LITTERING

DISCUSSION PAPER FROM THE INTEREST GROUP PLASTICS OF THE EUROPEAN NETWORK OF THE HEADS OF ENVIRONMENT PROTECTION AGENCIES (EPA NETWORK)

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Interest Group Plastics of the EPA Network

Working paper

LITTERING

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The Interest Group Plastics (IG Plastics) is a working group of the European Network of the Heads of Environment Protection Agencies (EPAs, http://epanet.pbe.eea.europa.eu/). Established in fall 2016, the group works on topics related to plastics and plastic inputs into the environment. Depending on the topic, about 15 active members attend the biannual meetings and contribute to the outputs of the group.

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Content

IG Plastics Key Messages on Littering

1) Put littering on the European agenda.

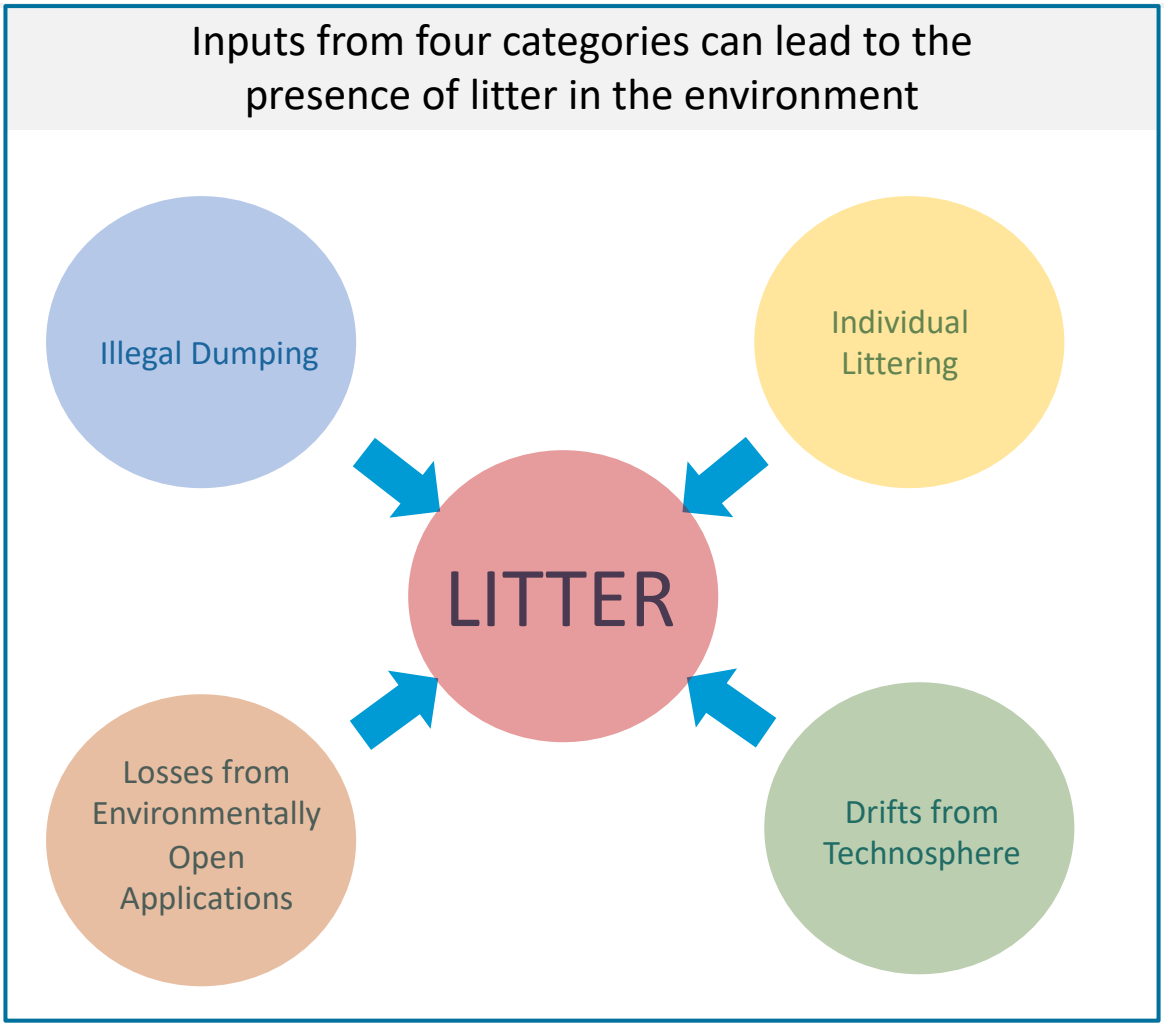
Inland littering is a severe problem. It is a threat to wildlife and ecosystems, raises significant economic costs for its removal, and is associated with societal problems. Furthermore, littering hinders a circular economy as littered items escape the recycling systems, can lead to the introduction of toxins into the environment, and can be a severe problem in case of heavy weather events when blocking pipes, increasing the likeliness of flooding. Eventually, litter on land can end up in the marine environment, where it is close to impossible to remove. Therefore, the IG Plastics states that it is high time for EU member states to join efforts and combat littering.

2) Promote a common understanding of littering.

The IG Plastics underlines the need to develop a common European understanding of the term "littering". Currently, the definition of littering depends on the Member State and context. The lack of a common definition makes it impossible to compare quantities, define mitigation measures or responsibilities, and distinguish littering from other sources of litter in the environment.

In order to bring clarity into the debate, the IG Plastics advises the distinction between inputs from individual littering vs. from other sources of litter in the environment. Inputs from all these categories lead to the presence of litter in the environment. However, once introduced, it is often impossible to distinguish different origins. Consequently, it is difficult to properly define responsibilities and countermeasures.

Therefore, the IG Plastics suggests the following distinction:



Explanation of the graphic:

- Litter refers to more than the legally defined term waste. Article 3(1) of the Waste Framework Directive defines waste as 'any substance or object which the holder discards or intends or is required to discard'[1]. Litter, however, can also consist of products used in outside areas and lost unintentionally, such as a teddy bear or a lighter. Other items present in the environment are a result of degradation, such as fragments of products used in horticulture. Litter therefore is the result of different inputs, one of them being littering[2].

[1] See http://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf.

2 While not providing a definition of litter, the EU waste directive states: "Litter, whether in cities, on land, in rivers and seas or elsewhere, has direct and indirect detrimental impacts on the environment, the well-being of citizens and the economy, and the costs to clean it up present an unnecessary economic burden for society. Member States should take measures aimed at preventing all forms of abandonment, dumping, uncontrolled management or other forms of discarding of waste" (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.150.01.0109.01.ENG, recital 33). This implies an understanding of litter being the result of abandonment, dumping, uncontrolled management or other forms of discarding waste, and thus corresponds with the broad understanding of this paper.

It should be noted that not all languages have a specific word for littering. In some, littering is a loanword, such as in Italian or German. The elaborations in this report therefore explicitly refer to the English use of language. If translated, this peculiarity should be considered.

- Littering is an individual behavior. It describes leaving behind (dropping, drifting, neglecting, losing) items, whether they are considered waste or not. These items may be left in urban and other environmental compartments intentionally, knowing that they will not be collected, but perhaps hoping that they might get properly disposed of by someone else. Other items may be left behind anywhere unintentionally, such as tissues falling out of a pocket.

  Please note that the distinction between *littering* and the next term, *illegal disposal*, is a linguistic distinction, and does not imply the legality of littering. Littering is, in most European countries, illegal, and subject to fines.

- Illegal disposal[3][4] means disposing of items such as household or industrial waste (such as building or demolition waste) in inappropriate locations without intending to pick them up at a later stage. Characteristically, these places for deposition can be parking lots, woods, and other areas that are not highly frequented but easily reached by car. Typical items include washing machines, furniture and other white waste, or larger amounts of household waste. Explanations for this behaviour that may seem inexplicable at first might include inconvenient opening hours of municipal waste management facilities (where electronic waste can be delivered for free according to EU legislation) or cost avoidance in case of "pay as you throw" systems. Another contributing factor may be misinformation in the case of electronic waste – some might expect having to pay for its disposal, which is not the case.

- Losses from environmentally open applications include all products intended to serve a function in the environment, such as snow fences, buoys, foils used in agriculture, items used in horticulture, tents etc. These items have an intended collection pathway at the time of introduction into the environment. However, losses may occur when the

3 Also called fly tipping in the British context.
4 Please note that "illegal disposal" is an established term; the distinction from "littering" should by no means imply that the latter is legal. In most countries in Europe, littering is an illegal behaviour, and can be subject to payment of fines.

products are lost, broken, or fragmented during use phase. They may also be forgotten, left behind, or not collectible after their use phase. Degradation over time, heavy weather events, and sun lead to abrasion and products breakdown.

- Drifts from technosphere refers to drifts and leakage of waste during waste collection (such as insufficient coverage of waste receptacles) and treatment and the processing of secondary materials. It may also occur during transport, such as in the case of pellet loss or leakage caused by damaged waste collection bags. This leakage is largely unquantified and typically occurs in poorly managed facilities and the informal sector[5]. Leakage at sorting and recycling plants can happen in the form of wind-blown litter during transport or storage, for example when waste is stored uncovered. Other factors include missing wind protection fences or nets, which lead to leakage from premises and emissions to air and water.

One example for the pathway "drifts from technosphere": waste collection (bring system) with suboptimal coverage.

Overall, it should be noted that these four sources are archetypes of inputs contributing to litter in the environment. There are grey zones between them. However, the classification helps to clarify where litter in the environment is coming from and which stakeholders need to be addressed in order to prevent further inputs.

While all four categories can constitute significant inputs (the share on the total amount of litter depends on various, often country-specific, factors), the IG Plastics messages of this paper refer to the category of individual littering (littering from here onwards).

[5] UNEP 2016.

3) Establish European guidelines to measure littering while considering peculiarities of littering.

Harmonized guidelines at EU level are essential in order to ensure comparability in the way littering is measured. Documenting the status quo and defining it as a baseline is the prerequisite for all mitigation measures – otherwise, the effect of mitigation measures cannot be analysed. These guidelines should be issued by the European Commission in form of a commission decision and at least include the need to monitor littering

- reflecting seasonal differences, e.g. at least two rounds of monitoring per year[6];
- reflecting different environments (e.g. urban areas, moderately frequented natural areas, highway on- and off-ramps);
- according to comparable categories. As a starting point, measuring could be based on the top 10 items upon which the SUP-Directive is based. Over time, the measuring guidelines should be adapted and extended according to the insights gained during the monitoring activities on land.

Based on the guidelines, a detailed elaboration of the monitoring concept should be left to the Member States. This approach will allow for regional differences and peculiarities, while drawing a representative and comparable picture of the status of littering across member states.

In light of the Directive on the impact of certain plastic products[7] and the requirement to achieve ambitious and sustained reductions, first rounds of monitoring should be conducted in a timely manner. Based on these initial measurement efforts, a baseline can be defined so that the effect of reduction measures can be analysed. For reasons of cost efficiency, it should be considered whether existing monitoring requirements or other ongoing activities can be used, creating co-benefits.

In addition to these guidelines on how to monitor, the same categories of estimating the quality of cleanliness should be applied all over the Union. One example could be the five grades of cleanliness used by Keep Scotland Beautiful, all referring to previously defined areas[8]:

Grade A: no litter of refuse
Grade B+: predominantly free from litter and refuse – up to three small items
Grade B: predominantly free from litter and refuse
Grade C: widespread distribution of litter and refuse with minor accumulations
Grade D: heavily littered with significant accumulations.

[6] In northern countries, the ground is snow covered during winter months, thus entirely different conditions apply. This should be reflected in guidelines and monitoring approaches.
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019L0904.
[8] https://www.keepscotlandbeautiful.org/media/1561096/16_17-leams-benchmarking-report.pdf, p. 27.

While comparability on monitoring and data collection has to be ensured in developing measures counteracting littering, country-specific peculiarities should be considered.

4) Producers need to recognize their share of responsibility on littering.

Studies from all over the world hint to similar product groups that are littered frequently. Producers of such items should recognize their role in contributing to the amount of litter in the environment and contribute to preventing any further inputs. An extended producer responsibility is outlined in the EU Directive on the impact of certain plastic product in Art. 8 and the funds generated from such schemes will be used to cover the costs of litter clean up and awareness raising measures of the specified items. Product design should play a role as well and could include guidelines to help design less litter-prone products.

Studies show that about 80% of the factors contributing to littering are intrinsic, the remaining part is extrinsic. This means that the behaviour of individuals can only be influenced to a relatively small degree – e.g. an increase of the number of litterbins will not necessarily result in an equal reduction of littering. Therefore, it seems wise to combat littering at the source, which is the product itself, and change the product design, making it less prone to littering.

5) Expand multi-use systems.

A simple way to avoid littering is to limit the use of single-use products, and switch to multi-use products instead. A measure to support multi-use systems are deposit return-systems, which encourage bringing empty containers back by providing a financial incentive[9], or discounts for customers bringing their own receptacles.

In Germany, a recent example for a new deposit return system has been designed for coffee to go cups, which are an increasing nuisance in many countries because they are often littered. A recent study recommends expanding multi use-systems for this type of cups[10]. If single-use options and multi-use systems exist in parallel, a fee for single-use cups proves to be more effective in promoting the system than decreasing the price for multi-use alternatives.

Art. 9 of the Directive on the impact of certain plastic products also introduces separate collection targets for beverage bottles, and the use of a DRS is suggested as a policy tool which should be considered for achieving these targets.

[9] See IG Plastics report on DRS, http://epanet.pbe.eea.europa.eu/fol249409/ig-plastics/working-paper-deposit-return-schemes-data-and-figures-16-epa-network-members.

[10] https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-02-20_texte_29-2019_einweggetraenkebechern_im_ausser-haus-verzehr_final.pdf.

INTRODUCTION

Littering in the public sphere is a nuisance for many, and some seem to know all too well whom to blame – be it "the youngsters", "the smokers", or "the packaging industry". However, as is the case with many other environmental problems, there is more than one aspect to littering, and if we take a closer look at the phenomenon, it becomes clear that we actually do not know much about the quantities littered, the reasons why people litter, and how to counteract littering.

Despite these knowledge gaps, it is indisputable that littering plays a role in polluting the environment, being one input pathway of waste into the environment. It is also one of the fewer input pathways over which everyone have control, as we can decide whether one wants to get rid of her/his waste on the street, in the woods, on beaches, or bin it. This fact distinguishes littering from other sources, such as pellet loss or abrasion of tires – which is harder to avoid at an individual level. However, while it is a tangible and, at least theoretically, controllable problem, knowledge on littering is both scarce and scattered. Accordingly, if we aim for a comprehensive understanding of the phenomenon and at designing common measures, the challenges are multifold. They include:

- the lack of a consistent definition of littering;
- that the quantities littered are hard to measure and vary considerably among regions, occasions, and items;
- that at the behavioral level, there are different factors likely to encourage littering;
- that in order to reduce littering, a plethora of measures is discussed and it is hard to estimate which will be most efficient;
- and lastly: who is responsible for littering? The producer, throwing products with little value und little use time on the market, thereby encouraging littering? Or the consumer, who could easily choose to handle waste appropriately, but decides to do otherwise? Or both?

For one specific form of littering, comparatively more data is available: beach litter. The reason is that at European beaches, beach litter monitoring activities have been going on since many years in a comparable way, and these activities are well documented[11]. They also constitute the basis for the EU's Directive on the impact of certain plastic products on the environment[12]. These beach litter counts show us that there is a top 10 list of items littered which, to varying degrees, occur at European coastlines everywhere. This data also puts us in a better position to measure the impact of mitigation measures by measuring the reduction of the litter present based on a baseline. While there are still questions to be answered in the context

[11] Compare http://mcc.jrc.ec.europa.eu/dev.py?N=41&O=441.
[12] http://europa.eu/rapid/press-release_IP-18-3927_en.htm.

of marine litter, compared to littering in other places, data on marine litter seems to be relatively advanced. Littering in urban contexts and other environmental compartments, however, is considerably less researched and requires a lot more groundwork.

This is the debate the IG Plastics would like to contribute to. What do we know about littering on land? Which gaps do we need to fill? If we combine all knowledge we have so far, what does the picture tell us?

Trash can fallen over, releasing its content.

For all of those wondering why the IG *Plastics* is dealing with the topic of littering, while obviously comprises more materials than only plastics: we find indeed products made of all kinds of materials littered, be it paper and cartons, wood, metals -, those made of plastics are among the most frequently found (such as cigarette butts or plastic bottles). In addition, litter made of plastics requires special attention due to the persistence of the material.

All diagrams in the document refer to replies of a questionnaire distributed among European Environment Protection Agencies in preparation of this report. It included 10 questions on littering, 16 EPAs replied. The data is therefore not representative, but shows the status quo of information in EPAs across Europe.

The main goal of this paper is to provide an overview of a selection of the literature on littering with a view to identify gaps in the knowledge on littering. This summary shows there is a need for a clear definition of the term “littering” as well as for comparable measurement techniques to monitor and quantify littering.

1. What is littering?

Many of us may have an idea or a mental picture of littering in mind, maybe something like “teenagers throwing trash on the street” or “candy wrapper near a path in the woods”. It is likely that most of these images include someone disposing of trash in an inappropriate area. However, once we see a piece of trash in an environment we consider unsuitable, it is often *de facto* impossible to trace it back to its source. It may stem from overflowing trashcans, debris carried away by wind from construction sites, trash actively disposed of, or accidentally lost. It is often the circumstances under which an item is introduced into an environment that categorizes it as either littered, illegally disposed of, lost, or carried away through drift.

Therefore, while the question “what is littering?” may sound trivial, it has far reaching consequences. Do we restrict the term to certain occasions, areas, or product characteristics? De-

pending on what is included in the definition, the quantities estimated and thus the seriousness of the problem as well as the measures proposed to mitigate littering vary considerably. In order to come to a European understanding and European measures to tackle the problem, a common understanding of littering is therefore indispensable.

If we look at the scientific literature on littering, there is no uniform definition of the term. In an attempt to approach the phenomenon, Wever says that the "act of littering can be described by three aspects: the environment, the littered item and the litterer"[13]. He also notices that while the environment as well as the litterer have been studied comparatively well, the littered item has been rather neglected so far. Not all authors follow this systematic approach, but focus on different aspects of the three. We will look at some examples of definitions in the following paragraph.

In the early days of scientific literature on littering in 1976, Robinson wrote: "Litter is trash, discarded or scattered about in disorder over a socially inappropriate area"[14]. This is a very broad understanding of the phenomenon and excludes all behavioral aspects. *Keep Australia beautiful* adds an individual to the trash and assumes a voluntary act: "Littering occurs where a person deposits any unwanted item or material on land or water" in its Litter Act from 1979 and its Litter Regulations 1981[15]. Terpstra et al. further refine the concept and understand litter as "[t]hose forms of trash that either originate by people throwing away or leaving behind artifacts they consider functionless in places not officially intended or designated for such a purpose, or that end up in such places by indirect action or inaction of people"[16]. This widens the scope from intended deposition to more deliberate acts of distributing unwanted items.

Recycling bag ripped open.

Bulky waste on a sidewalk.

Flat iron on a bench near a wood.

[13] Wever 2006.

[14] Robinson, 1976.

[15] Available at https://www.kabc.wa.gov.au/resources/for-local-government/litter-laws.

[16] Terpstra et al. 1979: FOUND IN RENEE WEVER – Influence of packaging.

While the previous definitions make no distinction between different kinds of trash – neither size, origin, nor weight - a more recent definition from Hansmann et al. characterize littering as "the careless, incorrect disposal of minor amounts of waste"[17]. This distinctively excludes larger quantities being labelled as "littering", such as bags full or trash or bigger items, e.g. washing machines. Another recent definition says: "The pollution of the public space as well as meadows and woods through – consciously or unconsciously – leaving behind or throwing away of waste"[18]. Apart from urban areas, this definition explicitly includes nature as well. The official website of the Swiss Federal Office for Environment Switzerland[19] says „[l]ittering means throwing away or leaving behind of smaller amounts of municipal solid waste, without using the available disposal points in place"[20]. This definition excludes items such as electronic and other bulky waste, and the notion of the *available* infrastructure raises the question of what happens if this infrastructure is *not* available – would it not be littering in this case?

Breitbarth et al negatively define the term "littering" by distinguishing it from waste disposal in order to avoid disposal fees, such as illegal depositing of bulky waste[21]. And lastly, Hartmann et al. understand *plastic* debris as "[…] plastic items occurring in natural environments without fulfilling an intended function, is persistent, mobile and ubiquitous in terrestrial and aquatic environments, including urban, rural, and remote locations"[22].

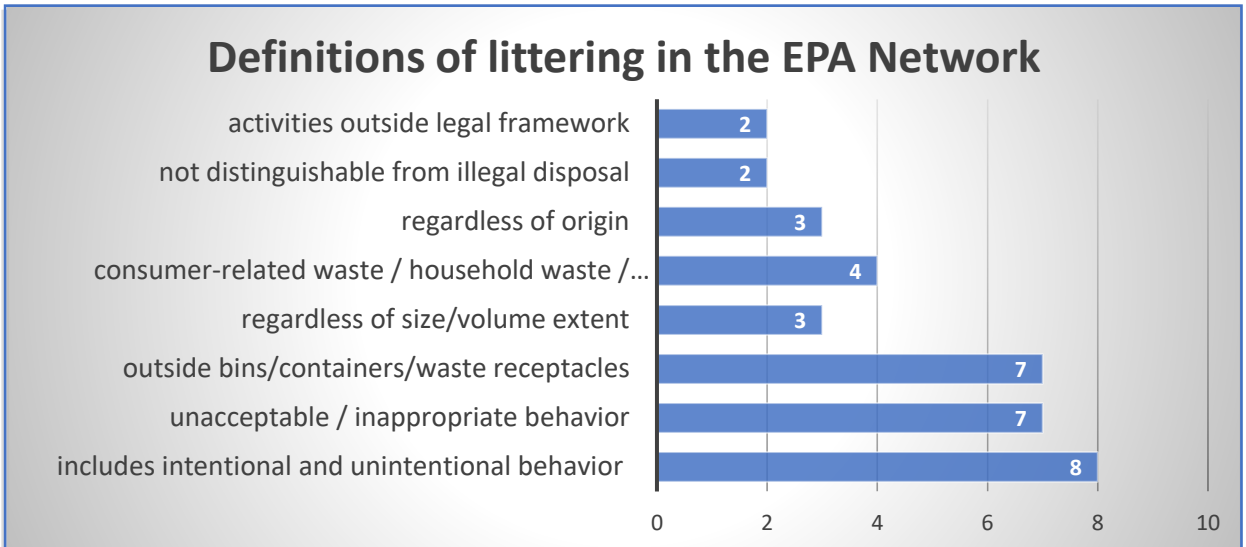
Note the difference between these definitions. Does littering necessarily imply an intentional act? Does the amount littered matter? Does the size of the littered item matter? Is the area where littering occurs defined? All the questions have considerable impact on the understanding of the phenomenon.

One of the most basic questions is what distinguishes trash from litter. The same item could be trash, if deposited in a bin, or litter, if left behind at a bus stop. The reason why it is not disposed of correctly can, depending on the definition, vary from neglect (I didn't notice my candy wrapper fell out of my pocket - *unintentional*) to purposeful deposition (I flip my cigarette butt behind me - *intentional*), to planned deposition (I take my flatiron to a bench near

[17] Hansmann et al. 2003.
[18] Translated after Fehr et al. 2014.
[19] Based on the Swiss environmental law, Art. 31b Disposal of municipal waste: The holder must hand over the waste for collection by the services organised by the cantons or deliver it to the collection points determined by the cantons. Art. 31c Disposal of other waste: Any other form of waste must be disposed of by its holder. He may instruct third parties to dispose of it. Art. 61: Any person who wilfully infringes these regulations on waste is liable to a fine not exceeding 20,000 francs, see https://www.admin.ch/opc/en/classified-compilation/19830267/201801010000/814.01.pdf.
[20] Available at https://www.bafu.admin.ch/bafu/de/home/themen/abfall/fachinformationen/abfallpolitik-und-massnahmen/littering.html.
[21] Breitbarth et al. 2018.
[22] Hartmann et al. 2019, p. 1.

the woods and leave it there - definitely with intention[23]). This distinction matters, as a) depending on the underlying motivation, measures should be tailored differently, and b), depending on the definition of the items littered, the amounts and types of trash littered vary considerably.

This becomes clear when thinking of cigarette butts and takeaway packaging, typical litter items in urban areas, vs. old tires or washing machines left behind in the woods or in parking lots on highways. Therefore, it seems wise to aim at a definition that either includes all types of trash scattered in urban areas, parks and the environment, or limiting in the scope in such a way that a clear distinction between the different types is possible.



This graph shows the different understandings of the term littering in different EPAs in Europe. The understanding that littering includes intentional as well as unintentional behavior is most consistent among the respondents (8). A majority (7) labels littering as unacceptable or inappropriate behavior and understands it as deposition outside waste receptacles. Four respondents say that littering consists of consumer-related waste, household waste, or in general only small amounts of waste, while three say that littering comprises items regardless of volume or size. Three claim that what is labelled as littering is regardless of the origin, two that littering cannot be distinguished from illegal disposal. Two respondents quite broadly understand littering as activities outside the legal framework.

Other basic aspects need to be clarified in order to come to a common definition:

- Is “littering” limited to urban areas, or does it include woods and meadows as well?

23 Unless open-air ironing is a new trend the author is unaware of so far.

- Does the amount of trash littered matter, or should there be a distinction, e.g. between disposal of trash carried on hand, and trash purposefully transported somewhere to be disposed of? What about items such as single-use BBQs left behind in parks?
- Is there a difference between littering in closed areas, such as festivals, and open spaces?
- What about items intended to serve a function (environmentally open applications), such as fences, advertising material or products used in horticulture, that break down through wear and tear or weathering?
- Does the intention or motivation matter?

One aspect should guide the decision: what is the ultimate goal of the definition? Depending on this goal, the definition will focus on different aspects. Is it…

- Keeping trash out of the environment? In this case, the definition should be broad.
- Highlighting the responsibilities of producers? Then the definition should address specific product groups often littered.
- Educating the consumer? This would require focusing the definition on the behavioral aspect.

2. Littering in legislation

The EU waste framework Directive does not include a distinct definition of littering but describes it as "[…] all forms of abandonment, dumping, uncontrolled management or other forms of discarding of waste."[24] It is important to note that this is a far-reaching understanding. It encompasses dumping of waste as well as uncontrolled management, which includes all forms of wear and tear, abrasion, withering, or fragmentation during the use phase of a product. The Directive goes one step further by defining Member States' responsibilities: "[they] should also take measures to clean up litter present in the environment, irrespective of its source or size and regardless of whether waste has been discarded willfully or by negligence"[25]. This make clear that the Member States are the addressees and their task in cleaning up litter is quite encompassing.

An important new provision of the 2018 Waste Framework Directive[26] is that the revised Directive requires all EU Member States to address litter prevention in their waste prevention programs (Art. 9 of the Directive). This provides the opportunity to look at the topic anew and to take specific action.

[24] EU Directive 2008/98/EC on waste, https://eur-lex.europa.eu/legal-content/DE/TXT/?qid=1530028986315&uri=CELEX:32018L0851, recital 33.
[25] Ibid.
[26] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.150.01.0109.01.ENG.

In the EU Directive on the Reduction of the impact of certain plastic products on the environment[27], Article 15 on Evaluation and review states:

> *"As part of the evaluation carried out pursuant to paragraph 1, the Commission shall review the measures taken under this Directive as regards single-use plastic products listed in Section III of Part E of the Annex and shall submit a report on the main findings. The report shall also consider the options for binding measures for the reduction of the post-consumption waste of single-use plastic products listed in Section III of Part E of the Annex, including the possibility of setting binding collection rates for that post-consumption waste. The report shall, if appropriate, be accompanied by a legislative proposal."*

The products referred to in Annex Part F III are "Tobacco products with filters and filters marketed for use in combination with tobacco products". This means that the member states might have to come up with an approach for how to estimate the quantities littered as well as on how cigarette butts can best be collected. As these are small items typically hard to reach, this is a challenging task.

3. What are the consequences of littering?

Litter accumulating underneath a bridge.

For many, littering is primarily an esthetic problem. While this is certainly one factor, there is definitely more to it. In the 60s and 70s, publications on littering started emerging in the United States. This coincides with the activities of Keep America beautiful[28] and its framing of the term "litterbug". 1978, Krauss et al. state that "At best, litter is unsightly and annoying; at worst, it gives rise to a sanitation problem of some magnitude and helps create the unwholesome and dispiriting atmosphere many associate with large urban centers"[29]. Interestingly, the social aspects are at the core of this definition, not environmental ones. A framing Reich et al. follow by defining littering as a "significant social problem"[30]. Newer definitions approach the topic more comprehensively: "Littering is a social, health, economic, aesthetic, and environmental pollution problem that cities around the world face. It

[27] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019L0904.

[28] Founded in 1953 by a consortium of American businesses such as Philip Morris, PepsiCo and Coca-Cola, NGOs and others. The non-profit organization substantially framed the concept of littering. See https://www.kab.org/about-us/mission-history.

[29] Krauss et al. 1978.

[30] Reich et al. 1979.

can pose a serious threat to human health and wellbeing through exposure to infection and biological contaminants, odour nuisance, and an increased number of vermin (rodents and insects) which breed and act as disease vectors. In some places, litter is an eyesore"[31], or "Littering constitutes a major societal problem.

Litter is perceived as unsightly and deleterious to quality of life. It can cause safety problems as well as contribute to environmental contamination. Moreover, there is evidence that the presence of litter in an environment can increase the prevalence of other social problems such as crime through what has been termed 'the spreading of disorder'. And as a basic consequence, it is well established in literature that 'littering begets littering'".[32]

Ong et al. add that littering can also cause blocked draining systems, contributing to flooding, which is exacerbated the problem of heavy rainfalls[33]. The EU points to the financial consequences: "Litter, whether in cities, on land, in rivers and seas or elsewhere, has direct and indirect detrimental impacts on the environment, the well-being of citizens and the economy, and the costs to clean it up present an unnecessary economic burden for society"[34].

Focus: Plastic litter

Currently, plastics seem to receive all the attention. Especially marine litter is often associated with plastic waste. Indeed, the majority of litter found on beaches consists of plastic. This also seems to be true for inland litter, such as plastic wrappers and chewing gum. Apart from other material-specific challenges (such as the presence of toxins in additives), the long decomposition rates of plastics depict a major problem. If not cleaned up, plastics waste is likely to remain in the environment for a very long time – some scientists estimate several hundreds of years (see Bertling et al. 2018). We are in the early days of understanding the complex processes going on in different environmental compartments when plastics are introduced and slowly break down into smaller pieces. However, it is indisputable that plastics is a material introduced into the environment by human activity in very large quantities that is entirely new to all ecosystems, and that will have a lasting negative impact for future generations.

When some say that littering is mostly only a temporary problem as city cleaning removes litter in structured intervals, it is neglected that littering also occurs in areas which are likely to be never or only very rarely cleaned, such as large stretches of woods, or pavement by rural

[31] Ojedokun et al. 2013.

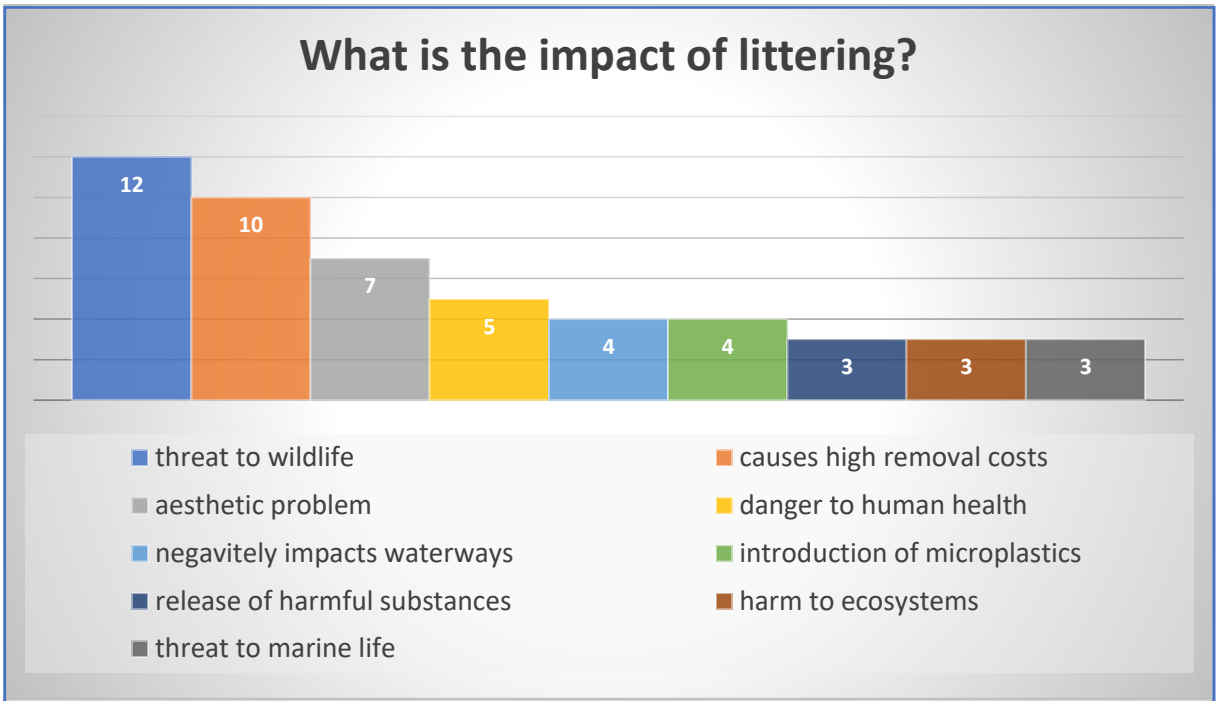
[32] Bateson et al. 2015.

[33] Ong et al. 2003.

[34] EU Directive 2008/98/EC on waste, https://eur-lex.europa.eu/legal-content/DE/TXT/?qid=1530028986315&uri=CELEX:32018L0851, recital 33.

roads, with negative consequences for wildlife and the environment. Therefore, even if cities look clean, litter prevention should be a top priority.

All of the above plus an additional aspect (the fact that littered items escape a circular economy) is also mentioned in the EU Plastics Strategy, which says “Growing plastic waste generation and its leakage into our environment must be tackled if we are to achieve a truly circular lifecycle for plastics. Today, littering and leakage of plastic waste harm the environment, cause economic damage to activities such as tourism, fisheries and shipping, and may affect human health through the food chain”[35].



Most respondents believe that the threat to wildlife is the most significant impact of littering, followed by the high costs for the removal of littering. 5 respondents also fear a danger to human health. A negative impact on waterways is equally concerning as the introduction of microplastics into the environment through littering (four each). The release of harmful substances through littering, harm to ecosystems in general and a threat to marine life are perceived negative effects of littering by three respondents each.

[35]https://eur-lex.europa.eu/resource.html?uri=cellar:2df5d1d2-fac7-11e7-b8f5-01aa75ed71a1.0001.02/DOC_1&format=PDF.

4. What do we know about littering?

The answer to this question comprises at least three dimensions: *what*, *where*, and *why*. Which items and quantities are littered, where does littering occur, and what is the motivation for littering? Reliable data on any of these questions, however, is scarce. There are some studies addressing individual questions or contexts, but there is no monitoring of the phenomenon at a broader level and close to no known quantities. One reason is that estimations on quantities largely depend on the definition of littering. Other reasons include:

- If we rely on data from city cleaning, there is often no distinction between the weight of littered items collected and other items of biogenic origin, such as leaves or rocks;
- The amounts of waste collected by city cleaning often only comprise bigger items, such as food containers, and cannot capture small items, such as cigarette butts, or such items hard to collect, such as chewing gum;
- There are no defined spaces in which littering occurs, and the results from one area are not transferable to other contexts.

Or as a study from England puts it:

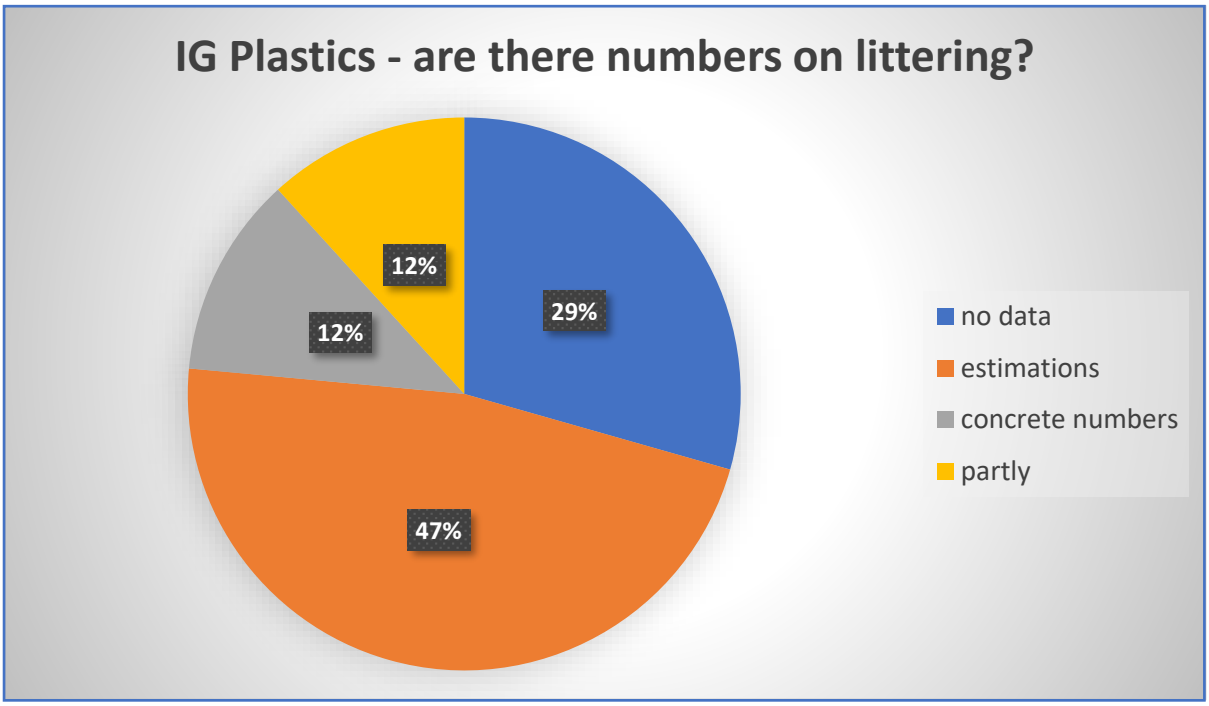
"There's no one perfect way to measure litter - for example:

- if we measured litter by weight, we wouldn't know if we were counting a small number of heavy items, or a large number of light items
- if we measured the number of litter items this wouldn't necessarily reflect the impact on the way a place looks - a small number of large items might make a place appear more littered than a large number of small items
- measuring only the presence or absence of litter does not show how long the litter has been there, or how much of it is present".[36]

These aspects outline the difficulties in analyzing littering. If we come back to the question of *what* is frequently littered, there are items that seem to be prone to littering almost everywhere. Recurring items on the list of findings from clean ups are cigarette butts, chewing gums, packaging (wrappers, containers), bottles, and cups. Many of these are associated with to go- consumption. However, especially on the quantities, most studies are vague approximations based on more or less refined models. A current study for Germany estimates that around 1.4 kg is littered per person and year, amounting to about 115.000 t. This is based on

[36] Litter and littering in England 2016 to 2017, https://www.gov.uk/government/publications/litter-and-littering-in-england-2016-to-2017/litter-and-littering-in-england-2016-to-2017#getting-people-involved.

the quantities collected by cleaning activities and an estimation of what remains in the environment after cleaning efforts[37].



Where does littering occur? According to Breitbarth et al, littering occurs in all public spaces, urban areas as well as peripheral areas, all traffic routes, cycling-, hiking, and forest paths, as well as water ways[38]. In addition, there are certain litter hotspots, such as tram stations or transitional areas (such as before entering an office building or a beach) which are especially prone to littering.

There some studies focusing on the *why*, the behavior or motivation why individuals litter, and there are some studies looking into cause and effect. Some evaluate measures implemented against littering (such as *watching eyes*, talking bins etc.), some look into the public perception of littering.

Trash scattered around a bin for paper.

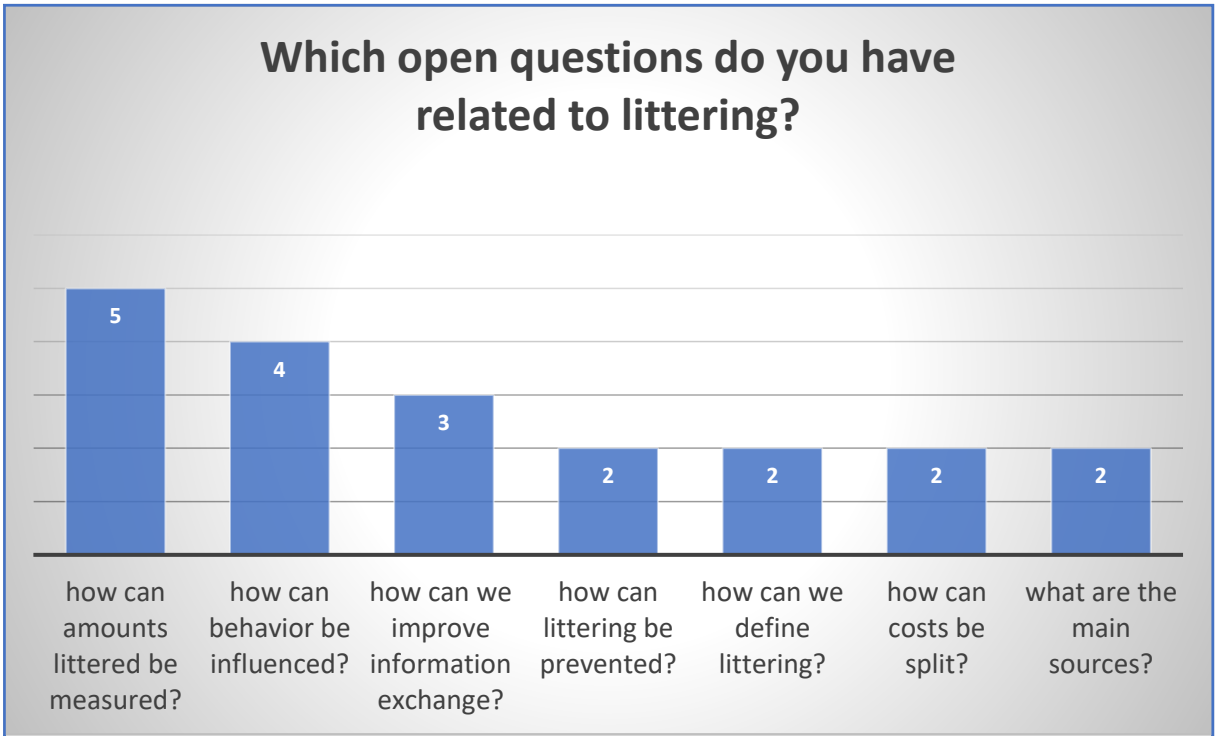
While the motivation of littering is difficult to assess and should therefore be read with caution, some studies, such as a UK survey, identify the following factors as relevant:

[37] Bertling et al 2019.

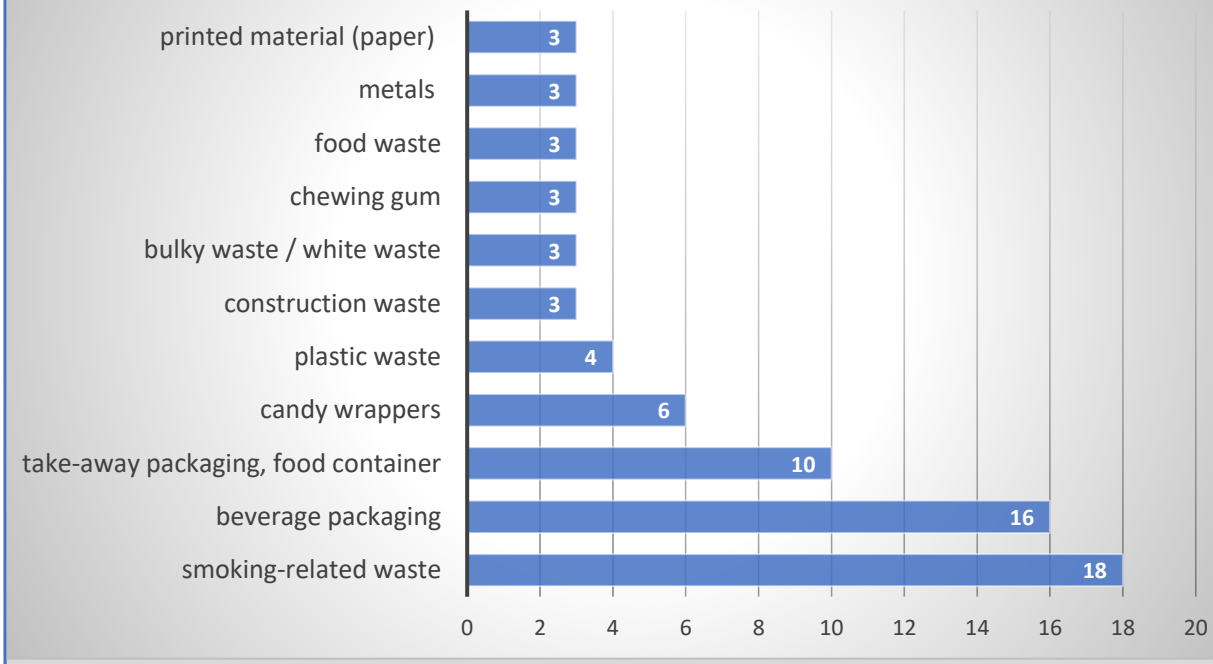
[38] Breitbarth et al. 2018.

- “it is seen at someone else’s responsibility (i.e. someone else, generally the local authority, will clear up the litter);
- it is not really littering (e.g. because the litter is biodegradable); or
- laziness.”

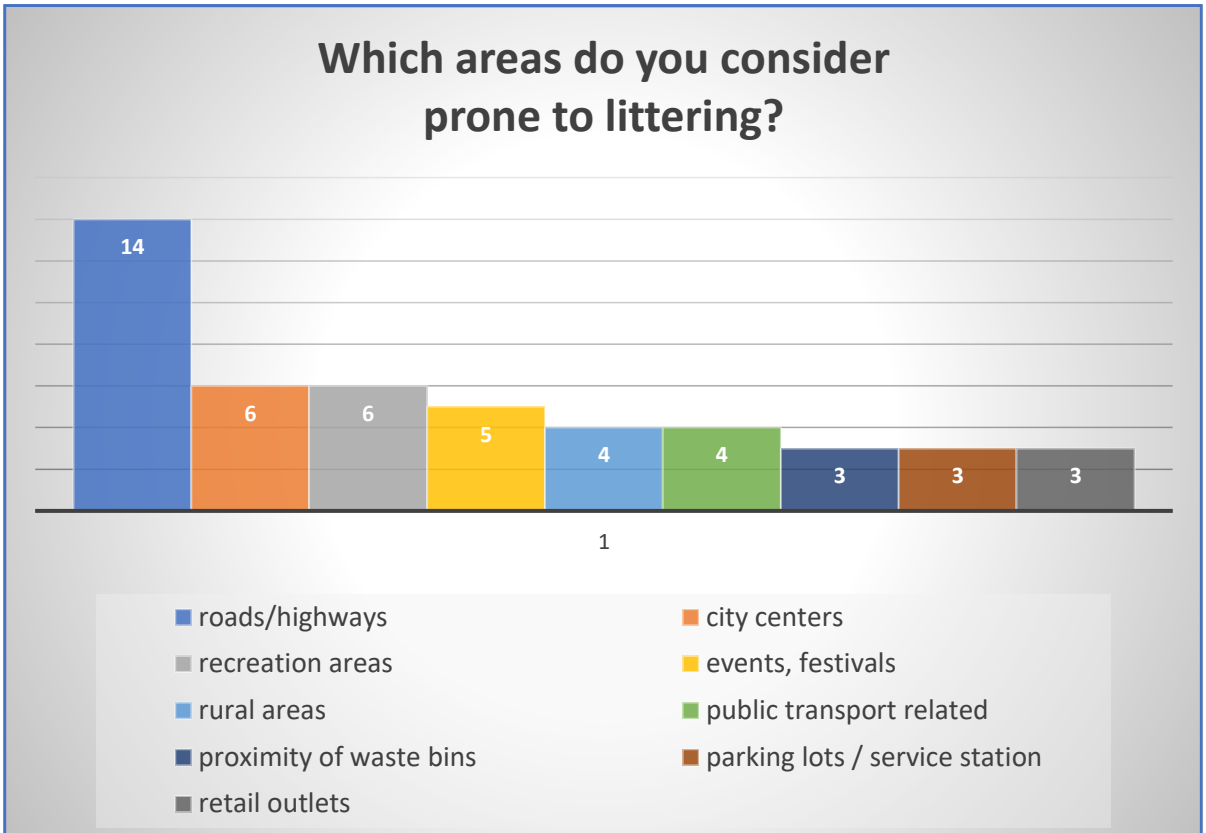
Here are some graphs on littering representing replies from European Environment Protection Agencies:



This first graph shows us that there are many open questions to littering. First of all, it seems unclear how littering can be measured and which method should be used. Second, the question how behavior can be influenced to counteract littering is unclear. Information exchange on littering and littering prevention (think nexus consumer, producer, and waste infrastructure) is another important topic, followed by the lack of a common definition of the term littering. Also, EPAs are wondering how the costs of littering can be split between municipalities and producers. Lastly, the main sources of littering are not clear.

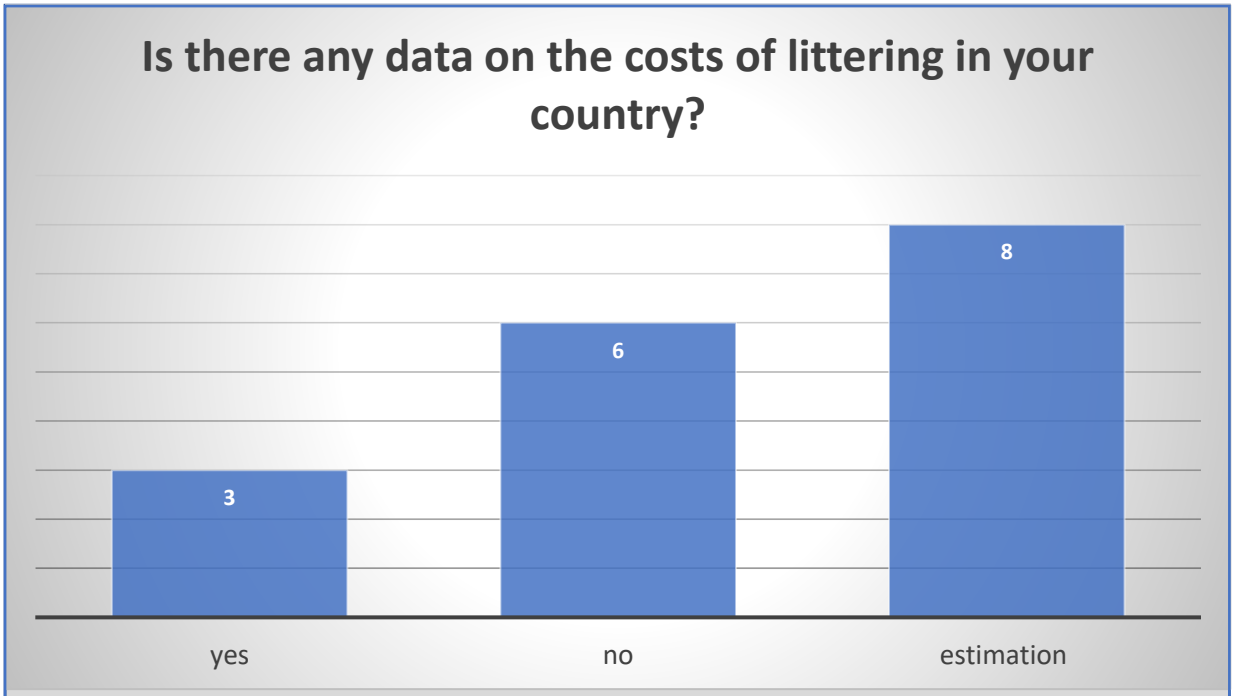


This graph shows the most littered items in different countries. Even if there are numbers from cleanups on which this compilation is based, it should be considered as an informed estimation, as there are always items escaping collection. However, the replies show that mostly smoking-related waste seems to be littered, followed by beverage packaging and packaging from the take away sector.



This figure shows which areas are assumed especially prone to littering. As the previous graph, this should be read as informed approximations, as an all-encompassing monitoring covering the whole country is usually not in place[39]. However, almost all respondents name roads and highway outlets as especially prone to littering, followed by city centers and recreation areas / parks. Four respondents said that rural areas and public transport related areas, such as tram stations, are often littered. Smaller numbers think that the proximity of waste bins is an area where littering frequently occurs (either because (household) waste is discarded close to bins, or because waste bins are overly full), as well as parking lots or service stations and retail outlets.

[39] The efforts put in monitoring vary considerably between different countries. Some, such as the Netherlands, have more data, while others (most) have no systematic approach whatsoever.



EPAs were also asked "Are there any estimations of the costs of clean up littering available? Maybe local figures or estimations at national level? And who pays for it?". Three said yes, we have data at some level. If elaborated, this info mainly refers to the cleaning costs of municipalities or estimations from NGOs. 6 said no, we do not have any data, and 8 said that there are estimations, but no reliable information.

4.1 "Without packaging, (people) would have nothing to drop"[40] – who is responsible for littering?

The opening statement of the study "Littering Behavior in America" claims: "Like many social problems, litter is caused by human behavior. Whether intentional or accidental, litter begins with the individual"[41]. But is it actually true that littering *begins* with the individual? Roper et al. take a different stance: "Litter is one of society's problems but, to date, manufacturers successfully distance themselves from the problem their packaging causes. (…) Once products have left factories, warehouses or retail outlets, the whole supply chain absolves itself of any further responsibility"[42]. The authors emphasize that campaigns such as *Keep America beautiful* have actually been established by manufacturers, and not, as one may assume, by environmentalists – and they cleverly shift the blame towards the consumer and distract from the share of responsibility producers have in littering (ibid.).

[40] Roper et al. 2013.
[41] Schultz et al. 2009.
[42] Roper et al. 2012.

A relatively new tendency in environmental surveys might help balancing this picture, as increasingly, not only amounts of litter by product type are surveyed, but also by brands. For example, according to *Keep Australia beautiful*, in 91% of the towns surveyed, empty Coca Cola- cans were found, and McDonald's was the second most common brand littered – a finding similarly observed in a UK survey[43]. This data shows that some brands, possibly representing a certain lifestyle (such as on the go- consumption), produce products more prone to littering than others[44]. Whether it is the target group the producers aim their marketing activities at that tend to litter more than others, or specific product characteristics, should be subject to further investigations.

In any case, it seems to be high time to recognize the producers' share of responsibility in relation to littering and to discuss the options on hand to limit littering at the source, i.e. the production. This should obviously not lead to neglecting additional factors. Indisputably, littering cannot occur without a product to be littered and an individual who litters. Despite this dyad, in literature and many initiatives against littering, the clear focus lies on the littering individual, while the influence products have is neglected. This is important as it implies that

- In order to fight littering, measures only need to address the individual level, and

Focus: Coffee to go- cups

A current study of the German Environment Agency (see https://www.umweltbundesamt.de/en/press/pressinformation/go-for-the-reusable-not-the-disposable-when-it) estimated that every ear, 2.8 billion tons of cups for hot beverages are used, which corresponds to about 34 cups per person or 28.000 tons of waste. The majority of these cups consists of plastic-coated paper cups. To this, 1.3 billion plastic lids can be added – plus a yet unknown number of cups and lids for cold beverages, which typically also come with straws. The cups for hot beverages alone fill about 8 billion typical communal waste bins. Due to the high volume quickly filling waste bins and the light weight of the cups, they often result as litter in public spaces – there is a reason that cups are among the top 10 most littered items at European beaches.

The study proposes for the to-go sector to switch from single-use cups to a system of multi-use cups, including multi-use lids. Those who use single-use cups should contribute to a littering fund responsible for clean-up measures and information campaigns.

According to the study, these measures could lead to a reduction of the use of cups and lids of 50% within three years. Should the proposed voluntary approach in cooperation with retail not be successful, mandatory regulatory measures should follow.

[43] For detailed references, see Roper et al. 2013.

[44] However, the frequency of brands littered obviously also depends on size of the company and the number of countries in which products are put on the market.

- Being solely responsible for littering, only the consumer who should pay for cleanup measures.

This one-sided framing should be questioned in light of recent research.

EPS packaging for hot food in France, ©Loic Lejay

Often, single-use products and packaging are blamed for being littered often. However, a small fraction of literature goes one step further and asks about the role of product design in littering. It seems that the product design plays an important role in the likeliness of a product to be littered. One study found that "many people consistently littered some objects but binned others"[45]. For example, while PET bottles are often reused, as they can be opened and closed again and used multiple times to carry liquids, food wrappers, especially when they are messy, are more frequently littered.

Therefore, changing the design of a product towards enabling multiples uses may have considerable impact of its risk of being littered. This hypothesis is substantiated in small experiments[46]. Consequentially, design guidelines could help design products in ways making them less prone to littering, such as giving the packaging a second function after use (such as Coca Cola's albeit questionable attempt "2nd lives"[47]), including the option of re-closing the packaging, prevent lids and other parts of the packaging to get loose from the package[48].

In the Netherlands, a checklist for designing products was developed to prevent littering. It includes five key aspects:

- Prevent loose parts;
- Make sure the packaging can be closed;
- Ensure clean and compact storage of packaging after use;
- Provide clear instructions for use and disposal; and
- Adding an anti-litter text[49].

With focusing on the consumer and individual littering behavior, producers are whitewashed from its contribution to the problem of littering. However, individuals also seem to find ways to distract from their role in littering. Hing at al. report that in Malaysia, "ensuring urban cleanliness is one of the primary responsibilities of a local authority"[50], resulting in a somewhat ill-

[45] Wever 2003.
[46] Wever 2006.
[47] https://www.theguardian.com/media-network/media-network-blog/2014/jun/12/coca-cola-2nd-lives-caps-recycling.
[48] All following Wever 2006.
[49] Fenn et al. 2016.
[50] Hing et al. 2012, p 1.

led justification to litter by referring to the rates paid to cover the clean-up costs of local authorities (ibid). This justification of littering behavior is certainly not exclusive to specific regions.

In the EU Directive on the impact of certain plastic products on the environment, the EU is aiming at holding producers accountable for their responsibility in littering via an extended producer responsibility (EPR). This EPR scheme includes clean up, transport, and treatment of certain litter, as well as awareness raising campaigns to inform consumers about the negative impact of littering. The EU waste directive backs this by stating "[t]he fight against litter should be a shared effort between competent authorities, producers and consumers. […] [P]roducers should promote the sustainable use of and contribute to appropriate end-of-life management of their products."[51]

Beverage can close to the river Rhine.

Basically, EPR schemes can contribute to internalizing externalities of to go-consumption and single-use packaging. Producers should seize the opportunity, as Roper et al. claim that "(t)he colours and font of Coca-Cola (…) are still recognizable when the can lies discarded in the gutter. Is it actually in the interests of the brand (…) to have such brand messages communicated in what could be viewed as free advertising space?"[52].

[51] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, recital 34: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.150.01.0109.01.ENG.

[52] Roper et al. 2012, p. 12.

4.2 Does *to go* mean *to throw*? The role of a changing lifestyle

Apart from others, one factor often used to explain littering is an increase in to go-consumption, single-use packaging and single portions packaging. Therefore, we will take a look at recent data on societal trends in this paragraph.

A recent study in Germany explores the development of waste composition and noticed a significant increase in single-use tableware and to go-packaging[53]. This includes plates, boxes, bowls, and pizza boxes. Outdoor food stands as well as system gastronomy contribute with about 1/3 to single-use tableware and on the go-packaging. Gas stations, vending machines, festivals and hot food counters also contribute considerably. In total, the amounts of waste generated through these product groups amount to almost 350.000t. In terms of weight, the majority is paper, cardboard and carton (64%), with plastics being an important contributor to the total quantities (30%). What is alarming about these numbers is that most of the products are consumed in outdoor areas, making them prone to be littered.

Focus: Paper & Cardboard vs. Plastics

For many, products and packaging made of paper or cardboard seem to have a "greener" image than plastics. Correspondingly, *litter* is often equaled with *plastic* litter. While the persistence of plastics is undoubtedly a serious problem, the perception that paper is always the better choice does not hold true. In the manufacturing process, substantial amounts of chemicals are used to produce paper and cardboard packaging. In addition, the very high amounts of energy and water required negatively impact the environmental footprint. Due to the heavier weight, paper and cardboard often require more energy in transport as well.

It is hard to make the right choice between two suboptimal solutions for the environment – therefore, reducing the consumption altogether and saying no to useless packaging is the right way to go. And obviously, neither plastics nor paper should ever end up as litter.

[53] NABU 2018.

The authors assume that increased wealth contributes to an increase in eating out and fast food consumption, which adds to an increase in packaging. Additional factors are an increase in commuters, more single households, and increased use of delivery services via internet. Compared to many single-use applications, multi-use solutions are often more expensive, less available and therefore less used, even when foods and drinks are consumed in-house (as is the case in many fast food restaurants and coffee shops).

While this study looked into the developments in Germany, similar trends are likely to occur in other European states as well.

Plastic gloves at a gas station. ©RWS

4.3 Flagrant flippers and young male smokers – is there a prototype litterer?

Compared to investigations of the environment and the products littered, the individual litterer is no stranger to research. However, before jumping into the literature, it should be highlighted that some studies rely on observation (sometimes in situ, sometimes in experiments), others rely on questioning. These latter studies mostly address questions of attitudes towards littering. Obviously, questioning individuals bears the risk of bias, triggered for example by reporting socially acceptable behavior. Because of these shortcomings, these kinds of studies will not be the focus of this paragraph.

A prototype litterer is a young, slightly more frequently male than female, smoker under 19, being outdoors with no trash can in sight. While this characterization is unjustly over generalized, understanding who litters and why is important in order to develop suitable measures to reduce littering. In short, the answer is

> *"The explanations of why individuals litter vary, but a study of litterers in public locations in the USA found that younger people littered more than older people, males more than females, that proximity of a trashcan was associated with a reduction in littering rates, and that previous presence of litter in the environment was associated with an increase in littering rates"*[54].

There seems to be little variation on these findings across time. Age wise, younger people below 19 seem to be most likely to litter. One explanation is that they "want to express their

[54] Ojedoku et al. 2013.

independence and nonconformity; and […] by littering, young people express their disregard for rules, while, at the same time, building an us-vs-them identity, clearly separating themselves from the rest of the society […]"[55]. This behavior seems to be even likelier when young people are out in a group of peers, possibly in a boisterous mood for one reason or another. A study from Germany concludes that the age group between 19 and 30 is most prone to littering behavior[56]. This, again, shows different estimations of the same context; but even if the age cohorts differ, there seems to be agreement that in general terms, there is a tendency that younger litter more than older people.

While gender is often assumed an important factor leading to littering, at least one study concludes that this might be a false claim – males do not litter more often, but may be more honest in reporting their littering behavior[57]. Beside the characterization of the individual, also differences in littering behavior can be identified. Kolodko et al: "Some people litter only occasionally, when circumstances force them to do so, and may be embarrassed or ashamed when they do. Some litter based on a conscious cost-benefit analysis; there are some for whom littering is a conscious anti-social" act; and some litter habitually and unthinkingly"[58].

Already touched upon earlier, the previous presence of litter seems to be another large factor influencing the decision to litter: "The difference is often as much as 2-3 times as much litter in dirty environments"[59]. This is often phrased as "litter begets litter", based on the broken window theory. Hansmann et al. explain that litter present sets a norm for littering – it is OK to do something otherwise not socially accepted[60].

Alongside the condition of the physical surroundings, another personal factor seems to play a role in littering behavior: social and personal norms. In general, the concern for littering seems to have increased since the 1950s. Overall, in the US, the majority of littering behavior is a result of individual (85%) instead of contextual variables (15%) (attitudes vs. previous litter)[61]. This is bad news for all those believing in putting up more trash cans will solve the problem of littering. In addition, influencing individual behavioral aspects can be much harder than optimizing the infrastructure. On the other hand, this brings the contribution of producers in focus – if items are produced in such a way that less littering can occur, then behavioral aspects only play a minor role. Turning the argument around: If motivation is intrinsic, then measures that aim at changing the environment will be less effective. This means that the product design itself has to change in order to have an impact.

[55] Kolodko et al. 2018.
[56] Van der Meer et al. 2018.
[57] Lead author being a male individual, Wesley Schultz et al. 2013.
[58] Kolodko et al. 2018, p.7.
[59] Schultz et al. 2013.
[60] Hansmann et al 2003.
[61] Schultz 2013.

4.4 Cigarette butts

Among the spectrum of littered items, cigarette butts constitute a specific problem.[62] "[D]iscarded cigarette butts increase litter removal costs, detract from the appearance of towns and cities, pose fire and safety risks, and are an environmental problem in that butts can be washed into waterways and marine areas, where they pose risks to aquatic life"[63]. They contain around 7000 chemicals, of which some are toxic, such as cadmium, lead and zinc in concentrated form[64]. In addition to the toxicity, in many countries, they are estimated to be among the most littered items containing plastics.

Cigarette butts in front of an apartment building.

The World Health Organization estimates that "up to two-thirds of every smoked cigarette discarded onto the ground, between 340 and 680 million kilograms of waste tobacco product litters the world each year"[65]. One study from 2012 shows that of 219 observed smokers, 76.7% littered the butts, while there was a mean of one bin every 24m on the pavements (3.5 bins visible respectively)[66]. A study in the US came to the result that 65% of the smokers observed littered the butts, most likely on the ground (drop with intent)[67].

Comparable to general littering behavior, also cigarette butt littering seems to be mostly rooted in individual variability (62%) instead of contextual variables (38% - note: higher value for cigarette butt littering than general littering). Similarly, younger individuals were more likely to litter than older ones. While the insight that presence of previously littered butts leads to more littering is consistent with littering in general, an interesting correlation was found between the presence of ash receptacles (not any, but specifically ash receptacles) and cigarette butt littering. Smokers seem to be value attending to their specific needs. Curtis et al, however, question this correlation and say that such approaches "should be recognised as downstream solutions to an upstream waste problem; they put the blame for TPW onto end users rather than to the manufacturers of a product that generates toxic waste once used. This is a 'blame the victim' response, not a source-based approach to waste reduction and prevention"[68].

[62] https://www.kabc.wa.gov.au/report-littering/cigarette-butts.
[63] Patel et al. 2012, p.1.
[64] Curtis et al. 2016.
[65] Novotny et al. 2017.
[66] Patel et al. 2012, p. 60.
[67] Schultz et al. 2013.
[68] Curtis et al.2016, p. 114.

Also, one study shows that cigarette butt littering often occurs at transition points – "areas where smokers must extinguish a cigarette before proceeding, such as outside retail stores, hotels, office buildings; before entering beaches, parks or other recreation areas; and at road-side rest areas, parking lots, bus shelters, and train platforms"[69]. In Australia, a study on cigarette littering found that smokers

- "do not believe littering their cigarette butts is inappropriate behaviour;
- Consider dropping butts into gutters or storm drains as a safe way to extinguish a cigarette; and
- Blame their littering on a lack of well-placed bins for cigarette butts"[70].

Despite the fact that cigarette butts are so frequently littered, they are not perceived to be among the category of "offensive litter", which for example beer cans are, or even litter at all[71]. One reason might be that many believe "[t]hey [cigarette butts] tend to squash up in the rain and disappear"[72] – either because they are small items or in the wrong belief that they are easily biodegradable.

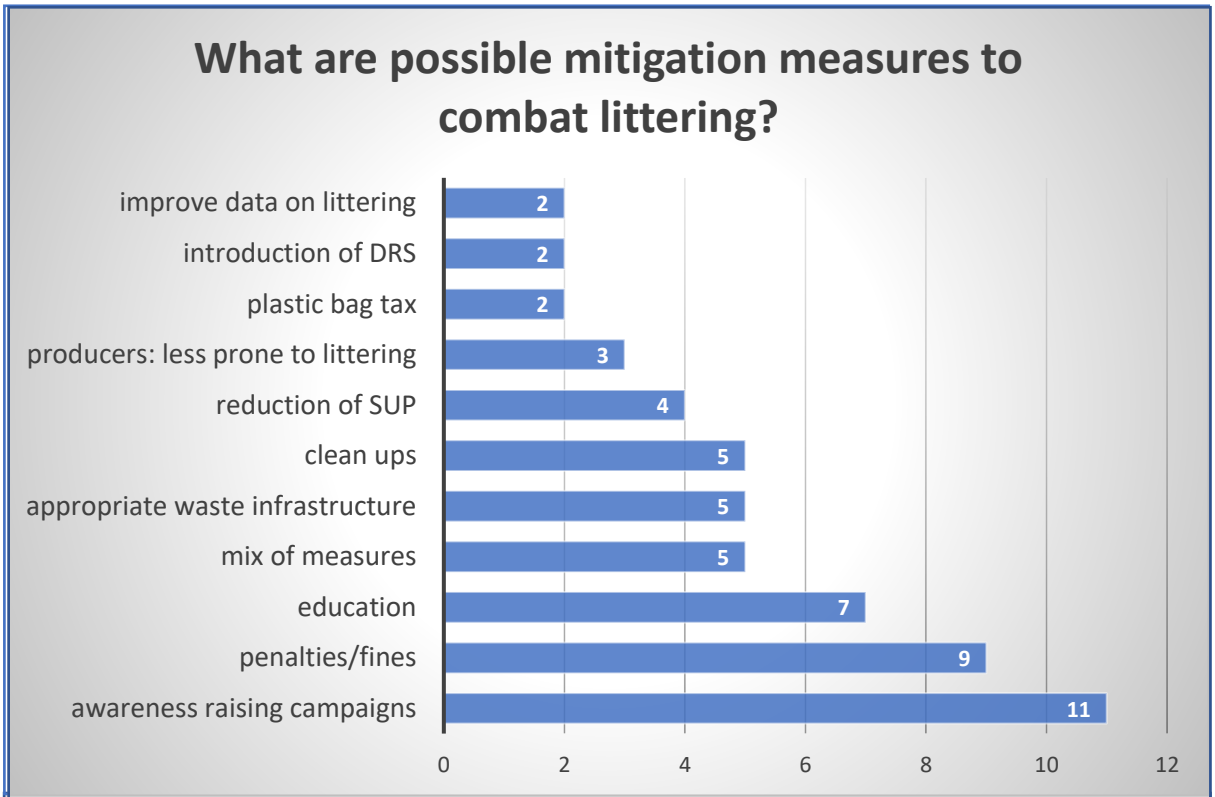
In many EU countries, laws to protect non-smokers are in place, often prohibiting smoking indoors, such as in bars and restaurants. This frequently leads to an increase in smoking outdoors, associated with increased volumes of cigarette butts littered on the street. In light of the above, unambiguous and well-placed signs emphasizing the negative impact of littered cigarette butts as well as sufficient and clearly visible ashers are especially indispensable where outdoor smoking occurs.

5. What are possible mitigation measures?

Mitigation measures can be broadly distinguished in measures targeting the individual, products, or specific situations. They are not always clearly separable (such as fines, which are a means to influence behavior), but roughly include:

a) Measures targeting **behavior** (such as educational measures, awareness raising measures, or deposit refund-schemes);
b) Measures aiming at **preventing littering** (such as product design or measures targeting waste infrastructure, such as more or better bins);
c) **Clean up measures** (which are necessarily end of pipe solutions);
d) **Financial measures** (such as fines).

[69] Fenn et al. 2013.
[70] Keep Australia Beautiful, cited according to https://www.kab.org/cigarette-litter-prevention/common-misconceptions.
[71] https://www.keepbritaintidy.org/sites/default/files/resources/KBT_CFSI_The_Big_Litter_Inquiry_Report_2013.pdf.
[72] Cited after ibid., p. 7.



Asked about possible mitigation measures against littering, awareness raising measures was mentioned most often. Nine respondents mentioned fines (which are in place in many countries, but not often enforced due to lacking capacities), followed by educational measures. Five said that a mix of measures would be the most promising approach, the same number proposes an appropriate waste infrastructure. The producer's side was addressed by claiming that a reduction of single-use plastic products would be effective (4) as well as products designed to be less prone to littering. Deposit return-systems were only mentioned twice. Overall, it was obvious that some countries have by far more encompassing approaches to combat littering in place than others. Information exchange on which measures work best in which context is likely to be highly beneficial for all EPAs.

The importance of awareness raising or educational measures seems to be well rooted in scientific studies, as over 80% of the littering behavior is influenced by individual characteristics. However, studies also show that normative messages should be avoided, as they might, contrary to the intended effect, lead to increased littering rates[73].

[73] Schultz et al. 2013.

Instead, motivational messages should be promoted. As most people believe that littering is wrong, enforcing this belief seems to be promising. Likewise, social disapproval can have a strong influence, which some initiatives make use of (as supported by analyzing the power of *watching eyes*[74]).

Many countries have laws against littering, but only little enforce them actively. Wever points out that the effect is often minimal, as a punishment realistically is not consequential of littering[75]. Singapore is a prominent exception, where the high fines and high enforcement rates have contributed to cleaner streets[76]. This, however, is not a path many countries seem to choose. In general, fines or other sanctions are perceived to have mixed effects.

Awareness raising measures, such as Adopt a Highway, seem to have positive effects on reducing littering[77]. In general, communication is one of the best-researched strategy in literature[78]. This can include prompts on site, different phrasings of these signs (requests or orders), or more general campaigns (such as Keep America Beautiful etc.). There are several studies investigating the phenomenon of psychological reactance, meaning that normative commands (such as "Do not dare to litter!") are less effective than appealing to internal normative standards, such as "Help to keep our environment clean".

Focus: high penalties, low littering rates?
Insights from Singapore and Japan

Singapore is often referred to as a prime example of cleanliness, which is attributed to strict enforcement of high financial penalties. It is often called upon as a role modern for other countries as well. The practice is accompanied by comparatively low educational activities. In 2011, a study compared the Singapore approach with Yokohama, Japan, where an ambitious plan to reduce waste from 2001 to 2010 by 30% was implemented (Ong et al., 2011).

The authors found out that the underlying approaches vary considerably: while in Singapore, responsibility for littering and removing litter lies on the individual, in Yokohama, the act of cleaning is perceived to be an honorable task and waste is perceived as an asset. Cleaning and sorting waste are incorporated in curriculae early on, creating a sense of community and shared responsibility.

The study shows that the littering rates in Singapore have gone up despite the draconic penalties, while in Yokohama, they are dropping while keeping the costs low as well.

These results indicate that it takes more than only high fines to achieve a sustainable reduction of littering rates. It seems that for an approach to be successful in reducing littering, it should tackle different spheres of life, calling upon a culture of careful handling of resources and the communal spirit.

[74] Studies have shown that "People behave better when they are being watched, even when the watcher is a picture of staring eyes placed on a litter bin or a wall", Kolodko 2018 p. 11.
[75] Wever, 2006.
[76] Whether these measures have lasting effects is questionable though. Recently, littering offences have gone up, which led to penalties that are even more drastic. See https://www.straitstimes.com/singapore/environment/litterbugs-going-out-of-fashion-as-nea-turns-to-tech-issuing-7000-more-fines.
[77] Schultz et al. 2013.
[78] Wever, 2006.

Litter begets litter[79]

Litter already present in an area leads to more littering – this observation is quite consistent among many studies[80]. It is also a consistent finding over the years, with early studies dating back to the early 1970s[81]. Regular clean ups and other "beautification" measures therefore seem to have promising, as Wever calls it, antecedent effects[82].

Design of trash cans

Also, the appearance of trash cans seems to play a role in reducing littering. The more noticeable they are, such as bright colors, footpaths leading towards them, or funny statements printed on them), the more likely they are to be used[83]. De Kort describes this as "norm-activating design"[84]. Also, the distance towards the nearest trash can plays a role in the likeliness of littering, studies say. The further away the next trash receptacle is, the more likely people are to litter their trash. This is especially true for cigarette butt littering.

In general, studies suggest that the local context should always be taken into account and that local communities play a crucial role in combatting littering[85].

Newer approaches, such as the litter count app Litterati[86], may have potential to raise awareness on the problem of littering and to gather data and insights in littering behavior and its effects. This research potential should not be wasted.

Trash can saying "Fill me up" in German.

[79] This term is derived from the broken windows theory by Wilson and Kelling 1982 (Weaver 2015).
[80] See e.g. Curnow et al. 1997.
[81] See Crump et al. 1977. However, this study concluded that the hypothesis of litter begets litter might be more relevant in urban areas than in forest environments.
[82] Wever 2006.
[83] Schultz et al. 2009.
[84] De Kort et al. 2005.
[85] Schultz 2013.
[86] https://www.litterati.org/.

Focus: Biodegradable plastics – a solution to the problem of littering?

Plastic litter is especially worrisome because of its long persistence in the environment. Some believe that biodegradable plastics might add to solving the problem of littering. However, the IG Plastics highlights that the fast degradation of these materials in different environmental compartments and geographical regions cannot be guaranteed at this point. Therefore, the IG Plastics advises against the use of biodegradable plastics for products especially prone to littering, such as single-use plastics, unless they are collected and treated separately.

For further information on this topic, see also IG Plastics report on biodegradable plastics:

http://epanet.pbe.eea.europa.eu/fol249409/ig-plastics/working-paper-biodegradable-plastics.

6. Member states mitigation measures

All EPA Network members were asked to present their mitigation measures here. This is a non-exhaustive list, but includes all responses received from the participating members and represent their opinion. The examples do not necessarily reflect the general opinion of the Interest Group on certain subjects.

Austria

BACKCUP - the returnable Coffee-to-go-Cup of the city of Graz[87]

According to an analysis by the City of Graz's Department of the Environment in 2017, around 1,000 disposable cups are wasted every day in the city center of Graz.

In cooperation with two companies, the Environmental Department developed the "BackCup" returnable cup in 2018. For a deposit of € 1, - the cup can be purchased and returned to all participating partner companies (unwashed). The participating companies can be recognized by a sticker on the door.

For the time being, 3,000 uniform BackCups (content 0.4 liters and 0.25 liters) were procured, and step by step more, if necessary.

The cup is made of polypropylene and can be cleaned by any company even in the dishwasher (with over 80 degrees) or is picked up by an own company (Alles Event) which washes the used cups and brings them back clean.

In November 2018, many companies already participated at 41 locations. Now, of course, it is important that as many companies as possible participate in this project, so that the return of the cups is easier. Some companies in Graz even offer discounts if you bring your own cup and avoid waste.

England

In England, the Litter Innovation Fund[88] is a £450,000 programme, funded by the Department for Environment, Food and Rural Affairs (Defra) and the Ministry of Housing, Communities and Local Government (MHCLG). The overall aim of the programme is to find new ways of reducing and preventing litter/littering through new methods and interventions that have not been tried and tested before. The programme will award small grants of up to £10,000 to support innovative research projects (located in England only) that have the potential to be scaled up or replicated more widely.

[87] https://www.umwelt.graz.at/cms/ziel/9274928/DE/.
[88] http://www.wrap.org.uk/content/litter-innovation-fund.

Germany

In Germany, a deposit return-system for certain reusable glass as well as reusable and single-use PET-beverage bottles and cans exists[89]. The introduction of the system for single-use beverage bottles and cans in 2003 has led to high return rates of over 95% and little presence of these cans and bottles in the environment.

Recently, different initiatives at communal, regional or federal level offer deposit-return schemes for reusable coffee to go-cups, which are increasingly used in Germany (currently 2.8 billion cups per year for coffee alone)[90]. These systems on the one hand lead to less material use, on the other hand, they reduce littering. Since April 2019, reusable cups charged with a deposit can be certified with the Blue Angel, the German Ecolabel.

Another example is Berlin City Cleaning (Berliner Stadtreinigung, BSR[91]), who is regularly updating its measures and campaigns to help ensure the correct disposal of waste and reduce littering. As one of the first cities in Germany, BSR introduced waste bins with ashers permanently attached to them. As studies have shown, smokers feel are more willing to dispose of their cigarette butts in these specific receptacles. These measures are accompanied by other nudges such as drawings on the pavement, guiding the steps of pedestrians towards bins.

BSR is also known for the design of the waste bins, which stand our because of their bright orange color and the short humorous messages applied to them. They draw the attention of passers-by to the bins, luring them closer, which increases the use of the bins and decreasing littering. One example is this bin on the right that says “I do the dirty work” (© BSR).

[89] See http://epanet.pbe.eea.europa.eu/fol249409/ig-plastics/working-paper-deposit-return-schemes-data-and-figures-16-epa-network-members.
[90] See https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-02-20_texte_29-2019_einweggetraenkebechern_im_ausser-haus-verzehr_final.pdf.
[91] https://www.bsr.de/.

According to the company, what makes the campaigns successful is that they are often at the right time in the right place, reflecting big events or other current developments.

The designs also vary according to different quarters of the city, responding to specific needs and strengthening the identification with the neighborhood. This encourages people to keep their quarters clean.

One example is the wordplay on this picture, a mixture of *Reinickendorf* (one of Berlin's neighborhoods) and *reinlich*, meaning tidy and clean (© BSR).

In addition, BSR supports voluntary clean up activities by providing equipment and the web platform for organizing the events[92].

According to BSR, the company is perceived as part of the city and its communities, and assume that their campaigns have lasting educational effects in changing the behavior of Berlin's citizens. This shows for example in numbers of followers of BSR on social media channels.

Italy

Fourth Part of Legislative Decree N° 152 of 2006 (Italian waste framework legislation)

1) Article 226-bis (Marketing ban for plastic carrier bags)

Marketing of lightweight plastic carrier bags is forbidden. It is also forbidden to market other plastic carrier bags not complying with certain features (e.g. presence of an internal/external handle, minimum thickness of each wall, minimum percentage of recycled plastic supplied, as packaging for transportation, in shops, with a distinction between food shops and other shops). Biodegradable and compostable plastic carrier bags can be marketed. Anyway, they cannot be distributed for free and their selling price shall be displayed on purchase invoices issued for the sale of goods to be carried in them.

[92] https://www.kehrenbuerger.de/.

2) **Article 226-ter (Marketing restriction for very lightweight plastic carrier bags)**

It is initiated the progressive marketing reduction of very lightweight plastic carrier bags different from those having the following characteristics, certified by accredited bodies:

a) biodegradability and compostability according to UNI EN 13432:2002;

b) minimum content of renewable raw material varying according to specific deadlines (40% by 1st January 2018, 50% by 1st January 2020, 60% by 1st January 2021).

Very lightweight plastic carrier bags cannot be distributed for free and their selling price shall be displayed on purchase invoices issued for the sale of goods to be carried in them.

3) **Article 232-bis (waste from smoking products)**

- The abandonment of smoking product butts on soil, in waters and discharges is forbidden.
- Obligation for municipalities to install in roads, parks and other public places specific collection systems for smoking product butts.
- Obligation for smoking product producers to carry out, in collaboration with the Ministry for the environment, information campaigns on the impacts of abandoned smoking product butts in the environment.

4) **Article 232-ter (ban of abandonment of very small waste)**

The abandonment on soil, in waters, in storm drains and in discharges of very small waste, like receipt slips, paper tissues, chewing gums, is forbidden.

5) **Article 255 (waste abandonment), paragraph 1-bis**

- Fines are envisaged for the violation of the above bans.
- Fines vary from 30 to 150 Euros for the abandonment of very small waste and are increased up to the double in case of abandonment of smoking product butts.

6) **Article 263 (revenues from fines), paragraph 2-bis**

50% of fine revenues is destined to the Ministry of environment and 50% to municipalities where breaches are registered. These revenues are destined to implement provisions and initiatives to fight littering, including information campaigns at national and local level and cleaning of urban wastewater collecting systems.

7) **Ministerial Decree of 15.2.2017**

It lays down detailed provisions on the use of the above fine revenues. Among others, specific requirements are set for:

- Information campaigns at national level;

- Information campaigns at local level;
- Installation of waste bins for smoking product butts.

Regarding, in particular, waste bins for smoking product butts, it is envisaged that on each bin, compatibly with its characteristics, information shall be displayed which concerns environmental impacts of the abandonment of waste from smoking products and applicable fines in case of their abandonment. The bins that are permanently installed in outdoor areas and, therefore, subject to atmospheric agents, shall be wear-resistant and equipped with cover systems in order to prevent water from entering them.

Portugal

Work in progress

1) Resolution of the Council of Ministers no. 141/2018, of October 26

Approves measures to promote a more sustainable use of resources and the adoption of circular solutions in Public Administration, particularly regarding plastic products, such as:

- Ban of purchasing/using single-use plastic products (ex: disposable tableware);
- Ban of using single-use plastic bottles (except for vending machines);
- Replace plastic bags with recycled paper bags (except bags for common trash).
  - A Good-Practice document has been prepared in the context of the Resolution.
  - Evaluation of compliance with the measures provided for in the Resolution has to be submitted to the Assembly of the Republic by January 31, 2020.

2) Circular Agreements

In 2018/2019, Circular Agreements were signed for the efficient use of plastic in the value chain, between APA and the following sectoral Associations:

- Associação Portuguesa das Bebidas Refrescantes não Alcoólicas (PROBEB, Portuguese Association of Non-alcoholic Refreshing Drinks),
- Associação da Hotelaria, Restauração e Similares de Portugal (AHRESP, Association of Hotels, Restaurants and similars of Portugal),
- Associação Portuguesa dos Industriais de Águas Minerais Naturais e de Nascente (APIAM, Portuguese Association of Natural Water Industrie),
- Associação Portuguesa de Empresas de Distribuição (APED, Portuguese Association of Distribution Companies).

Under the Agreements, a commitment was made to achieve by 2025:

- 90 % PET bottle collection rate, anticipating the target foreseen in the SUP Directive, and
- 25 % incorporation of recycled PET in new bottles.

3) Law no. 69/2018, of December 26

Until 31 December 2019, an incentive system is implemented, in the form of a pilot project, to encourage the final consumer to return of non-reusable plastic beverage containers;

From 1 January 2022, a mandatory deposit-refund system for non-reusable plastic, glass, ferrous metals and aluminium beverage containers should be in operation.

- In January 2019, a Working Group including several stakeholders was set up with the purpose of issuing recommendations for the implementation of incentive and deposit-refund systems. The WG intends to present its proposals during June.
- The criteria of the incentive system are defined by Ordinance to be published until 27 June.

4) European Economic Area Financial Mechanism: EEA Grants 2014-2021

Programme Title: Environment, Climate Change and Low Carbon Economy
Programme Operator: General Secretariat of the Ministry for Environment
Donor Programmme Partner: Innovation Norway (IN)

Priority areas:

- Deposit-return solutions for plastic bottles (and cans)
- Solutions for re-using plastic bottles
- Solutions for producers to use recycled plastic bottles (and cans)
- Solutions for treating and recycling plastic bottles (and cans).

Sweden

Government	The government has a special focus to reduce plastics in the sea and in nature, which also includes prevention of microplastics in the environment. Within this initiative, the Swedish Environmental Protection Agency has awarded grants to coastal municipalities to support beach cleaning. The SEPA also cooperates with the foundation *Keep Sweden Tidy* for information campaigns for the public about the negative impact of plastics on the environment and to raise public awareness.
Municipalities	Two good examples are from Gothenburg and the municipality of Vellinge regarding nudging. For example, the municipality placed large models of cigarette butts on trash bins that had ashtrays, and green foot prints were painted on the ground, leading towards the trash cans. The aim was to increase the probability of people throwing garbage in trashcans instead of on the ground. Also, trash bins with the opportunity to vote on a current issue were produced. In addition, they handed out small cans for cigarette butts for smokers to be used as ashtrays. These

	where handed out at the same place where cigarettes are sold. In combination with this, simple information material was also produced to raise awareness of the littering problem. The results from both municipalities show that littering has decreased as littering was monitored before the tests and after.
Legislation	In Sweden there is a national deposit system for PET-bottles and aluminum cans for beverage packaging. By putting a value on the packaging, there is an incentive for the consumer to return the packaging after consumption, which reduces the risk of littering. In Sweden, 84% of all the PET-bottles were recycled in 2016. Sweden has introduced an information requirement for plastic carrier bags. Anyone who supplies plastic carrier bags to consumers must inform about the environmental impact of the plastic carrier bag (especially in the context of littering) and how to reduce the consumption of carrier bags. The use of plastic bags has decreased and information about the impact of carrier bags and other plastics has increased among the public. A good example that shows that with the public´s commitment and with information we can come a long way. Both an example for information on littering but also a reduction of the consumption of unnecessary plastic products. Littering is a focus area in the municipal waste plans for the municipalities to set goals and reduction measures. This has helped the municipalities to prioritize the work of litter prevention and cleaning.
Voluntary initiative	Some restaurants do not distribute disposable plastics, e.g. straws to the consumer, the consumer must ask for it. There are also those who charge for take-away packaging or reduce the price if the consumers bring their own take-away cup.

7. Conclusion

Looking at the literature, littering is a fairly new topic. Starting in the 1970s with a clear framing of littering as the result of misbehaviour of individuals, currently, there seems to be a paradigm shift towards recognizing the share of responsibility of producers to the problem of littering. This is fired by the European Commission's Directive on Single use Plastics, in which producers are tasked with encompassing efforts to fight littering of certain product groups.

Apart from a new impetus on awareness on and actions to combat littering, it is likely that the SUP Directive will also increase data on littering – especially on the amounts and products littered. The reason is simple: if producers are to pay for measures against littering, there is

an interest in measuring the success of these measures. Therefore, a strategy on monitoring is required and needs to be developed.

Additional data and information on littering are indeed urgently needed, as this paper is proof of. Literature paints a patchy picture of littering, starting from diverse definitions, to inconsistent explanations of the underlying behaviour, to different measures proposed to combat littering. This is also reflected in the replies of the questionnaire on littering distributed in the EPA Network. However, the analysis has also shown that uniformity of actions is not the key to less littering – instead, targeted actions, considering regional peculiarities, are required to take full effect. On the one hand, there seem to be specific legacies of littering, meaning that communal waste practices, age- and community-specific communication, cultural differences and product-specific approaches are needed in order to reduce littering. What should be harmonized, on the other hand, is a common understanding of littering, and the methods used to analyse and monitor littering. This enables us to communicate about littering, to learn from each other and to develop common strategies for less littering.

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