Smarter Regulation of Waste in Europe (LIFE13 ENV-UK-000549) LIFE SMART Waste Project

Action B8: Phase 1 (Research): Develop innovative remote sensing techniques, pilot them and produce evaluation and intelligence reports

Non-Technical Summary

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This document provides a high level, non-technical summary of the LIFE SMART Waste project's **Remote Sensing Phase 1 (Research) final report**. This report forms part of Project Action B8 which aims to develop, pilot and evaluate innovative Remote Sensing (RS) techniques.

Waste crime is a high priority challenge for environmental regulators in the European Union (EU). Remote sensing techniques can potentially play a significant role in supporting the work of regulatory agencies in identifying waste management licence breaches, as well as more serious waste crime. **This report examines the potential for innovation in using RS data** in this area. Although remote monitoring of the Earth's surface using satellite-mounted instruments has been undertaken almost as long as satellites have been launched, its full potential is arguably yet to be appreciated. One of the main areas where this is certainly true is in the enforcement of environmental regulation.

Section 1 of the report contains the executive summary.

Section 2 of the report focuses on documenting **current regulatory environmental monitoring applications which use RS data**, providing case studies of applications in Australia, the USA, Europe, Brazil and Chile. It highlights for regulators interested in utilising the approach the results of significant experience with RS to date. It is clear that many monitoring programmes using RS have resulted in successful outcomes, which should promote confidence in the opportunities it offers in the context of waste crime.

Section 3 considers the **technical capabilities of RS**. Data acquisition and processing techniques are reviewed as part of an attempt at cataloguing an easily understandable list of applicable sources and datasets. This section also provides an introduction as to where RS can technically contribute to detecting waste crime. For example, optical imagery can enable waste sites to be detected visually by RS (and archives of data can provide evidence of timing). Old waste sites may be characterised using RS data by the poor health of the vegetation growing on the site. Radar provides a potentially reliable source of RS data to detect unknown waste sites because radar can penetrate cloud, although the of use of radar data is not as mature as other RS technologies.

Section 4 looks at **regulatory requirements** and in this context, **considers opportunities for innovation**. The big opportunity for innovation in the waste crime sector is to integrate RS data as a key component of a joined up intelligent capability; as part of an intelligence-led, better informed enforcement team. RS could provide important evidence in both a historical context and in a dedicated and targeted monitoring programme. We found that there have not been many studies to date looking at the use of RS to detect waste crime. Accordingly, we accumulated and analysed our own database to examine the characteristics of the problem and to reach insights into the opportunities for innovation. We examined: the types of waste crime and their ability to be monitored by RS; the types of waste being dumped and their ability to be detected by RS; and the signs of illegal activity that could be detected by RS. Generally, we found that investigation of known sites was preferable for the analysis of RS data. Searching for unknowns is more problematic although such detection can be very beneficial.

Section 5 contains a **technical assessment of RS data sources for waste crime detection**. It builds upon the analysis in Section 3 by examining in more detail the different RS techniques that could be appropriate for the identification of waste crime. Remote sensing has changed significantly in the last few years, so this section also examines the implications of emerging capabilities in satellites and in unmanned aerial vehicles (UAVs), such as as technological step-changes, artificial intelligence, new entrants to the market and planned satellite constellations. Generally, most of the locations of waste sites examined in the report would be evident on very high resolution optical imagery. In some areas, it may be more effective to use airborne remote sensing rather than focus solely on satellite sensors.

Section 6 summarises how in practice it is possible to **access RS data** through either access to existing data in archives or through requesting specific data acquisition through tasking a satellite mission. This encompasses data that is commercially available, as well as open data sources that are free of charge. Section 6 also examines policy issues such as the ownership and intellectual property of RS data (which lies with its creator), copyright (which for some data has restrictions and others does not apply), and licences (which can have implications in respect to evidence disclosure).

In section 7 we present the **costs of RS data compared to monitoring needs**. Open data is appealing as it is free of charge, easily accessible and available across Europe. However, open data tends to have a lower spatial resolution than the best commercially available data, which can sometimes make it less relevant in a law enforcement context.

Whilst RS seems to have great promise in the waste crime field, technological solutions for the waste crime sector have not been successfully demonstrated to the required degree for regulators to adopt them as yet. There is a need to show whether RS can actually be a rigorous and legally-reliable tool in waste monitoring regimes. Evidence is needed that such data will be operationally effective and result in positive outcomes, whilst at the same time being affordable and cost-effective. In Section 8 **we recommend four pilot projects** that might be taken forward to examine how RS can be utilised to support waste regulation and improve the awareness, knowledge and understanding of the technology amongst environmental regulators in this field. **The four pilot project proposals** are as follows.

- An operational 'live' case (based on historical data) to analyse remote sensing and related geospatial data of a known illegal site.

- A case study of monitoring waste tyre piles by using RS data to examine compliance and potential licence breaches.

- A behavioural case to assess changes in compliance with and without knowledge of satellite surveillance.

- A test of the detection of unknown sites using RS data to examine the success rate of detecting unlawful waste crime sites.

The four pilot projects are deliberately different in character so that different attributes of the use of the RS data can be expertly assessed by regulators.

Section 9 presents the **report's conclusions**. We conclude that there are real opportunities for innovative approaches using RS in waste regulation applications but that much more work is needed to examine the role of the data in an operational context. RS data is at its most useful to regulators when integrated into operational value chains.