12 Waste

Prepared by: Ricardo Serpell, September 2018.

12.1 Waste sources

For most of the history of Rapa Nui, it was common practice for households to accumulate their domestic solid waste in their own backyards. Back when transport of goods and materials to the island was limited and expensive, most plastics, metals, and other inorganics were stored in this way for eventual reuse. Organic waste were composted and whatever was left was burned or used as a fill material within the land lot limits [1]. In the 1990s, at the time when tourism was taking off as a major economic activity, municipal solid waste management emerged as an urgent need to cope with the explosive growth of solid-waste brought by this new boom. Since then, solid waste generation has experienced an exponential growth, linked to the growth of population and tourists visits (Figure 12.1).

Almost 7,500 metric tons of solid waste were generated in the island in 2016 [2]. This amounts to almost 1 ton per capita of permanent population per year and is equivalent to more than 20 tons per day on average. The amount of waste collected varies significantly according to the seasonal variations of touristic affluence, doubling around the peak of touristic affluence. The global composition of the waste has not been studied in detail but can be linked to the types and quantities of products and materials being brought to the island within a particular time frame. For example, nowadays the rapidly increasing number of motor vehicles on the island generates large amounts of waste in the form of scrap, used spare parts, oil, etc. Likewise, the construction sector has also been a large contributor to solid waste in recent years. Solid waste drifting across the pacific constantly land on the island shores. Volunteers collect more than 2 tons of waste from the shore each month [3].

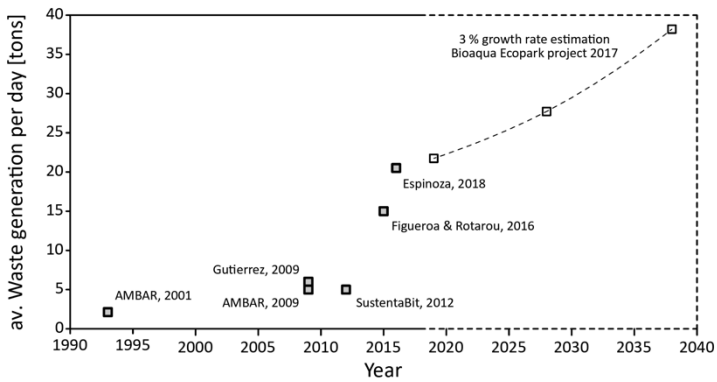

Figure 12.1 Evolution of solid waste generation (own elaboration based on various sources).

12.2 Solid waste management

Since 2009, solid waste management has been the responsibility of the Environmental Management Unit of the Municipality of Rapa Nui. The rear-loader garbage truck of the Municipality collects domestic waste from the streets of Hanga Roa 6 days a week and also from the rural areas in the periphery of the island on 2 of those days.

Two official waste processing areas exist on the island in the proximity of Hanga Roa: Orito and Vai a Ori (Figure 12.2). The Orito site was formerly a quarry that sourced aggregates for the construction of the roads and airstrip of Hanga Roa. Local authorities approved in 1993 its use as landfill for municipal waste. The pit is in fact a waste dump that does not comply with the current environmental standards required by Chilean sanitary authorities for an official landfill. The major concern in relation to its operation is the potential leaching of percolates from solid waste into the Hanga Roa aquifer that sits directly under it. Chemical components found in the leachate could then flow into the island's drinking water supply. Some of them "are known carcinogenic and mutanogenics such as lead, arsenic, mercury, cadmium, benzene, vinyl chloride, trichloroethylene, chloroform, benzo pyrene, PCBs" [4]. In 2014 studies were undertaken to close and seal the 10,000 m^2 landfill. The engineering project was developed by the private company Bioaqua [5,6]. A public request for tender for the construction of the project was published on June 2018 with an official total budget of approximately US$ 1.5 million [7]. Construction is expected to begin by the end of 2018.

Figure 12.2 Location of Orito and Vai a Ori municipal waste processing sites (own elaboration using Google Maps data).

The rest of the municipal waste is currently managed in Vai a Ori, on land leased to the Municipality of Rapa Nui by the mainland government. At this site a larger capacity landfill is feasible. With the sponsorship of the Valparaiso Regional Government, the Rapa Nui Municipality has proposed the development of an integral solid-waste treatment centre on this site, the "Vai a Ori Eco-park". The US$ 2,500 million project, designed by private company Bioaqua, is expected to satisfy current and future needs for safe and controlled treatment, transfer and final disposition of solid-waste of Easter Island [8]. It comprises the closing of the current landfill of Vai a Ori and the construction, implementation and operation of new facilities on the same site. Construction is expected to last 4 years, entering operation phase in 2021 [9]. In May 2017 the Chilean Environmental Evaluation Service

(SEA) declared the project acceptable for evaluation [10]. As of August 2018 the project is still under qualification.

In addition to the official processing areas, a number of places are used to dump waste illegally. An example of this is the abandoned pit at the Maunga Tararaina, where aggregates were sourced for the extension of the Mataveri airport runway [11].

Figure 12.3 Vegetation invading old cars and scrap metal dumped at Orito (August 2018).

12.3 Recycling

In 2011 a compacting plant for recyclable materials was inaugurated at Orito (Figure 12.4). Separation of cardboard, plastic and aluminium was expected to allow recycling of 20% of total municipal waste. Current operation is based on sorting and cleaning performed at the source. Unfortunately, no more than 40% of the population commits with the recycling campaign, and only about 50% of the waste that do arrive at Orito are in the condition required to effectively process them [12]. The largest contributors of recyclable materials are companies in the touristic accommodation sector. Chilean regulations enable private companies and institutions to subscribe Clean Production Agreements with relevant public institutions to cooperate in the compliance of environmental and sanitary laws. By 2006, the Chamber of Tourism of Rapa Nui had already signed an agreement committing to improve on several health and environmental fronts, including separating recyclable materials from other waste at the source. The Chamber represents a large number of companies working in the tourism sector on Rapa Nui, including accommodation, hotels, restaurants, show producers, tour operators, car rental, shopping and other services. A new agreement was signed in August 2015 between national and local authorities, the tourism chamber and the public energy and water supplier [13]. Through this new agreement, the companies commit to an 8% reduction in solid waste generation through separation of glass, paper and cardboard, plastic bottles, aluminium cans, metal food cans and tetra-pack at the source, implementing best practices according to national recommendations such as the

Guide of Best Available Techniques to Minimize the Generation of Solid Waste for the Accommodation and Restaurant Sector [14].

For the management of scrap metal, the plant is equipped with a compactor able to produce ferrous briquettes 40x40x20cm in size, and oxy cut equipment for size reduction of larger pieces (both donated by private company Gerdau AZA) [15]. Glass is processed in a crusher donated by the Explora hotel to obtain smaller sized material to be used as aggregate. The Chilean Chamber of Tires Industries (CINC) donated a cutting machine to deal with the more than 4,000 car tires and 200 truck tires received every year at the site.

Recovered waste are subject to a 6-12 months' quarantine period that includes fumigation against the Aedes aegypti mosquito (vector of Zika, Denge and Yellow fever viruses, present on the island since 2000). Once a week LATAM Airline, the largest servicing the island, transports approximately 7 tons of recyclable material to the continent. Chilean recycling company RECUPAC declared treating over 500 tons of cardboard from Rapa Nui in the period 2014-2017 [16]. A baler, donated by the EU in 1999 and in operation since 2004 [17], is used to compact the largest part of the waste including those remaining to be buried in the Vai a Ori site.

Figure 12.4 ***a***: The Orito recyclables compacting plant (source: incargonews.com). ***b***: the dump at Vai a Ori in 2011 (from [1])

12.4 Composting

In 2010, 400 plastic compost bins were distributed to the resident population, in the context of project "Integral household solid waste management plan and environmental sanitation in the commune of Easter Island". Private company CompostChile – consultants in Environmental Management and Education, was in charge of community education in the use of the bins. As part of the program, the company carried out a study that analysed waste composition from 19 households over a one-week period [1]. Results showed 49.2% of total waste mass was suitable for composting, while 21.5% consisted of recyclable materials. Daily production of organic compostable waste was estimated at 186 g per capita.

12.5 CO_2 emissions

In 2010, a research team from the *Instituto de Estudios Urbanos y Territoriales* (IEUT, lit.: Institute of Urban and Territorial Studies) of the Catholic University of Chile performed a detailed assessment of the carbon footprint of Easter Island [18]. The study, published in 2012, showed annual equivalent CO_2 emissions just shy of 60,000 metric tons directly linked to the Island [19]. Considering a 2010 population of 4,888 [20], this translates to 12.1 tons of eq. CO_2 per capita: triple the value of mainland Chile (4.2 tons [21]), though comparable to other populated islands in the pacific, such as Hawaii (12.8 tons, though considering only emissions from energy production [22]). Only one third of the emissions inventoried in the study were generated on-site, the rest originates from air and maritime transport to and from the island. The main contributors to locally generated emissions were cattle husbandry (13% of total), city electricity energy generation from diesel (10%) and local transportation by motor vehicles (8%). Maritime transport emissions included shipping of goods (8%) and fuel for local transportation and energy production (10%). Air transportation alone accounted for almost half of the island's CO_2 emissions (46% of total). Considering by 2016 airline passengers had already doubled compared to 2010, these numbers are likely to differ significantly from current reality. Annual emissions likely exceed 100,000 tons eq. CO_2, i.e. around 13 tons eq. CO_2 per capita.

12.6 Perspectives

Several of the solid-waste management recommendations proposed by Campbell [4] have been partially implemented[1]. Evidently, most of them require a strong community commitment in order to achieve optimal levels. Unfortunately, cultural obstacles, both in the local population and in the visitors remain to be addressed. In the Rapanui language there is no word for "garbage" [23].

12.7 References

[1] V. Ika, Lineamientos para el manejo sustentable de los residuos sólidos domiciliarios en la Isla de Pascua (Rapa Nui), Universidad de Chile, 2012.

[2] S. Espinoza, Estudio advierte que aumento de población en Isla de Pascua amenaza su infraestructura, El Mercur. (2018). http://www.economiaynegocios.cl/noticias/noticias.asp?id=452109 (accessed May 15, 2018).

[3] C. OCEANA; Almarza, Mama Piru, Ocean. Chile Faceb. Page. (2015). https://www.facebook.com/OceanaenChile/?hc_ref=ARTxskHzQMRcug2JPa34U3FeVweVSb4v

[1] Campbell's 2008 recommendations for solid-waste management:
- All recyclable material be sorted in the home, processed on Island and exported to Chile or Tahiti (requiring around 2,400 color-coded wheelie bins for home sorting). - A green waste and home composting program be put into place to remove the organic residue leaching into the Hanga Roa aquifer from Orito (a grinder to shred green waste). Large scale composting is also a prerequisite for future reforestation and soil rehabilitation. A grinder is an urgent piece of equipment required by the island. - The remaining non-recyclable waste be buried in a new synthetically-lined refuse landfill; methane to be extracted to power the onsite leachate purification plant. - Rat and dog-proof home composting bins. - Orito landfill to be closed down and remediated. - Proper collection, storage and treatment of hazardous waste, pending treatment facilities in Latin America or better on-site treatment technology. - 'In vessel' rapid composting bins for the treatment of organic waste, dead animals and even sewage sludge (two needed for Rapa Nui). - Waste minimization and cleaner production practices put into place.

rZbaxgEW4an8XXkWbe2wBxVCkwXbvB-1rTI&fref=nf (accessed July 10, 2018).

[4] P. Campbell, Easter Island: A Pathway to Sustainable Development, Rapa Nui J. 22 (2008) 48–53.

[5] Bioaqua, Bioaqua – Diseño de las Obras de Cierre, Sellado y Reinserción del Vertedero de Orito en la Comuna de Isla de Pascua, Bioaqua. (2015). http://www.bioaqua.cl/diseno-de-las-obras-de-cierre-sellado-y-reinsercion-del-vertedero-de-orito-en-la-comuna-de-isla-de-pascua/ (accessed May 16, 2018).

[6] Bioaqua, A1 Especificaciones Técnicas Cierre Vertedero Orito, (2015) 60.

[7] Ilustre Municipalidad de Isla de Pascua, Bases Administrativas Económicas Generales del Llamado a Propuesta Pública para la Ejecución del Proyecto Denominado: "Construcción Obras de Cierre Vertedero Orito Isla de Pascua," (2018) 26.

[8] Bioaqua, Bioaqua – Isla de Pascua somete a evaluación ambiental el primer Ecoparque de Chile, Bioaqua. (2017). http://www.bioaqua.cl/isla-de-pascua-somete-a-evaluacion-ambiental-el-primer-ecoparque-de-chile/ (accessed May 16, 2018).

[9] C. Sandoval, Eco Kuhane: El primer ecoparque del país está más cerca de ser una realidad, Ilus. Munic. Isla Pascua. (2017). http://www.rapanui.net/component/content/article/8-noticias-espanol/354-eco-kuhane-el-primer-ecoparque-del-pais-esta-mas-cerca-de-ser-una-realidad-en-rapa-nui.html?Itemid=101 (accessed May 16, 2018).

[10] SEIA-SEA-Chile, Ficha de Proyecto: Ecoparque - Vai a Ori, (2017). http://seia.sea.gob.cl/expediente/ficha/fichaPrincipal.php?modo=ficha&id_expediente=2132346382 (accessed May 16, 2018).

[11] J.M. Ramírez Aliaga, Manejo del recurso arqueológico en Rapa Nui: Teoría y realidad, Chungará (Arica). 36 (2004) 189–197. doi:10.4067/S0717-73562004000300049.

[12] A. Fernández/AFP, Waste-besieged Easter Island slowly learns to recycle - Business Insider, Bus. Insid. (2016). http://www.businessinsider.com/afp-waste-besieged-easter-island-slowly-learns-to-recycle-2016-9?IR=T (accessed July 5, 2018).

[13] Consejo Nacional de Produccion Limpia, APL - 0106 - 551010: Acuerdo de Producción Limpia Turismo Sustentable Sector Alojamientos Turísticos Isla de Pascua, Región de Valparaíso, (2015).

[14] Consejo Nacional de Produccion Limpia, Guía de Mejores Técnicas Disponibles para Minimizar la Generación de Residuos Sólidos en el Sector Gastronómico y de Alojamiento Turístico, (2012) 12. www.produccionlimpia.cl.

[15] A. Saavedra, Isla de Pascua más limpia, SustentaBit. (2012) 24–27. http://biblioteca.cchc.cl/datafiles/26863-2.pdf (accessed July 10, 2018).

[16] HSEC, Recupac ha reciclado 500 toneladas de cartón en Isla de Pascua, Rev. HSEC. (2017). http://www.emb.cl/hsec/noticia.mvc?nid=20170703w8 (accessed July 11, 2018).

[17] P. Campbell, Easter Island: On the verge of a second environmental catastrophe, Rapa Nui J. 20 (2006) 67–70. http://islandheritage.org/wordpress/wp-content/uploads/2010/06/RNJ_20_1_Campbell.pdf (accessed May 15, 2018).

[18] R. Moris, Estudio Huella de Carbono Isla de Pascua, FACTOR URBANO. (2012). https://factorurbano.cl/2012/04/14/estudio-huella-de-carbono-isla-de-pascua/ (accessed May 18, 2018).

[19] IEUT-PUC, Huella de Carbono de Isla de Pascua - Informe Final, Santiago, 2012.

[20] INE Chile, Base demografica 2002 a 2020, (2016).

[21] World Bank, CO2 emissions (metric tons per capita), World Bank Open Data. (2018). https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=CL (accessed May 18, 2018).

[22] U.S. Environmental Protection Agency, State CO2 Emissions from Fossil Fuel Combustion, 1990-2014, 2015. https://archive.epa.gov/epa/sites/production/files/2016-08/documents/co2ffc_2014.pdf (accessed May 18, 2018).

[23] A.M. Gutierrez, Nuestra Realidad con una Visión Estratégica de Futuro, Rapa Nui Responsab. (2009). http://rapanuiresponsable.blogspot.com/2009/12/ (accessed July 10, 2018).