that are for human consumption cannot be cut under any argument and are considered special forests in national protected areas.

Article 24 protects areas of planted forest bordering bodies of water.

1. Areas that border springs originating from the forest.

- 100m radius of tree cover must be maintained.
- 50m radius if the area is flat.

2. Around rivers and streams.

- Both sides must be forested at a level equal or greater to the width of the river or stream with a width no less than 10m.

3. Around springs that are for human consumption.

- Radius of 50m.

4. Areas in natural or artificial reservoirs

- 10ft from the maximum water level.



Appendix II.b: Eco-guide pamphlet on Riparian Zones in Spanish

QUE SON ZONAS RIBEREÑAS

Zonas ribereñas son áreas que bordean cuerpos de aguas como lagos, estanques, ríos o quebradas.

En la península de Azuero estas zonas han sido deforestadas, pero donde sigue existiendo bosque representa uno de los últimos sitios de cobertura de árbol.

Proporcionan servicios muy importantes como:

1. La vegetación protege la calidad del agua y del suelo previniendo erosión y agroquímicos entrando al río
2. Árboles a lo largo de las zonas ribereñas albergan diversidad dando semillas y fruto para consumir o vender
3. Árboles son un hábitat importante para los animales, incluyendo el Mono Araña de Azuero
4. Zonas ribereñas absorben agua y lo liberan poco a poco comparado con zonas deforestadas o descubiertas. Proporcionan suministros constantes de agua potable. Estas contribuciones "se logran mediante la minimización de la erosión del suelo en el sitio, la reducción de los sedimentos en el agua y la captura o filtración de otros contaminantes del agua en el suelo forestal" (FAO)



CONTACTOS PARA ZONAS RIBEREÑAS

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Las Tablas: (500-0921 Ext 6430)

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CONSERVACIÓN DE ZONAS RIBEREÑAS

UNA GUÍA PARA ENTENDER & PROTEGER LAS ZONAS RIBEREÑAS



REFORESTACIÓN DE ZONAS RIBEREÑAS

Para aumentar la integridad de estas áreas se puede reforestar alrededor de las zonas ribereñas utilizando árboles que crecen bien alrededor del agua

CONSERVACIÓN DE ZONAS RIBEREÑAS EN FINCAS GANADERAS

El ganado con acceso a una zona ribereña afecta negativamente al suelo, agua y vegetación. Pisoteando, defecando y orinando en el agua limita la regeneración natural de las plantas dejando zonas vacías de vegetación. Para proteger el suelo, el agua y la vegetación lleva el agua al ganado.

Recomendaciones como proteger las zonas ribereñas cuando el ganado esta presente:

1. Limitar ambos lados de una zona ribereña para evitar que el ganado entre
2. Una vez que haya sido cercada, instale pozos de agua. Lleve el agua al abrevadero usando una manguera que viene de la quebrada o el río. Estos abrevaderos pueden ser hechas de neumáticos viejos, contenedores, boyas u otros artículos reciclados. Ten en mente si estos contenedores serán movidos o no. Si desea que sean móviles utilice materiales ligeros

CONSIDERACIONES LEGALES PARA ZONAS RIBEREÑAS

Las leyes nacionales protegen estas zonas debido a la importancia de estas áreas -- es ilegal deforestar. De acuerdo con los artículos 23 y 24 de la 1ª Ley del 3 de febrero de 1994 está prohibido registrar o destruir árboles en la siguientes zonas:

Artículo 23 protege la vegetación natural que bordea los cuerpos de agua:

1. Zonas que bordean las quebradas que se originan en el bosque.
 - ▶ Debe mantenerse el radio de 200m de la cubierta del árbol
 - ▶ Radio de 100m si la zona es plana
2. Alrededor de los ríos y las quebradas
 - ▶ Ambos lados deben tener árboles al nivel igual o mayor de la anchura del río o quebrada con una anchura no inferior a 10m
3. Alrededor de lagos naturales y embalses
 - ▶ 100m de la orilla
4. Los bosques en las orillas de las zonas acuíferas que son para el consumo humano no pueden ser cortados bajo ningún argumento y se consideran bosques especiales en áreas protegidas nacionales

Artículo 24 protege las zonas de bosques plantados que bordean los cuerpos de agua.

1. Área que bordean las quebradas originarias del bosque

- ▶ Radio de 100m de la cubierta del árbol debe mantenerse
- ▶ Radio de 50m si la zona es plana

2. Alrededor de los ríos y las quebradas

- ▶ Ambos lados deben tener árboles al nivel igual o mayor a la anchura del río o quebrada no inferior a 10m

3. Alrededor de las quebradas destinadas para el consumo humano

- ▶ Radio de 50m

4. Áreas en embalses natural o artificiales

- ▶ 10 pies del nivel máximo de agua



Appendix III.a: Eco-guide pamphlet on Tree Planting & Harvesting in English



To protect your right to harvest your trees in the future it is best to register these trees with the MiAmbiente forest registry when you plant.

This ensures that you will be able to cut trees from your plantation when you want and without paying any fees. There are numerous economic benefits associated with registering, such as tax reductions.

To register your plantation the cost is \$43 USD. If your plantation is registered you may harvest multiple times free of charge. Simply alert MiAmbiente of your intention to harvest and they will provide a free inspection.

Farmers and landowners who have not registered must pay \$33 USD each time they want to harvest. Non-registered plantations do not benefit from the financial incentives provided by the tree registry.

CONTACTS FOR TREE PLANTING

Pedasi: Miguel Batista (6706-6707)

Las Tablas: Forest registry Engineer Dilsa Barrios (994-7313)

Planting and harvest regulations Forestry Department (500-0855 ext 6070)

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TREE PLANTING

A GUIDE ON RIGHTS TO TREE PLANTING & HARVESTING



DOCUMENTS TO REGISTER PLANTED TREES

For areas smaller than 2 hectares:

1. Letter (memorial petitorio) written to the MiAmbiente office requesting inscription into the MiAmbiente forestry registry with personal and farm information
2. Copy of property title, copy of the rights of possession, or copy of the certificate of public record
3. Copy of identification of all property owners and co-owners
4. Payment of paz y salvo (\$3 USD)
5. Inspection done by MiAmbiente technician after property owner delivers all information
6. Payment (\$40 USD) to MiAmbiente for administrative and inspection services

For areas larger than 2 hectares, you need the same items listed above along with:

1. Reforestation plan elaborated and signed by a forestry engineer. Contacts for local engineers are available at your regional MiAmbiente office
2. Geo-referenced map of the planted area (CD) - this should also be done and signed by a forest engineer

After registering you will receive a document that summarizes trees registered. **Store this document in a safe place and make copies of this document**



PERMITS TO HARVEST NON-REGISTERED TREES

To cut a tree that was never registered, a landowner must obtain a permit from the local or regional MiAmbiente office each time (s)he would like to harvest. The permit requires:

1. MiAmbiente inspection
2. Payment of paz y salvo (\$3 USD)
3. \$30 USD fee per harvest
4. Copy of identification (cédula) of all property owners
5. Copy of property title
6. For every tree cut, the property owner must plant 10 trees with a 70% survival rate. Note: this is only if the tree grew naturally and was NOT planted

MiAmbiente issues three types of permits:

NECESSARY, DOMESTIC AND SUBSISTENCE

All permits have one month of validity from their date of issue. For all three permits \$3 paz y salvo will be charged

1. **Permit for necessary cutting:** required to cut trees that pose an imminent threat or that are in a site where a house will be constructed
2. **Permit for domestic use:** required to cut trees for use within the family in furniture making, saddles, home construction etc.
3. **Permit for subsistence cutting:** required for wood that will be sold. In addition to paz y salvo the landowner pays per cubic meter (either \$10 or \$15 meter cubed depending on the value of the wood)

HELPFUL TIPS FOR SMALL LANDOWNERS

The challenge for landowners to cut trees is to prove they planted those trees. The first step is to register the trees with MiAmbiente. Also having a good relationship with technicians and giving them updates in forms of pictures and memos that are stamped as received especially when there are new employees, such as after an election, is helpful.

Appendix III.b: Eco-guide pamphlet on Tree Planting & Harvesting in Spanish



Para proteger su derecho a cosechar árboles en el futuro lo mejor es registrar sus árboles en el registro forestal de MiAmbiente cuando siembra.

Esto asegura que podrá cosechar los árboles cuando quiera sin pagar una tarifa. Además, hay beneficios económicos asociados con el hecho de registrar sus árboles, tales como reducciones en impuestos.

Para registrar su plantación hay un costo de \$43. Si su plantación es registrada es posible cosechar varias veces sin tener que pagar. Solamente hay que avisarle a MiAmbiente y proveerán una inspección gratuita.

Granjeros y propietarios quienes no han registrado deben pagar \$33 cada vez que quieran cosechar sus árboles. Del mismo modo, plantaciones no-registradas no reciben los incentivos brindados por el registro forestal.

CONTACTOS PARA ZONAS RIBERENAS

Pedasi: Miguel Batista (6706-6707)
Las Tablas: Registro forestal Dilsa Barrios (994-7313)
Regulaciones acerca de plantar y cortar árboles (500-0855 ext. 6070)

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PLANTAR ÁRBOLES

UNA GUÍA SOBRE SUS DERECHOS DE PLANTAR Y COSECHAR SUS ÁRBOLES



DOCUMENTOS NECESARIOS PARA REGISTRAR ÁRBOLES

Para un área menor que 2 hectáreas:

1. Una carta (memorial petitorio) escrita a la oficina de MiAmbiente pidiendo inscripción al registro forestal de MiAmbiente con información personal y de la finca
2. Copia del título de propiedad, copia de los derechos posesorios o copia del certificado del récord público.
3. Copia de identificación de todos los propietarios y copropietarios
4. Pago de paz y salvo (\$3)
5. Inspección hecha por un técnico de MiAmbiente después del entrega de toda la información
6. Pago (\$40) a MiAmbiente para servicios administrativos y de inspección

Por áreas más que 2 hectáreas, necesita los mismos documentos que arriba, además:

1. Un plan de reforestación elaborada y firmada por un ingeniero forestal. Estos contactos son disponibles en la oficina regional
2. Un mapa geo-referenciado del área plantada (CD) - esto también debe ser hecho y firmado por un ingeniero forestal

Después de registrar sus árboles con MiAmbiente recibirá un documento que resume el registro con MiAmbiente. Guarda este documento en un lugar seguro.



PERMISOS PARA COSECHAR ÁRBOLES NO-REGISTRADOS

Para cortar un árbol que nunca fue registrado, un propietario debe obtener un permiso de la oficina local o regional de MiAmbiente cada vez que desea cosechar. El permiso para tumar requiere:

1. Inspección de MiAmbiente
2. Pago paz y salvo (\$3)
3. \$30
4. Copia de identificación (cédula) de todos los propietarios
5. Copia del título de la propiedad
6. Por cada árbol tumbado, el propietario debe plantar 10 árboles con una tasa de sobrevivencia de 70%. Nota: Esta regla aplica solamente si el árbol creció naturalmente y NO fue plantado

MiAmbiente otorga 3 tipos de permisos: **NECESARIOS, DOMÉSTICOS Y SUBSISTENCIA**

Ten en cuenta que tienen un mes de validez después de sus fechas de otorgación. Por todos los tipos de permisos \$3 de paz y salvo serán cobrados

1. **Permiso necesario:** requerido para tumar árboles que amenacen a su propiedad o si está en un sitio donde va a construir una casa
2. **Permiso para uso doméstico:** requerido para tumar árboles para uso a dentro de la familia en muebles, construcción, sillas de montar, etc.
3. **Permiso para subsistencia:** requerido para madera que será vendida. En adición a paz y salvo el propietario paga por metro cúbico (\$10 o \$15 por metro cúbico dependiendo del valor de la madera)

PISTAS PARA DUEÑOS DE PEQUEÑAS PROPIEDADES

El desafío para propietarios que quieren tumar sus árboles es comprobar que fueron plantados. La primera etapa es registrarlos con MiAmbiente y mantener en contacto con los técnicos. Puede mandarles fotos y avisos de su propiedad y su progreso solicitando sellos. Es especialmente importante hacer esto cuando los empleados son nuevos, como después de una elección

Appendix IV.a: Eco-guide pamphlet on Live Fences in English



DISADVANTAGE OF LIVE FENCES

They need regular maintenance. Because of their shallow roots, trees grown from cuttings are more prone to blow over than trees grown from seeds. Fortunately, pruning can alleviate this.

PROPERTY LINE RESPONSIBILITY

There is a traditional 50/50 division of responsibility for live fences on a property line. It is each owner's responsibility to maintain their part of the live fence, including pruning the fence bi-annually and planting new cuttings to replace bad posts. New property owners should discuss the division with their neighbors and record it on a map. Where cattle are concerned, a property owner is financially responsible for damage that his cattle causes in a neighboring property as a result of not maintaining his part of the live fence.



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LIVE FENCES

A GUIDE TO CREATING AND MAINTAINING LIVE FENCES



A live fence is composed of living tree cuttings (called *madrocas* or *estacas* in Spanish) that are planted and maintained as fence posts. They are connected with barbed wire and serve the same purpose as a conventional fence.

WHY PLANT A LIVE FENCE?

- 1. To save money**
 - ▶ Live posts last a very long time.
 - ▶ Each post generates branches which can be cut and planted to create new live posts.
 - ▶ Some live post species can produce fodder, fruit, timber, and/or firewood.
- 2. To conserve nature**
 - ▶ Diverse tree species attract birds, butterflies, and monkeys.
 - ▶ Live posts reduce the need to cut down trees for dead posts.
- 3. To increase soil quality**
 - ▶ Some live fence species are nitrogen fixing: they increase the availability of nitrogen in the soil.
- 4. To reduce erosion**
 - ▶ Live fences protect soil and water quality from erosion, especially when planted on slopes.
- 5. To offer protection**
 - ▶ Shade for cattle reduces heat stress and can result in higher weight gain, greater milk production, and higher rates of reproduction.
 - ▶ Live fences protect crops and cattle.

HOW TO PLANT A LIVE FENCE

A typical live fence uses a combination of cuttings, large trees, and dead wood posts for fence corners, gates, and support. Refer to the **tree database on the AEP website** for more information.

- 1. During the dry season (January-April) collect healthy cuttings from the live fence or from trees. About 575 live posts and 60 dead posts are required for 1 km of fence.**
 - ▶ Cut the living post branch neatly with a machete. Make sure to cut the branch at its base or right above the circular head on a living post. Harvest cuttings that have a minimum height of 2.0-2.5 m and a thickness of 5-15 cm. Cut the bottom flat.
 - ▶ Remove side branches and cut the top on a diagonal to avoid decay from rainwater.
 - ▶ Store cuttings upright in the shade (they can be stored for many months).
- 2. Plant live fence posts every 1 or 2 meters about 20 cm in the ground.**
- 3. Plant dead posts where necessary at least 30cm deep into the ground.**
 - ▶ Select dead posts from trees that do not rot and have been harvested sustainably (beware of posts taken from Cerro Hoya or other protected forests).

4. Attach barbed wire

- I. Wrap barbed wire around a large tree or sturdy post and tie a knot.
- II. Stretch the barbed wire to the next large, sturdy post. Tighten the barbed wire with pliers, pulling it so the wire is tight and does not vibrate when touched.
- III. Attach a staple to the taught barbed wire using a hammer. Drive the staple far into the post.
- IV. Using your judgment, hammer staples into other posts so that the wire line looks tight. Repeat this process until you reach a corner. Staple the post and cut the barbed wire leaving enough of it to tie a knot.
- V. Repeat steps I-IV to make other barbed wire fence lines. Usually people have 3-4 lines of barbed wire.

5. Maintenance: To prevent live fences from tipping and at the same time to harvest cuttings it is necessary to prune the live fence.

- ▶ There is no definitive rule on how often to prune to keep posts from tipping over, but pruning the fence every other year is a good rule of thumb.
- ▶ Prune the live fence during the dry season.
- ▶ While pruning the live fence plant the harvested cuttings to replace older, worn out live fence posts. The cuttings will root and propagate during the dry season and produce new branches when it starts to rain.

Appendix IV.b: Eco-guide pamphlet on Live Fences in Spanish



DESVENTAJAS DE CERCAS VIVAS

Necesitan mantenimiento regular. Debido a sus raíces poco profundas, los árboles crecidos a partir de las estacas son susceptibles al viento comparado con los árboles crecidos a partir de semillas, podadas.

RESPONSABILIDAD DE LA LÍNEA DE PROPIEDAD

Hay una división tradicional de 50/50 para la responsabilidad en una línea de propiedad. Cada propietario tiene la responsabilidad de mantener su parte de la cerca viva, incluyendo la poda de la valla cada dos años y la plantación de nuevas estacas para reemplazar los postes malos. Los nuevos propietarios deben discutir la división con sus vecinos y registrarla en un mapa. Cuando se trata de ganado, un dueño de la propiedad se considera responsable de los daños que su ganado causa en una propiedad vecina como resultado de no mantener su parte de la cerca viva.



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CERCAS VIVAS

UNA GUÍA PARA HACER Y MANTENER CERCAS VIVAS



Una cerca viva se compone de estacas o madrocas que se plantan y se mantienen como postes de la cerca. Están conectados con alambre de púas y sirven el mismo propósito que una valla convencional.

¿PORQUE PLANTAR UNA CERCA VIVA?

- 1. Para ahorrar dinero**
 - ▶ Postes vivos duran mucho tiempo
 - ▶ Cada poste genera ramas que pueden ser cortadas y utilizadas para generar nuevos postes
- 2. Para conservar la naturaleza**
 - ▶ Diversas especies de árboles atraen pájaros, mariposas y monos
 - ▶ Los postes vivos reducen la necesidad de cortar árboles para los postes muertos
- 3. Aumentar la calidad del suelo**
 - ▶ Algunas especies de cercas vivas fijan nitrógeno; aumentan la disponibilidad de nitrógeno en el suelo
- 4. Para reducir la erosión**
 - ▶ Las cercas vivas protegen la calidad del suelo y del agua contra la erosión
- 5. Ofrece protección**
 - ▶ La sombra para el ganado reduce el estrés térmico y puede resultar en mayor ganancia de peso, mayor producción de leche y mayores tasas de reproducción
 - ▶ Las cercas vivas protegen las cosechas y el ganado

CÓMO PLANTAR UNA CERCA VIVA

Una cerca viva típica utiliza una combinación de estacas, árboles grandes, y postes de madera muertos para las esquinas de la cerca, las puertas, y como apoyo. Consulte la base de datos de árboles en nuestro sitio de web para más información.

1. Durante la época seca recolecta recortes saludables de la cerca viva o de árboles adecuados. Alrededor de 575 postes vivos y 60 postes muertos son necesarios para un 1km de valla.

- ▶ Corta la rama del poste vivo con un machete. Asegúrese de cortar la rama en su base o justo encima de la cabeza circular en los postes vivos. Estacas de la cosecha que tienen una altura mínima de 2.0-2.5m y un espesor de 5-15cm. Corta planamente la parte inferior.
- ▶ Retira las ramas laterales y corta la parte superior en una manera diagonal para evitar la descomposición a causa de la lluvia.
- ▶ Guarda los cortes verticales en la sombra (pueden guardarse por meses).

2. Planta los postes vivos cada 1 o 2 metros cerca de 20cm dentro del suelo.

3. Planta postes muertos cuando sea necesario, por lo menos 30 cm de profundidad en el suelo.

- ▶ Seleccione los postes muertos de los árboles que no se pudren y se han cosechado de manera sostenible (cuidado con los postes de áreas o árboles protegidas).

4. Pon alambre de púas

- I. Envuelva el alambre de púas alrededor de un árbol grande o un poste robusto y ate un nudo.
- II. Estira el alambre de púas a los siguientes postes resistentes. Aprieta el alambre con alicates tirando de él para que el cable éste apretado y no vibre cuando se toca.
- III. Sujeta una grapa al alambre de púas usando un martillo. Pon la grapa hasta el poste.
- IV. Martilla grapas en otros postes de modo que la línea de alambre parece apretada. Repita este proceso hasta llegar a una esquina. Grapa el poste y cortar el alambre de púas dejando suficiente para atar un nudo.
- V. Repita pasos I-IV para hacer otras líneas de alambre de púas. Por lo general, las personas tienen de 3 a 4 líneas de alambre.

5. Mantenimiento: para evitar que las cercas vivas se caigan, y al mismo tiempo para recolectar estacas, es necesario podar la cerca viva.

- ▶ No se sabe exactamente con qué frecuencia se debe podar una cerca viva pero cada dos años es una buena regla.
- ▶ Poda la cerca viva durante la estación seca.
- ▶ Cuando pode la cerca viva planta los cortes recolectados para reemplazar los postes desgastados. Las estacas se enraizan durante la estación seca y producen nuevas ramas en la lluviosa.

Appendix VI.a: Eco-guide pamphlet on Fire Control in English



WHO TO CALL

1. To put out a fire currently burning contact the fire department (#103)
2. If the damage is ecological contact MiAmbiente (6706-6707)
3. If a source of revenue less than \$250 USD is damaged visit Corregiduría (Pedasi: in front of supercentro between post and mayors office)
4. If a source of revenue worth more than \$250 USD is damaged visit Personería if you believe the fire was spread intentionally (Calle José A. Carrasquilla, close to Casita Margarita)
5. If you wish to negotiate with your neighbor, a lawyer is available at the Centro de Mediación (corner Calle la Policía N°3 and Avenida Norte)

MiAmbiente Law on Burning

February 3, 1994 Title VI articles 84-93

1. Property owners need written consent from their adjacent neighbors
2. Property owners need a permit from MiAmbiente to burn 15 days before the anticipated burn date and should provide the following:
 - Payment of Paz y Salvo (\$3.00)
 - Copy of property title
 - Copy of official identification of landowner
 - Firebreak around perimeter of burn area (min 5m width)
 - Signature of acceptance of adjoining property owners
3. **Once a permit has been issued, neighbors must be advised at least 5 days in advance of the date the burn will take place**
4. **The consequences for breaking the law are as follows and depend on the extent of damage determined by MiAmbiente**
 - \$100 to \$500 for burning private property
 - \$1000 to \$2000 if that private property has a primary forest
 - 1 to 3 years in prison if in a protected area or special forest

FIRE CONTROL: RIGHTS & REGULATIONS

A GUIDE TO PROTECT YOUR FARM FROM NEIGHBORING BURNS



Burning is used for the removal of trash and dead or unwanted vegetation from land.

Fire can quickly spread out of control, damaging forests, wildlife, and agriculture. Inhaling smoke damages health.

PREVENTATIVE MEASURES FOR THE BURNING SEASON

1. **Alert your neighbors to the fact that permission from you and MiAmbiente must be obtained.** If you do consent to burn they must inform you 15 days in advance. If this requirement is not met, they will be responsible for any damages to your property
 - You can do this in person or by letter sent to your neighbors, the mayor and MiAmbiente
2. **Contact MiAmbiente if you believe your neighbors plan to burn without your consent**
 - Call or go to the MiAmbiente office to see if your neighbor has a permit to burn (6706-6707). If they have a permit without your consent you can report them directly
3. **Construct Firebreak around perimeter of your property**
 - Made by plough, hoe or axe to remove all the vegetation and underbrush in a 5m wide strip that contains only rocks and soil. Make your firebreaks around the perimeter of your property. The person intending to burn is the one responsible for paying for the firebreaks

HOW TO PROSECUTE SOMEONE THAT BURNED WITHOUT YOUR CONSENT

1. Contact MiAmbiente officials or the fire department as soon as possible to determine the origin of the fire.
2. Take pictures of the site and know the name of the property owner.
 - Make sure you bring your property title, even if it is not necessary it will expedite the process
3. **Go to MiAmbiente office and file an official complaint**
 - After a burn you have 5 days to present your written defense and allegation and 8 work days to present proof (photos) of illegal burn. If you visited before and presented your concerns, it will be helpful to prove negligence



CONTACTS FOR FIRE PERMITS AND LEGAL CONCERNS

Pedasi: Miguel Batista (6706-6707)
Las Tablas: Engineer Dilsa Barrios (994-7313)

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info@proecoazuero.org
(507) 995-2995

Authors: Megan Corbett-Thompson, Megan Zimba, Leo Mena

Collaborators: MiAmbiente Las Tablas/Pedasi, Dr Vernon Scholey, Ruth Metzel, James Beck

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Appendix VI.b: Eco-guide pamphlet on Fire Control in Spanish



A QUIÉN LLAMAR

1. Si hay un fuego actualmente llame a los bomberos (#103)
2. Si el daño es ecológico contacte MiAmbiente (6706-6707)
3. Si el daño vale menos que \$250 balboas visita Corregiduría (Pedasí enfrente del super centro entre correos y alcaldía)
4. Si el daño vale más que \$250 balboas y fue propagado a propósito, visita Personería (Calle José A. Carrasquilla, cerca de Casita Margarita)
5. Si desea negociar con su vecino hay un abogado disponible en el Centro de Mediación (en la esquina de Calle la Policía N°3 y Avenida Norte)

MiAmbiente Leyes sobre quemas

febrero 3, 1994 Titulo VI articulos 84-93

1. El propietario necesita consentimiento escrito de sus vecinos colindantes
2. El propietario necesita permiso de MiAmbiente para quemar 15 días antes de la quema y debe poseer:
 - ▶ Pago de Paz y Salvo (\$3.00)
 - ▶ Copia del título de la propiedad
 - ▶ Copia de cédula del dueño
 - ▶ Cortafuegos alrededor del perímetro del área de quema (mín 5m de anchura)
 - ▶ Firma de consentimiento de los vecinos colindantes
3. Una vez que el permiso haya sido otorgado, los vecinos deben ser avisados con un mínimo de 5 días de adelanto del día de la quema
4. Las consecuencias de romper las leyes dependen del daño determinado por MiAmbiente:
 - ▶ Una multa entre \$100 y \$500 por quemar propiedad privada
 - ▶ Una multa entre \$1000 y \$2000 por quemar propiedad privada que tiene bosque primario
 - ▶ Entre 1 a 3 años de cárcel si la quema ocurre dentro de un área protegida

INCENDIOS: DERECHOS Y REGULACIONES

UNA GUÍA PARA PROTEGER SU FINCA DE LAS QUEMAS COLINDANTES



Las quemas son un método para quitar desechos domésticos o rastrojos de tierra.

Las quemas pueden propagarse muy rápidamente, dañando bosques, animales y agricultura. Además, inhalar humo daña la salud.

MÉTODOS PREVENTIVOS PARA LA TEMPORADA DE QUEMAS

1. **Avisa tus vecinos al hecho de que necesitan su permiso y el de MiAmbiente para quemar.** Si da su permiso, la persona que quiere quemar debe avisar 15 días por adelantado. Si este requisito no es cumplido, ellos serán responsables por cualquier daño que ocurra en su propiedad
 - ▶ Puede avisar en persona o a través de una carta a sus vecinos, alcalde y MiAmbiente
2. **Contacte MiAmbiente si cree que sus vecinos van a quemar sin su consentimiento**
 - ▶ Puede llamar o ir a MiAmbiente para ver si su vecino tiene permiso (6706-6707). Si tiene permiso sin su consentimiento puede reportarle directamente
3. **Construye un cortafuego alrededor del perímetro de su propiedad**
 - ▶ Hechos con hacha, machete o otra herramienta quita toda la vegetación y malezas, dejando una tira de 5m que contiene solamente rocas y suelo. Haga su cortafuego alrededor del perímetro de toda su propiedad. La persona que quema tiene la responsabilidad de pagar para los cortafuegos.

CÓMO ENJUICIAR A ALGUIEN QUE HA QUEMADO SIN SU CONSENTIMIENTO

1. **Contacte MiAmbiente o los bomberos tan pronto que sea posible para determinar el origen de la quema**
2. **Saque fotos y averigüe el nombre de la persona responsable si es posible**
 - ▶ Asegurarse de llevar su título de propiedad, aunque no sea necesario el proceso será acelerado
3. **Visita la oficina de MiAmbiente para presentar una denuncia oficial e informarles que su vecino quemó sin su permiso**
 - ▶ Tiene 5 días para presentar su defensa escrita y alegación, y 8 días para presentar prueba de la quema ilegal (fotos). Si visitó antes para presentar sus preocupaciones ayudará en comprobar negligencia.



CONTACTOS PARA PERMISOS Y CONSIDERACIONES LEGALES

Pedasí: Miguel Batista (6706-6707)

Las Tablas: Engineer Dilsa Barrios (994-7313)

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Appendix VII.a: Eco-guide pamphlet on Recycling in English

Recycling in Pedasí

Aluminum

- ▶ **Examples:** aluminum beverage cans, food cans like packaging for tuna, soup, olives etc.
- ▶ While there is no set collection or pick-up in the town of Pedasí, trucks occasionally drive by collecting aluminum cans and large scraps. If possible, save your aluminum and listen out for these collection announcements (similar to the announcements made by fruit vendors, the truck will have a speaker announcing the collection) or take cans to the recycling centers listed below.

Reducing waste through compost

Composting is an excellent way to reduce the amount of trash a household adds to the waste stream, while simultaneously producing an excellent garden fertilizer! Vermi-compost is an excellent option for those with limited outdoor space. There are links available on the AEP website for more information on how to get started. To see vermi-compost in Pedasí and get starter worms contact Dr. Elicer Vera (gavilan7ev@gmail.com)



CONTACT FOR RECYCLING IN PEDASÍ:

Edith Diaz (6752-8696)

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REDUCE, REUSE, RECYCLE

A GUIDE ON WASTE IN THE AZUERO PENINSULA



Trash on the Peninsula, even in dumps, is frequently subjected to open-air burns. Burning releases toxins into the air which can cause cancer, respiratory conditions, nausea, headache, skin irritations, and permanent damage to nervous and reproductive systems (US EPA).

How to reduce, reuse & recycle

Here are some strategies to help reduce the amount of trash that is created and burned reducing the threat trash burning poses to human health.

1. Reduce means to lower the amount of waste produced by buying or using less. To reduce consumption:

- ▶ Avoid buying products that are difficult to recycle. For example, Styrofoam products are made of 90% air. Due to its low density, it is rarely recycled.
- ▶ Avoid using plastic bags when you go to the store by using a cloth bag or simply carrying goods in your hands if you only have a few items.
- ▶ Buy items in bulk when possible to avoid unnecessary packaging. Individually packaged snacks are convenient but create a lot of trash. Instead buy a larger quantity and package things in reusable containers.

2. Reuse means to use an item for many purposes, rather than throwing it away after one use.

- ▶ Reuse old plastic bags when possible by taking them back to the store with you.
- ▶ Take old plastic bottles, cups and containers and use them again or re-purpose them. For example, vegetables or tree seedlings can be planted in small re-purposed plastic containers.

3. To recycle means to convert waste into another item that can be of use.

- ▶ Aluminum cans can be melted down and made into new cans. Aluminum can be reused without any change in the quality of the metal.
- ▶ Plastic bottles can be melted down and used to make other plastic products. However, each time plastic is recycled harmful toxins are released and the quality is downgraded until it is no longer recyclable.
- ▶ Buy soda and beer bottles (ask your local store what brands they accept) that can be returned for a deposit under the bottle return system used in Panama.

Recycling centers in Azuero and Panama

Note: Recycling centers receive different recyclables based on what they will be able to sell to outside institutions. Call ahead to make sure they are currently accepting your items.

Recimetal

El Uverito Dump, Las Tablas/ Main Street
Tel: 6931-1794

Recimetal

Vía Circunvalación and Vía Boca de Parita, Chitré
Tel: 970-1719

Reciclado Los Canto

Vía El Agallito, Chitré
Tel: 6530-9092

Reciclado Pamersa

Vía Tocumen close to Río Juan Díaz Bridge, Chitré
Tel: 220-4481

Centro de Acopio y Manejo de Desechos sólidos FCDS/FAS Panamá

Calle Rodolfo Benítez, Edificio 216
Ciudad del Saber, Panamá
Tel: 306-3700

Punto Limpio Betania

Parque Santa Eduvigis, Panamá (Collection box)

Recicla Panamá S.A.

Juan Díaz, Los Pueblos, Calle A
Desarrollo Los Alcázares
+(507) 391-2376

Appendix VII.b: Eco-guide pamphlet on Recycling in Spanish

Reciclaje en Pedasí

Aluminio

- ▶ Ejemplos: Latas de bebida y alimentos (como los envases de atún, sopas, aceitunas, etc.)
- ▶ Mientras no hay un centro de acopio fijo en el pueblo de Pedasí, las camionetas pasan recolectando latas y chatarra. Si es posible, guarda su aluminio hasta escuchar uno de estos anuncios de recolección (parecidos a los anuncios hechos por los vendedores de fruta, la camioneta tendrá un parlante anunciando que recogen aluminio).



CONTACTOS PARA RECICLAJE EN PEDASÍ:

Edith Diaz (6752-8696)

Reduciendo los desechos a través del compost

Compostaje es una manera excelente de reducir la cantidad de basura que una casa agrega al vertedero. ¡A la vez, produce un abono increíble para su jardín! Vermicompostaje es una opción excelente para los que tienen poco espacio a fuera. Hay enlaces disponibles en nuestro sitio de web para los que desean saber más. Para ver vermicompost en Pedasí y conseguir lombrices para empezar, contacta Dr. Elicer Vera

(gavilan7ev@gmail.com)

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REDUCE, REUTILIZA, RECICLA

UNA GUÍA SOBRE EL MANEJO DE DESECHOS EN LA PENÍNSULA AZUERO



Los desechos de la península, hasta en los vertederos, son frecuentemente quemados al aire libre. Quemar basura se libera toxinas al aire que pueden causar cáncer, trastornos respiratorios, náusea, dolores de cabeza, irritaciones de piel, y daño permanente a los sistemas nerviosos y reproductivos (US EPA).

Cómo reducir, reusar, y reciclar

Aquí hay unas estrategias para reducir la cantidad de basura que es generada y quemada, mitigando la amenaza que la quema de basura provoca a la salud humana.

1. Reducir significa disminuir la cantidad de desechos producidos. Para lograr esto, uno puede comprar y usar menos. Para reducir el consumo:

- ▶ Evite comprar productos que son difíciles de reciclar. Por ejemplo, foam es hecho de 90% aire. Debido a su baja densidad, es reciclado con poca frecuencia.
- ▶ Evite usar bolsas de plástico cuando hace compras. Use una bolsa de tela o simplemente lleva las cosas en mano si tiene pocos artículos.
- ▶ Compre las cosas en grandes cantidades para evitar los envases innecesarios. Las cosas en envases individuales son convenientes pero producen mucha basura. En lugar de eso, los artículos en grandes cantidades pueden ser repartidos en contenedores reusables.

2. Reutilizar significa usar un artículo por muchos propósitos, en vez de botarlo después de un solo uso. Por ejemplo:

- ▶ Reutiliza bolsas de plástico que ya tiene en casa volviendo con ellas al supermercado.
- ▶ Tome viejas botellas de plástico, vasos, y otros contenedores y usarlos para el mismo propósito o reusarlos de otra manera. Por ejemplo, vegetales o plantones pueden ser sembrado en pequeños envases reutilizados.

3. Reciclar significa convertir los desechos en otro artículo que puede ser utilizado.

- ▶ Las latas de aluminio pueden ser derretidas y hechas otra vez en una nueva lata. El aluminio puede ser reutilizado muchas veces sin cambiar la calidad del metal.
- ▶ Las botellas de plástico pueden ser derretidas y transformadas en otros productos de plástico. Sin embargo, cada vez que el plástico es reciclado, toxinas dañinas son liberadas y la calidad es empeorada a una forma cada vez menos útil hasta que no se puede utilizar más.
- ▶ Compra sodas y cervezas que tiene botellas que pueden ser devueltos por un depósito (pregunta en tu negocio local cuáles marcas pueden aceptar).

Reciclaje en Azuero y en Panamá

Nota: Los centros de acopio reciben diferentes materiales dependiendo de que pueden vender a otras procesadores. Es por eso que esta información cambiará con tiempo. Llama antes para averiguar que artículos están aceptando actualmente.

Recimetal

El Uverito Dump, Las Tablas/ Calle Principal
Tel: 6931-1794

Recimetal

Vía Circunvalación y Vía Boca de Parita, Chitré
Tel: 970-1719

Reciclado Los Canto

Vía El Agallito, Chitré
Tel: 6530-9092

Reciclado Pamersa

Vía Tocumen cerca al puente Río Juan Díaz, Chitré
Tel: 220-4481

Centro de Acopio y Manejo de Desechos sólidos FCDS/FAS Panamá

Calle Rodolfo Benítez, Edificio 216
Ciudad del Saber, Panamá
Tel: 306-3700

Punto Limpio Betania

Parque Santa Eduvigis, Panamá
(Estación de reciclaje adentro del parque)

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