Fact Sheet

Plastic Removal Technologies 101

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INTRODUCTION

Plastic Removal Technologies (PRTs) promise to improve environmental quality by removing plastics from the environment, but they can also threaten biodiversity. Almost no environmental impact assessments (EIAs) are done on PRTs[1,2,3].

Unselective PRTs can alter habitats and catch plants and animals. Manual collection selectively removes plastic, but it is limited in efficiency and effectiveness. Municipalities and communities ultimately bear the burden of plastics removal. Some PRT examples are discussed here.

Beach grooming involves the use of tractors or robots to rake or sieve the sand to remove plastic debris. It can alter beach habitats, reduce biodiversity, and destroy plants and invertebrates. When plastics are removed, plant debris (food and habitat for many animals) can also be removed.

Figure 1: Hilton_Fiji_Beach_Resort_and_Spa-Denarau_Island_Viti_Levu.htmlIronically, award-winning beaches are subject to more grooming and thus lower biodiversity . Source: https://www.tripadvisor.com/LocationPhotoDirectLink-g612490-d616998-i28817204-

Figure 2: *"Seabin mounted to a pontoon and anchored down to a fixed location at the University of the South Pacific, Marine Studies campus jetty". Source:* Paris, Kwaoga, & Chintaka (2022).

Seabins™ are used in many harbours to trap floating trash. Two scientific evaluations in the UK and in Fiji showed that they capture small amounts of plastic (0.0059 kg per day) but many plants and animals[4,5]. For every four pieces of plastic, the Seabin would catch one organism, and almost three quarters were dead after two days[4]. 500 Seabins™ would need to run continuously to keep even a small harbour free of floating plastics[4]. Their maintenance costs are orders of magnitude higher than those of manual cleaning[4].

Rivers. Forty types of PRTs are used in rivers and estuaries including booms, watercraft vehicles, bubble curtains, or receptacles[3]. Most also remove organisms and natural flotsam, important habitats for organisms. Many PRTs target the river surface missing plastics at depth. Devices at river mouths do not remove plastics from rivers themselves. One study estimated the efficiency of river barriers to reduce plastic outflow to the ocean at 54%. Thousands of rivers would need PRTs to have a significant impact[7]. Stormwater traps (e.g., LittaTraps™) capture plastics closer to the point of release.

Figure 3: *LittaTrap™ Source: https://www.enviropod.com/products/littatrap*

Ocean surface. Ocean surface cleanups were popularized by The Ocean Cleanup© (TOC). TOC uses a net towed by two ships for up to two weeks to capture macroplastics. This results in significant bycatch, killing many surface organisms central to the functioning of food-limited ecosystems. A single device running for one year could impact 675 tons of zooplankton[2]. In 2022, TOC caught over 667 kg of bycatch including sea turtles[9]. The floating plastics that TOC could collect are only a fraction of the plastics in the ocean. 200 TOC devices running for 130 years would only capture 5% of the world's floating plastics[6] and release significant amounts of CO_2.

Figure 4: *TOC uses a net towed by two ships for up to two weeks to capture macroplastics Source: https://theoceancleanup.com/media-gallery/*

Figure 5: *Robotic systems to clean ocean waste. Source: https://roboticsandautomationnews.com/2020/06/15/5-ways-robots-are-being-used-to-clean-up-the-worlds-oceans/33050/*

Seafloor. Much of the plastics in the ocean accumulates on the seafloor. Recent EU-projects aim to remove plastics from the seafloor using autonomous vehicles, robotic systems, and artificial intelligence[1]. Such complex systems will be costly and it is questionable if they will ever be technically mature. Trawling for plastics, like bottom fishing, is likely associated with high bycatch mortality and damage to habitats. Fishing-for-Litter initiatives, in which fishers collect plastic debris during fishing operations, can reduce plastics on the seafloor at low additional effort and inspire behavioural change[10]. Manual collection by divers comes with health and safety risks and is limited in scale.

Scale. PRTs cannot scale up to the rapidly increasing scale and complexity of the plastics crisis. Worldwide, coastlines cover hundreds of thousands of kilometres. The ocean has a water volume of 1.37 billion km^3 covering 361 million km^2, and rivers stretch over an area of 773,000 km^2. The Pacific Island region alone includes 30,000 islands and 15 countries scattered across 165.25 million square kilometres (ca. 33% of the Earth's surface). No PRTs have been evaluated for their removal efficiency[1].

Figure 6 *Plastic rubbish scattered along beach. Source: https://foe.scot/campaign/plastic-pollution/*

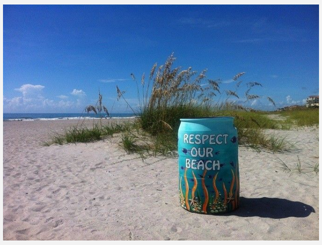

Figure 7: *Creative Cans in the Sand, will help clean up the growing trash problem on the beach. (PHOTO/Jerry Hume, Staff). Source: https://www.pinterest.com/pin/357473289146481223/*

Reuse, recycling, and disposal. Plastics collected using PRT or manual cleanups can almost never be reused nor recycled: over 13,000 chemicals are known to be used in plastics production, a quarter of which are categorized hazardous[11]. Plastics also attract other environmental pollutants once they are in nature and are subject to weathering[12]. In places like the large ocean small island developing states of the Pacific region (the safe and sustainable disposal of collected plastics presents significant challenges due to limited land for landfills and options for the safe disposal of hazardous materials. The best option is prevention coupled with removal of plastic out of the region before it becomes a persistent environmental and biological hazard.

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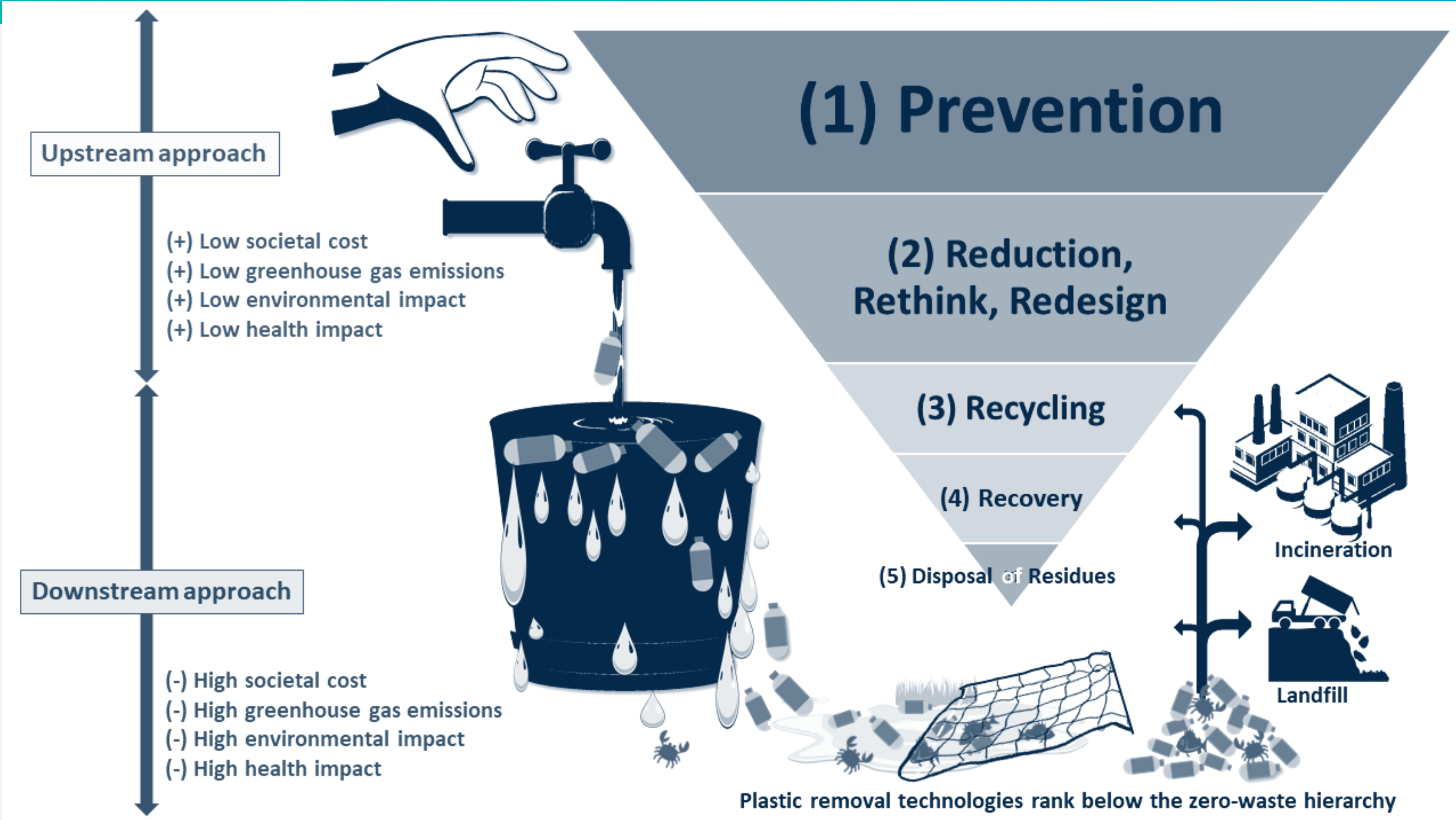
Key Messages

PRTs distract resources from efficient preventive actions; do not address rapidly growing global plastic production; and can give people a false sense of security. The plastics industry may start funding PRTs as a form of 'greenwashing' including related extended producer responsibility or plastic credits schemes, analogous to failure of 'carbon capture schemes'.

This will further externalize the costs of plastics production onto non-producing countries like PSIDS, municipalities, communities, and consumers. Science-based criteria are needed to assess the impact of PRTs on the economy, human health, and the environment to avoid unwanted consequences.

The most effective and low-cost interventions will be guided by global legally binding control measures[13] underpinned by preventive and precautionary principles and the toxic-free zero-waste hierarchy[14].



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A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.

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