sea to source pre-monsoon survey

India and Bangladesh 2019



March 2020

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introduction

This report compiles the results of **ellipsis.earth** surveying in a research expedition undertaken in May - June 2019 in India and Bangladesh by National Geographic Society, as part of their wider 'Planet or Plastics' campaign. The results summarised here are from pre-monsoon surveys of 24 subsites along the Ganges river system.

why plastics are a problem...

the growing and urgent crisis of ocean plastic pollution has gained increased visibility in recent years against a backdrop of increasing management costs for governments, and both public and corporate demand for solutions. numerous new technologies, initiatives and policies have been applied all over the world to try to curtail, manage and reduce the leakage of plastics into our oceans, with more countries, companies and individuals pledging every day to join the fight.

the impacts of ocean plastic pollution are also being increasingly documented;

environmentally, the increase in marine litter has devastating consequences to marine life, with everything from biodiversity, breeding and survival rates, and spread of disease, being affected.

economically, marine plastic waste has significant impact, with fishing, shipping, and coastal tourism industries impacted around the world.





why the ganges?

as well as inputs from shipping and fishing industries, a major sourceof ocean plastic pollution is the mismanagement of plastic waste onland, for example by consumers directly littering, local authorities failing to provide sufficient waste facilities, waste management providers experiencing leakage from their systems, illegal dumping, and industrial non-compliance with plastic management.

a significant conduit for land-based plastic waste to enter our oceans is via the global river system, with studies suggesting riverine litter contributes up to **25%** of total land-based inputs. It is also estimated that the **20** most polluting rivers are responsible for the vast majority of riverine inputs, with up to **95%** of estimated contribution of plastics entering the oceans.

> The Ganges basin is a significant contributor to the agricultural economies of both India and Bangladesh; by supporting agriculture, animal husbandry and fisheries, tourism, river-based trade and transport, and hydroelectric power, the river contributes significantly to the livelihood, food and nutritional security of about one-third of Indian and two-thirds of the Bangladeshi population...

protecting mother ganga

with extensive human activity comes pollution, and the holy Ganges river is listed as the world's 2nd highest contributing river to ocean plastics in the world; sources of ocean-bound plastic pollution include untreated sewage, food packaging and household waste, industrial manufacturing, fishing nets, ropes and buoys, agriculture, funeral remnants and landfill leakage.



ellipsis technology

The acquisition of baseline, ongoing and comparative data are critical for understanding our grasp of, and impact on, the plastics pollution issue.



our complete solution combines **universal image gathering** with **autonomous object detection**, to create an end-to-end system that provides data at a scale, speed and efficiency not previously achieved in this field.

with up to a kilometre of coastline being mapped every **15 minutes**, and image processing of **1,000** images per second, our technology provides a **more efficient method** than existing platforms, in addition to being remotely operated, safer and less immersive in harsh environmental conditions, enabling us to map **otherwise inaccessible regions**. furthermore, our software is scientifically robust and globally comparable, with an average accuracy of **93%** and certainty of **95%**, whilst also removing subjectivity and human error.



our novel methodology generates data that are globally standardised, scientifically robust, objective and repeatable, to enable a clearer overview of the problem and provide key information for targettable action...

Ellie Mackay, Ellipsis CEO



#seatosource expedition

ten sites were surveyed incorporating a variety of characteristics, from densely populated urban environments to rural agricultural settlements, plus a range of geographic regions from low-lying flood plains to mountainous glaciated valleys.

> our data can be used in conjunction with parallel research from the same expedition, to groundtruth previous estimates against current manual monitoring methods such as photo quadrats, transect studies or mobile tagging apps.













total items detected per site





density results

los angeles river - 3.40 items per m² patna - 3.08 items per m² chandpur - 2.53 items per m² varanasi - 2.19 items per m² senegal river - 1.92 items per m² rajbari - 1.85 items per m² rishikesh - 1.83 items per m²

kannauj - 1.26 items per m²

harsil - 0.36 items per m²

baltic - 1.02 items per m²

chilean - 0.24 items per m² rhine - 0.05 items per m² danube - 0.03 items per m²



example site results

varanasi

Eastern-Central India Lat 25.319420, 83.033528 975 km to sea, 875 km from source large urban city & busy trading zone



382 bags



139 non-plastic foreign objects



223 bottles & caps



50 rubber objects



115 fishing nets & ropes



632 food containers & wrappers



rajbari

Central Bangladesh 23.778698, 89.690360 240 km to sea, 1610 km from source small semi-rural fishing community



12 bags



32 non-plastic foreign objects

100 bottles & caps

19 rubber objects

1 wire object



259 fishing nets & ropes

22 food containers & wrappers





summary

the results reported here provide a well-populated, detailed database of items detected as well as an extensive litter baseline for the Ganges, upon which future data can be built and compared

in addition, the expedition achieved further outcomes, **educating local communities** on plastic waste management and drone flight safety protocols, and resulted in the **on-site training** of Rakib Sikdar, a Bangladeshi national, in introductory methods for UAV survey co-piloting.

overall, this expedition demonstrated the powerful capabilities of ellipsis.earth technology as well as providing a **world-first aerial baseline of the Ganges** river system from sea to source. ellipsis.earth is pleased to have achieved these goals and hopes that the results reported here can be used in supporting the ongoing work of National Geographic Society and affiliate academic institutions, providing critical data to Indiand, Bangladeshi and wider international stakeholders, and developing a **transferable methodology for riverine plastic waste assessment around the globe**.

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