

# War on Waste: Waste Management Practices in Srinagar

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Report by Green Kashmir

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## **Aims**

This report highlights the current status<sup>1</sup>, effectiveness and challenges of existing waste management practices; waste legislation; and environmental awareness raising strategies in Srinagar. The report provides recommendations for more effective waste management, and can be used to inform and guide the development of local solutions to raise awareness, reduce waste, improve recycling rates and address litter blight more effectively.

In particular this report identifies:

- the scope and effectiveness of official and informal waste management arrangements, including collection methods and waste infrastructure;
- current practices and opportunities for more sustainable management of biodegradable waste;
- impacts of pollution and management options for waterways;
- effectiveness and enforcement of existing legislation in relation to litter; and
- public awareness of waste related issues and opportunities to build on awareness raising efforts.

The study draws mostly on primary research using semi-structured stakeholder interviews and discussions. A wide spectrum of stakeholders were interviewed to capture a representative cross-section of society:

- Srinagar Municipality Corporation
- Private businesses
- Waste management businesses
- Academics
- Media
- Religious leaders
- General public



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<sup>1</sup> As of September 2017. Research and interviews for this report were conducted during August and September 2017.

## 1. Context

Srinagar is the state capital and largest city in Kashmir, with an estimated population of 1.5 million in 2016.<sup>2</sup> The city has seen rapid expansion both in terms of population and area, due to significant rural-urban migration and unbridled urban sprawl, and is one of the 100 fastest-growing urban areas in the world.<sup>3</sup>

**Population:** 1.53 million (2016)  
**Population density:** 4,000 persons per sq km  
**Annual population growth:** ~4%  
**Area:** 294 sq km  
**Administration:** 35 wards  
**Religion:** 96% Muslim  
**Literacy rate :** ~70%



Image: *bloated remains of animal detritus dumped in Dal Lake, after the sacrificial Eid 2017.*

These changes have placed unprecedented strain on the environment, including severe impacts on the condition of local water bodies and growing problems relating to the management of municipal waste. Over the past four decades alone, the city's world famous Dal Lake, has lost nearly half of its surface area due to large-scale developments, deforestation and unsustainable land use changes in the drainage basin surrounding the lake. Other adjoining lakes which form an important network of waterways in the area have almost entirely disappeared. Water quality has also drastically declined and urban encroachment and deforestation in the water catchment has further increased the susceptibility of the area to flooding, as seen by recent disasters. The growing size and density of the city's population has exacerbated the problem of waste, as too have attendant levels of consumption. The impacts of litter and waste on the terrestrial environment are also becoming increasingly pronounced.

In contrast to other major cities in India, Srinagar lies in the heart of a rich and ecologically complex wetland ecosystem. The beauty of the city and surrounding region is a major lure for tourists and a source of pride, identity and recreation for locals. Tourism and agriculture are important pillars of the regional economy, both of which depend on the ecological richness and beauty of the landscape. It is vital therefore, for the future of the environment, the area's identity and vitality of the local economy that measures are taken to preserve and restore the landscape.

<sup>2</sup> Anon, 2017. *Population Of Srinagar 2017.*  
<http://indiapopulation2017.in/population-of-srinagar-2017.html>

<sup>3</sup> Parvaiz, 2017. *As Indian Kashmir's lush valleys turn to concrete, fears of flooding rise.*  
<http://news.trust.org/item/20170424010733-burer/>

Like other municipalities in India which are grappling with the challenges of rapid urbanisation, Srinagar will need to develop sustainable waste management solutions at both local authority and grassroots level and foster civic pride and greater environmental consciousness across all tiers of society. The growing profile of waste in Srinagar, including recent rulings by the National Green Tribunal (NGT) on the inadequacy of solid waste management efforts in the city, have highlighted the severity of the situation and the urgent need for a comprehensive waste management strategy.

## **2. Waste legislation**

A primary component effective waste management is the establishment of a strong legislative framework and an overarching strategic plan in relation to waste management. These mechanisms enable appropriate authorities and stakeholders to be held accountable for delivery and develop the most sustainable and socially beneficial solutions to waste. Waste management plans can help:

- set waste reduction and recycling targets;
- establish timeframes for delivery;
- define guiding principles to identify the most sustainable waste management solutions and assess trade-offs between competing options;
- estimate present waste volumes and projected waste streams;
- assess financial, expertise and technological needs; and
- identify stakeholders responsible for delivering different aspects of the waste management plan.

There is currently no coherent strategy, legislation or long term vision directing waste management in Srinagar. The municipality can benefit by looking to international examples of waste legislation.

### **2.1. Case study: waste legislation in the EU**

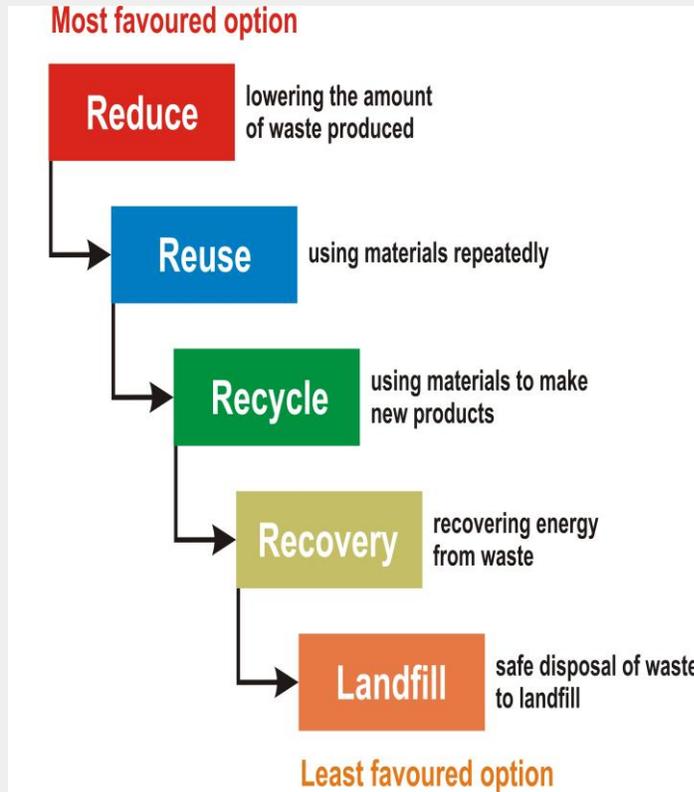
Waste management strategies adopted in the European Union are underpinned by strong legislation. The Waste Framework Directive is the central legislation which provides the overarching framework to guide the development of waste management policies.<sup>4</sup> The Directive lays down measures to protect the environment and human health by reducing the adverse impacts of waste generation and management; reducing the overall impacts of resource use; and improving the efficiency of such use.

The Directive is centred on the concept of a waste hierarchy, which ranks waste management

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<sup>4</sup> European Commission, 2016. *Directive 2008/98/EC on waste (Waste Framework Directive)*. <http://ec.europa.eu/environment/waste/framework/>

options according to their sustainability profile. Member States are expected to adopt measures to encourage options that deliver the best overall environmental outcome. According to the waste hierarchy, the direct disposal of waste such as landfilling is the least preferred option, as it does not extract any use or value from waste. Options that recover



some value from the waste in the form of energy through incineration, such as energy from waste (EfW incineration) facilities, are thus preferred to disposal, but are in turn secondary to strategies that reclaim even more value by extending the life of materials by recycling and processing. In the most advanced Member States, energy recovery is primarily used to capture energy from residual waste once recyclable materials have been fully segregated.

The most sustainable waste management options which authorities are encouraged to adopt, are those supporting reuse and waste prevention. By facilitating reuse, product life is extended further, saving scarce material and energy

Figure 1: EU waste hierarchy

resources, and reducing pollution. Ultimately if waste can be prevented altogether, such as through reducing excessive packaging and designing products such that they can be modified rather than disposed when old, significant amount of resources can be saved and pollution averted.

It is imperative that municipalities aim to move as high up the waste hierarchy as possible. The benefits of doing so are enormous, not simply in terms of a cleaner and healthier environment but also the material savings for businesses and financial savings for society at large. Municipalities such as Srinagar, that have yet to develop advanced waste management systems, in some ways have the advantage of learning from the experiences of other countries and benefitting from the latest waste management technologies and global thinking on sustainability. SMC should use these benefits to make the most sustainable waste management choices.



Figure 2: EU recycling rates (2013)

### **3. Household waste collections**

#### **3.1. Municipal door-to-door waste collections**

Household waste in Srinagar is largely managed through a combination of official collection rounds organised by the municipality and informal collection arrangements carried out by private operators.

Srinagar Municipal Corporation (SMC) has in place a door-to-door household waste collection service that is intended to reach all households in the city. In practice, municipal collections do not appear to cover all parts of the city. Residents in some neighbourhoods report that they have never received collections. Households in these areas tend to dispose of waste in communal makeshift dump sites in their neighbourhoods, from where municipal waste is collected. In other areas with no makeshift sites, waste is typically burnt or dumped anywhere that is convenient and unattended.

Door to door collections have been in place in Srinagar for around five years. This service does not exist outside of the city, where it is common practice for residents to dispose of waste by burning or communal dumping. SMC collects all residual waste from households for mechanical segregation and disposal at the city's landfill site in Anchan. The municipality does not require households to segregate rubbish at source in order to capture materials that can be recycled. Collection rounds typically take place twice a week, though residents informed that this service is not always regular.

The service is provided at a small charge to households, of one hundred rupees a month. It is not obligatory that households take up this service. Households that do not subscribe by

payment, are not in theory, eligible for municipal collections, although in practice the SMC has stated that it also tries to engage and collect waste from these households.

Our interviews suggest that the large majority of households participate in the municipal collection service, though a small but notable percentage, around 10 to 25 percent of households do not cooperate. The municipality is uncertain over the exact number of households that do not participate. The evidence indicates that these households continue to dispose of waste on street verges, communal areas and unattended private lands in their neighbourhoods.

Communal dumping is a major source of litter and waste pollution in neighbourhoods. The municipality insists that there are ongoing efforts to engage non-participating households and collect waste regardless of whether households have paid the service charge. It is not clear how sustained these efforts have been and whether they have helped to increase participation rates in the city.

Interviews with residents in different localities reveal that problems of non-cooperation are not restricted to poorer neighbourhoods alone (as would perhaps be expected). It is apparent that some households in relatively affluent areas have also not subscribed to municipal collections. Household motives behind non-participation are thus likely to be varied, and not simply related to a lack of affordability. Some residents, for example, expressed that they were not satisfied with the collection service provided by the municipality and felt that it was not sufficiently regular to be worth paying for. Households also mentioned that the price of collections was not in itself prohibitively expensive, but did not fairly reflect the quality of service they received.

There is no doubt that more effort is needed to engage with some segments of the population and alter entrenched behavioural patterns. Nonetheless the municipality also needs to understand the legitimate grievances of non-participating households and take steps to evaluate and improve the quality of its service.

### 3.2. Open waste burning: an unacceptable health hazard

Make-shift open burning of waste is widespread across the Valley (as across India), and remains a common way in which waste is managed informally by residents. This causes far more problems than it solves. Open combustion is unable to generate the levels of heat required to break down different types of waste completely. The partial combustion of materials such as plastics, which almost always results from burning in this manner, releases extremely noxious and carcinogenic fumes that are seriously damaging to health. Coupled with air pollution from vehicle exhausts and heavy industries in the Kashmir valley such as brick kilns and cement manufacturing, burning waste continues to exacerbate the decline in air quality in Srinagar and the Kashmir Valley.

The health risks of open combustion are clearly highlighted by international bodies such as

the World Health Organisation. In developed countries, waste incineration is only legally permitted in highly controlled indoor environments with stringent safety precautions and after treating emissions released from incineration. There does not appear to be any legislation relating to this issue in Srinagar either banning this practice outright or efforts to warn the public of the dangers of open combustion. The municipality must take urgent action to end this practice or sufficiently educate the population through high profile outreach programmes. A complete ban on open burning should however take into account seasonal considerations, as large amounts of biodegradable matter is burnt in the autumn months to produce charcoal for warming *kangris* (fire pots) over winter. There is however scope to promote more sustainable winter heating strategies such as improved design and insulation of homes<sup>5</sup>, solar thermal heating and more efficient biomass and wood fired stoves, which ultimately enables more biodegradable resources to be freed up for composting and food production. It is important therefore that the municipality supports the effectiveness of any potential future ban on open burning through parallel policies to promote alternative heating technologies.

### 3.3. Informal recycling collections

A critical waste management function is played by the informal network of private rag pickers and wholesalers who facilitate household and business recycling. This is a highly flexible and opportunistic system of collection. A large number of individuals, often from the poorest rungs of society, make a living from collecting recyclable materials from households and businesses all over the city. The system thus serves both an important environmental and socio-economic function for the poorest. Door-to-door collection rounds take place numerous times a week. Rag pickers pay households and businesses for recyclable materials. Varying rates are offered for the different materials, and charged by the weight of materials collected. Rag pickers also routinely scour municipal bins to salvage any recyclable materials that may be intact.

These materials are sold on by rag pickers to wholesalers and processors for a markup on the price at which they buy from households. Rag pickers work closely with wholesalers. Wholesalers also typically provide rag pickers with the funds to purchase from households. The segregated materials are transported and sold to larger wholesalers and recycling plants outside of Kashmir, such as in Jammu, Amritsar and Delhi.

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<sup>5</sup> Improved insulation and home designs can for example include: double and triple glazing, passive solar designs and use of natural construction materials with better insulation properties.



A number of recyclable materials are presently collected from households: hard plastics, newspaper, cardboard and scrap metals. Informal recycling collections appear to reach most though not all parts of the city. Rag pickers visit both households and businesses. Households varied in their commitment to recycling. Most of the households interviewed in this study, indicated that they participate to some degree in these recycling collections but also acknowledged that they sometimes forget to segregate recyclable materials and dispose most of their waste in municipal collections. None of the households interviewed seemed to have clear segregation facilities in place at home to separate out waste such as designated recycling bins.

Some residents gave recyclable materials to rag pickers for free, choosing not to accept a fee. Most of the residents who gave recyclable waste on a charitable basis did so because they deemed rag pickers to be poor and felt they were providing an important service. It is not clear whether all residents will continue to recycle if they were not paid for their waste, particularly given households receive municipal collections that they could readily use to dispose waste.

This informal system of recycling operates with little or no support from the municipality. The existence of such a functioning system removes the need for the type of complex waste collection, segregation and transport infrastructure common in other parts of the world.<sup>6</sup> Given the circumstances in which the recycling sector in Srinagar has emerged, there are benefits to forming public-private partnerships that build on and improve the effectiveness of the service, and work with local economic realities such as a surplus in labour and shortage in capital. As the recycling sector provides a vital public service, it is important that the municipality plays a part to support its economic viability and provide greater financial security to the substantive numbers of casual labourers employed in the sector.

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<sup>6</sup> In many countries, municipalities have invested heavily in the provision of multiple segregated bins for each household and specifically designed dump trucks with compartments to facilitate the segregated transport of different materials.



Image: roadside accommodation of rag pickers on Shalimar Link Road, Srinagar, Kashmir.

## Recommendations

Some examples of how the municipality can better support recycling are provided below:

- There is need for more sustained efforts to raise awareness and engage the public to promote recycling. Private recycling operators and rag pickers simply do not have the resources to market their activities. There is considerable scope for the municipality to fill this gap and develop a comprehensive door-to-door engagement programme to encourage the public to recycle more.
- Provide households with simple segregation bins to assist recycling. It is also important to provide roadside recycling bins for pedestrians. There are very few, if any, recycling bins in public spaces; almost all public bins are at present unsegregated. Roadside recycling bins will also improve conditions for rag pickers, who are otherwise compelled to search for recyclable materials in dirty unsegregated bins.
- Public recycling facilities should be introduced alongside an extensive awareness raising and notification campaign to ensure new bins are used properly and contamination is avoided. Awareness and training programmes should extend to institutions such as schools, colleges, municipal buildings and company offices where it is easier to monitor and capture recyclable materials in larger volumes.
- Introduce a biodegradable waste collection service to reduce contamination and soiling of recyclable materials and thus improve the quality and value of recyclate that is recovered.
- Incentivise rag pickers to reach out to neighbourhoods that are presently not visited. The municipality needs to identify the exact scope of collections at present in order to understand gaps in coverage.

- Provide financial incentives to improve existing segregation and processing sites and support the establishment of local recycling plants. More localised processing will reduce both transportation costs and attendant transport-related emissions. The municipality should consider propping up prices of materials, in particular those that are currently uneconomical to recycle, but also more widely to support and motivate an underpaid and struggling workforce. As local recycling becomes more profitable there will be added incentive for processors to invest more in marketing efforts and collection services and improve the quantity and quality of recyclables captured.
- There are benefits to modernising the cart vehicles used by rag pickers to transport waste. Our observations suggest that these vehicles are enormously strained and in need of replacement, due to years of underinvestment. They also place an inordinate burden on rag pickers, who are largely underpaid.

## **4. Waste management infrastructure**

The city is served by public and private waste management infrastructure. A landfill site is run by the municipality with limited segregation and composting facilities. There are also private facilities around the city, where recyclable materials are sorted and processed.

### **4.1. Local sorting and recycling plants: opportunities and feasibility**

Recyclable materials are gathered, sorted and processed at private wholesale dump sites scattered around the city. These enterprises buy up the materials gathered by private rag pickers and receive some materials which are dropped off directly by individuals and businesses. Small quantities are also purchased from the municipality.

As many as 140 different types of materials are sorted and processed in some of these sites, including different metals, paper, cardboard, hard plastics, rubber, reclaimed wood, tyres and textiles. Almost all widespread household materials with the exception of soft plastic films (e.g. carrier bags, polythene, polystyrene) are accepted. One operator interviewed, estimated that around 700 kilograms of recyclable materials are collected and sorted daily at his facility. A small amount of processing is also undertaken at these sites, such as shredding and pelleting plastics for sale to recycling plants. Metals are also carefully extracted from electrical appliances and other sources. Recyclates are mostly sold on to recycling plants outside of Kashmir and occasionally two main recycling facilities in Srinagar which process rubber and scrap iron.



Recycling businesses deemed there to be sufficient volumes of recyclable materials generated locally to make it viable to establish recycling plants in Srinagar itself. The only hurdle was the significant capital investment that would initially be required. With government support, these obstacles could be surmounted easily. Local processing could significantly reduce transportation costs and increase the profitability of recycling. Whilst wholesalers in Srinagar are able to profit from all the materials they presently collect, it is not economically viable to collect materials for which margins are very low. This is true of soft plastics and films. Some plants in other cities are able to recycle polythene and plastic films profitably though the margins are currently too small to be able to accept materials from further afield such as Srinagar, for which transportation costs are prohibitively high. Recycling businesses suggested that the sale price of soft plastics needed to rise to around five to six rupees per kilogram to be profitable to collect these materials. There is potential to process these materials in Srinagar as the removal of transportation costs would render it economically viable. Interviewees stated that the only major barrier to the development of recycling plants in Srinagar was the large initial capital outlay that would be required, which was beyond the wherewithal of local recycling operators.

Financial incentives can be offered by the municipality to initiate collection and bolster the price of materials such as polythene which are not at present economically viable to recycle. By guaranteeing a floor price for these materials, local wholesalers will be able to collect and sell materials profitably to processors outside the state. For materials such as polythene and plastic films, which the government is aiming to or ought to phase out altogether, it is not sensible that investment is directed towards developing local processing facilities as volumes of these materials will decrease over time if government policies are successfully implemented. Rather it may be more effective to prop price signals to facilitate their collection and sale to external processors.

#### 4.2. Anchan landfill: moving up the waste hierarchy

Municipal solid waste from Srinagar is taken to the city's only landfill site at Anchan. The landfill is the subject of a damning ruling by the National Green Tribunal highlighting the inadequacy of the city's waste management practices. The site has been causing significant groundwater pollution and extensive contamination of the neighbouring Anchar lake. Anaerobic decay of biodegradable waste in the landfill site is also significant source of harmful methane emissions that is a potent greenhouse gas. There have been persistent complaints from residents living near the landfill concerning the growing incidence of odours and health problems. Officials at

the landfill indicated that there were systems in place to collect and treat leachate, as is common to all modern landfill designs. Given the severity of the pollution caused by the landfill, these protection measures are likely to be inadequate.

The landfill's remaining capacity is expected to be filled within the next three years, by around 2020, although more cells are likely to be created once the landfill reaches full capacity. A mechanical segregation facility has recently been established on the site, to segregate and collect hard and soft plastics from incoming waste. Metals are also manually segregated. The municipality sells some of this recyclate to wholesalers and processors, who in turn sell on to recycling plants. As the segregation facility is in its infancy, the municipality is yet to find buyers for some of the reclaimed materials, in particular, soft plastics.



#### 4.3. Energy from waste (EfW)

There are no targets or specific measures to reduce the amount of waste entering landfill, although there are plans for an energy-from-waste (EfW) plant in Srinagar. The incineration and recovery of energy from waste will relieve pressure on landfill and enable the recovery of some value from waste, but is by no measure the most environmentally friendly waste management solution. It is important that the municipality does not allow investment and focus on energy recovery to compromise much needed support for recycling and waste prevention efforts. The more comprehensive and successful recycling efforts are, the fewer the materials available for generating energy from waste. As large energy from waste plants require significant volumes of waste feedstock to be economically viable, there may arise a trade-off between recycling and energy recovery. Any investment in major waste management infrastructure such as energy from waste plants must take into consideration long-term volumes and characteristics of waste, and construct facilities at an appropriate scale that does not jeopardise other critical aspects of the waste management plan.

There are benefits to the development of a small scale energy recovery facility in Srinagar which can produce energy from the city's residual waste, once the full potential of recycling and reuse has been realised. Energy recovery can also benefit from the supply of waste feedstocks from further afield, if supported by the introduction of waste collections in areas outside of the city which at present do not have any official system of waste management. In order for energy

recovery to be more effective, there will need to be changes to the way waste is collected and the kinds of materials eligible for disposal. Biodegradable wastes with higher moisture content, for example, are generally not as suitable for incineration as they require more energy to combust. As this kind of waste will need to be segregated or collected separately, it is important that the municipality considers plans for large scale biodegradable waste management facilities such as in-vessel composting (IVC) or anaerobic digestion (AD). Strict controls will also be needed to monitor, capture and treat harmful emissions from incineration. In other parts of the world such as the EU, Member States which rely on energy recovery to treat residual non-recyclable waste have in place stringent legislation relating to management of emissions and requirements to use the best available technologies.

#### 4.4. Case study: EU landfill directive

The EU's Landfill Directive sets out measures to ensure Member States adopt sustainable landfilling practices that safeguard both the environment and human health.<sup>7</sup>

A sustainable landfill can be defined as one:

- i. that is managed so that outputs are released in a controlled and acceptable way;
- ii. where the residues left in the site pose no unacceptable risk to the environment;
- iii. where the need for aftercare should not be passed onto the next generation;
- iv. that does not compromise the future use of groundwater and other resources.

The legislation aims to significantly reduce reliance on landfilling over time. This includes increasingly tighter restrictions to reduce the amount of biodegradable waste entering landfill. Current targets require Member States to reduce the amount of biodegradable waste landfilled to 35 percent of 1995 levels by 2020.<sup>8</sup> The legislation also supports the use of financial levers such as landfill taxes (based on the tonnage of waste disposed in landfill sites) to incentivise municipalities to choose more environmentally friendly means of waste management. The Directive also calls for segregated disposal of specific hazardous wastes in designated landfill sites with more stringent environmental protection measures. At present, the Commission is considering a legislative proposal aiming to phase out landfilling by 2025 for recyclable waste (including plastics, paper, metals, glass and bio-waste) in non-hazardous waste landfills, corresponding to a maximum landfilling rate of 25 per cent.<sup>9</sup>

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<sup>7</sup> European Commission, 2016. *Waste*. [http://ec.europa.eu/environment/waste/landfill\\_index.htm](http://ec.europa.eu/environment/waste/landfill_index.htm)

<sup>8</sup> Previous targets required a 75 percent reduction in biodegradable waste on 1995 levels sent to landfill by 2010 and a 50 percent reduction by 2013. CIWM, 2018. <https://www.ciwm.co.uk/ciwm/knowledge/landfill-directive.aspx>

<sup>9</sup> European Commission, 2016. *Waste*. [http://ec.europa.eu/environment/waste/landfill\\_index.htm](http://ec.europa.eu/environment/waste/landfill_index.htm)

## **5. Biodegradable waste management**

There is presently no proper municipal or informal system in place for the segregation and sustainable utilisation of biodegradable waste, such as composting or anaerobic digestion methods.

Our interviews suggest that households and businesses deal with biodegradable waste in a number of ways:

- a significant number of households and businesses leave out a part or majority of their food waste to stray dogs, livestock and birds. Meat is typically left for dogs, whilst vegetable and fruit remains are left to sheep and cattle;
- households with kitchen gardens are likely to adopt some basic form of composting by returning some of the uncooked food wastes to the soil as a fertiliser; and
- a significant amount of food waste continues to be discarded by households in the municipal collections.

Mixed wastes captured through municipal collections are mechanically segregated in a facility adjoining the city's landfill site. Some of the biodegradable waste that remains once other materials have been extracted is composted on site. The scale of the municipality's composting operation appears to be small and in its infancy.

Current methods of managing biodegradable waste present numerous environmental problems. The widespread practice amongst households and businesses of distributing food waste to animals, in particular stray dogs, helps proliferate their population and exacerbate attendant problems of dog menace and disease. Whilst it is more ethical to feed stray animals compared to landfilling biodegradable waste, it is far more effective to return these wastes as organic matter to the soil through composting. The large amount of biodegradable waste that is landfilled contributes to climate change, as they release harmful methane emissions whilst decaying under relatively anaerobic conditions. Nutrient-rich leachate from biodegradable waste eventually enters waterways and accelerates eutrophication. The decomposition of food in municipal bins and communal areas is also a major source of odours and is conducive to the spread of diseases and pathogens.



### 5.1. Composting: promotion and development

There is enormous potential for better composting in Srinagar and the wider Kashmir Valley. Biodegradable waste represents a free, under-utilised resource that can be effectively composted to enrich the soil for food production. Conventional, industrial farming methods rely greatly on the purchase of expensive inputs such as synthetic fertilisers that unnaturally alter the chemical balance of the soil. Artificial fertilisers are produced at huge energy cost both in manufacturing and transportation, and do not provide plants with the complexity of minerals they require for healthy growth. Returning organic matter to the soil through compost can help nurture the vital soil organisms and micro-ecosystem that is essential for the vitality of food crops.

There are many examples of successful composting campaigns that urban municipalities around the world have established. These include a mix of large scale, centralised composting facilities for urban food waste and localised solutions such as community and backyard composting initiatives.



*Image: a houseboat on Dal Lake; the owner composts nitrogen-rich weed from the lake. This is a time-honoured practice and used by local growers to enrich the soil quality of kitchen gardens linked to their houseboats. A practice in need of renewal. A rich natural resource in need of being returned to the ecosystem.*

### 5.1.1. Biodegradable waste collections

Many municipalities around the world require households to segregate biodegradable wastes in a separate bin that is typically provided by the authority or private contractors. This waste is then collected separately for composting or anaerobic digestion at municipal or privately run sites. There are two significant advantages to source segregation of biodegradable waste from other waste materials:

- it enables biodegradable waste to be turned into a resource at low cost and generate enormous environmental benefits (e.g. reduced methane emissions and leachate into waterways; improved soil health); and
- significantly reduces soiling and contamination of recyclable materials and thus maintains the quality and value of materials that can be captured.

It would be relatively easy for the municipality to organise segregated collection of biodegradable waste. Our scoping interviews suggest that most residents are more than willing to participate if suitable bins are provided and collected at frequent intervals. The municipality should also introduce separate municipal bins for biodegradable waste in public spaces. Many residents also felt that it would be easier than practices they were currently adopting such as discarding food wastes outside for animals. Biodegradable waste segregation at source, will also reduce both contamination of recyclable materials and the burden of mechanical segregation. The municipality can also support private businesses to organise collections and turn the waste profitably into compost for sale to growers, should it not wish take on the responsibility for collections.

### 5.1.2. Home composting



The most sustainable methods of waste management are often the simplest solutions that turn local waste into useful local resources. Home composting has the potential to deliver a whole host of environmental, health and economic benefits, without the need for new waste management infrastructure. The most progressive urban municipalities around the world are beginning to develop more joined-up approaches to the multiple challenges of lifestyle illnesses, environmental degradation and food security.

An effective way to use food waste sustainably is to support households with small land parcels to develop and maintain kitchen and medicinal gardens. With the right knowledge and care, even the smallest parcels of land can be highly productive and help meet a share of household food and medicinal requirements. Simple composting techniques can enable household food waste, green waste (e.g. leaf litter, twigs) and other biodegradable materials to be turned into rich organic matter for growing food. This knowledge of returning organic matter to the soil

appears to be lacking across the Valley. Growers tend to rely mostly on manure and ash but do not utilise the full potential of other biodegradable matter.

There is also potential for households to keep poultry for egg laying. Chicken manure can be used as a rich natural fertiliser for an accompanying kitchen garden and some food waste can additionally be diverted as poultry feed. Home produced eggs are likely to be healthier and far more ethical and sustainably produced than commercial varieties from birds that are typically reared in highly cramped and stressed conditions.

These kind of closed-loop solutions to waste are a central part of permaculture - an approach to global sustainability challenges that uses both traditional and scientific knowledge to find solutions that safeguard human and environmental health. As an NGO focusing on finding local solutions to environmental problems, Green Kashmir has significant experience and access to global expertise in permaculture. Green Kashmir is very well-placed to help develop and support the municipality in implementing permaculture solutions to waste, particularly through knowledge exchange, awareness raising, teaching and technical support.

To support biodegradable waste management in Srinagar, Green Kashmir is able to:

- Help identify and target households/neighbourhoods which may be interested in developing kitchen gardens;
- Organise and deliver composting and organic food production workshops for households and the municipality including incentives such as seed giveaways;
- Support public organisations such as schools, hospitals and municipal offices to compost their own biodegradable waste, grow food and reconnect with land;
- Help local food growers in and around Srinagar to increase food production and reduce reliance on synthetic agrochemicals through improved composting and organic cultivation methods, and use of local wastes as a resource (e.g. food waste, excess algal and floral blooms in lakes);
- Encourage and provide support to the unemployed and other disadvantaged segments of society to create land-based livelihoods such as market gardens, horticultural, food processing and other artisan enterprises - an important step towards creating a more resilient, self-sufficient economy;
- Guide the development of awareness raising campaigns to improve public understanding of sustainable waste management and the urgent need to return organic matter to the soil.

Although once self-sufficient in food, Kashmir is becoming increasingly dependent on imports. The ability of the people to endure protracted curfews, in recent years, demonstrates the resourcefulness and self-sufficiency of the region. But that way of life is under threat as changing land use patterns, climate change and trade place increasing pressure on local agriculture. Promoting local food growing, horticulture and agricultural efforts will be critical to regaining food sovereignty and local economic empowerment.

## 5.2. Case study: 'Clean Home, Clean City' initiative - Alappuzha, Kerala<sup>10</sup>



The 'Clean Home, Clean City' campaign was initiated in the Alappuzha district of Kerala, with a focus on segregating and composting biodegradable waste at household level. The campaign was developed in response to the failures of more centralised dumping and waste treatment approaches adopted in other major cities in Kerala such as Thiruvananthapuram, Kochi and Thrissur. The Alappuzha municipality found that mixed dumping and segregation of waste in large sites caused significant contamination issues and affected the quality of the compost produced. Large transportation costs were also incurred in the process of moving waste through the city to these sites. Instead the municipality decided to launch an extensive programme to promote home composting. Pipe compost<sup>11</sup> units and biogas plants were set up in households depending on the amount of organic waste that was generated, and large

government subsidies offered to reduce the cost of these units. Subsidies helped to significantly reduce the cost of pipe composts unit from Rs.960 to Rs.150 and biogas plants from Rs.13,500 to Rs.3,375. Households that were unable to compost at home were required to bring their segregated waste to aerobic compost units established around the city. Businesses were obliged to establish their own plants or entrust their waste to recognized private service providers for recycling.

## 5.3. Case study: food waste management practices in the UK

Municipalities in the EU have come under growing pressure to reduce the amount of food waste entering landfill to meet waste reduction targets. Consequently municipalities have begun to collect food waste separately for large scale composting or anaerobic digestion. Households in an increasing number of municipalities in the UK are provided with a free indoor kitchen caddy to segregate food waste from other recyclable materials. A large outdoor

<sup>10</sup> Venugopal, n.d. *Waste Management – The Alappuzha Approach*. <http://climatesouthasia.org/waste-management-the-alappuzha-approach-2/>

<sup>11</sup> Pipe composting is a simple low cost method of *in situ* home composting which uses pipes (typically PVC) partially embedded around a foot in length into into food growing or other vegetation beds. Holes are drilled into the side of the piping under soil. Biodegradable waste is deposited into the pipe through the top. The tops of the pipe are sealed to prevent vermin from entering. The holes at the side of the piping in the soil allow worms and other organisms to move in and out of the unit to decompose biodegradable wastes and leave nutrient rich compost. Multiple pipes can embedded depending on the amount of biodegradable waste produced.

biodegradable waste bin is also provided to households to keep food and garden waste, which is collected weekly.

All types of food waste is collected together, including cooked food and meat waste which take longer to decompose. As such, indoor controlled treatment methods which accelerate the decomposition process (such as in-vessel composting and anaerobic digestion), are typically preferred. Processes such as anaerobic digestion also generate biogas (as microbes break down the biodegradable matter in the absence of oxygen) which can be used to produce heat, electricity or transport fuels. Waste slurry remaining after the anaerobic digestion process is sold as a nutrient-rich fertiliser for commercial growers. Cumulatively, anaerobic digestion plants in the UK have enough capacity to power 850,000 homes (over 708MW per annum) and are estimated to reduce greenhouse gas emissions by one per cent annually.<sup>12</sup> UK government estimates that the net electrical yield of food waste is around 200kWh per tonne.<sup>13</sup> More traditional outdoor methods of managing biodegradable waste such as open heap composting are increasingly less preferred to anaerobic digestion as they are unable to capture energy. They also run the risk of attracting vermin and create difficulties for managing odours, especially when cooked food and meat is involved.

Alongside the introduction of biodegradable waste collections, to encourage households with gardens to compost their waste, some local authorities provide composting bins for free or at discounted rates. Municipal efforts have also been complemented by a resurgence in local food growing, amidst public concerns over the safety, quality and freshness of food and popularisation on TV.



<sup>12</sup> Farmers Weekly, 2016. *Number of AD plants in UK grows to 540.* <http://www.fwi.co.uk/business/number-ad-plants-uk-grows-540.htm>

<sup>13</sup> Tamar Energy, 2017. *How much power does an AD plant produce?* <http://www.tamar-energy.com/renewable-energy/how-much-power-does-an-ad-plant-produce/>



Figure 3: Anaerobic digestion (AD) and in vessel composting (IVC) cycle

## **6. Litter**

There is wide consensus on the increasing levels of litter in Srinagar. The continued growth in litter brings with it a litany of environmental and social problems. Litter can proliferate the population of stray animals, injure or suffocate wildlife, cause visual blight and undermine confidence in authorities. Moreover, litter breeds litter - the presence of litter encourages further littering as makes it more acceptable for citizens to shirk responsibility for their rubbish.

Whilst some popular tourist areas in Srinagar have benefitted from commendable anti-littering efforts including the provision of more public bins, more regular street sweeping and awareness campaigns, in many parts of the city, litter remains a significant problem. The improper disposal of waste also encourages harmful local practices to manage litter such as open burning.

### **6.1. Polythene ban: unabated plastic use is making a mockery of legislation**

Almost a decade on from the Jammu and Kashmir State Non-Biodegradable Material (Management, Handling and Disposal) Act 2007 which effectively imposed a blanket ban on the manufacture, stocking, distribution, sale and use of polythene, the use of these materials in the Valley, continues unabated. A further blow came with the recent revision of the act (2017), to permit the manufacture and sale of polythene above 50 microns in thickness within the state.

This amendment raises serious questions over the government's commitment to the environment. Officials feel that the new rules will make it more difficult to enforce legislation as it is virtually impossible to determine the thickness of plastics by eye during inspections.

Our interviews with shoppers and businesses in Srinagar clearly indicate that there is widespread use of polythene bags throughout the city. Whilst locals note that there was some enthusiasm from authorities in the early months following the implementation of the ban, enforcement efforts have waned significantly. With the exception of large businesses for which it is difficult to evade the ban without notice, the majority of small enterprises and market stalls routinely distribute plastic carrier bags to customers. None of the businesses interviewed, who use plastic carrier bags, charge customers for these bags. Nor do shopkeepers make any effort to educate customers on the ban or ask customers whether they necessarily needed a bag. Bags are issued as standard practice. Businesses indicated that there is very little awareness amongst customers. Virtually no customers ever brought their own bags.

Businesses stated two main reasons why they were continuing to use plastic bags:

- **Plastic bags are easily and widely available** from sellers. The ban on plastics has done little to terminate or reduce the supply of plastic bags entering the city. There is a large and well established network of vendors selling plastic carrier bags to businesses. Businesses know exactly where to get hold of plastic bags to replenish stocks and are also approached by vendors.
- **Plastic bags are considerably cheaper than degradable bags.** Our interviews suggest that the ban has not altered the price of plastic bags, even on the black market. Businesses pay between 80-100 rupees for a pack of hundred plastic bags. Non-printed jute bags cost around 200-300 rupees for the same quantity (2-3 rupees per bag), over double the price of plastics. Printed jute bags cost even more, at around five rupees per bag. Some shops, whilst using plastic carrier bags, also stock sturdier, reusable jute bags which their customers are able to purchase at a cost of around ten rupees per bag. Paper bags are likely to be cheaper than jute but are generally not considered to be sturdy enough. Degradable bags are widely available to shopkeepers, and in the absence of strict enforcement policies, the price differential is a deterrent to them choosing these alternatives. Businesses indicated that if degradable bags are cheaper than plastics, they would readily purchase these alternatives. Some businesses have found resourceful ways to wrap their products. A small number of market stalls and butchers are using makeshift sleeves made of newspaper. This appears to be related to the higher cost of purchasing plastic bags compared to using newspapers. Some types of outlets, particularly butchers, indicated that use of plastic bags was low in their sector, as they have noticed that the taste and quality of the meat is affected when packed in plastic. Bakeries also indicated that use of plastic bags was typically lower in their sectors.

The flagrant and unabated use of plastics in Srinagar is severely undermining the credibility of legislation and confidence in the municipality, as well as devastating the environment in untold

ways - choking waterways and wildlife, and leaching toxic chemicals and micro-plastics as they decompose slowly over centuries.



*Image: plastic dumped on the landscape by the residents of a village in Budgam. The villagers do not receive any waste collection service from their municipality, and feel that they have no choice but to household rubbish in this way. From time to time the piles of rubbish are set on fire with the resultant air pollution and dangers to health.*

The municipality needs to work together with businesses and the general public to eliminate the use of plastic bags urgently and avert an otherwise irreversible environmental crisis. The benefits of doing so are not restricted to environmental reasons alone. Businesses can save on the cost of purchasing plastic bags if customers begin to reuse them or bring their own degradable bags. As demand for jute bags increase, their production is likely to expand and bring down prices.

Reducing plastic pollution also has social benefits by creating a cleaner, more amenable environment that encourages more active lifestyles and reduces usage of motor vehicles. Cleaner and quieter streets encourage more people to walk and children to play.

There are a number of measures that stakeholders can take to enforce legislation more effectively and engender a positive cultural shift in attitudes to waste:

Action	Detail	By whom
Regular monitoring of businesses	<p>The municipality needs to undertake regular, sustained spot checks to ensure that businesses are not breaking the law. This should cover all major market precincts and shopping districts around the city.</p> <p>There is evidence to suggest that such enforcement activities were taking place in the early years of the ban but quickly lost momentum. The municipality can also do more to encourage compliant businesses and the general public to come forward to report breaches of legislation. It can be expected that as a culture of compliance develops, with more and more businesses becoming compliant, more informants will also come forward to report illegal use of plastic.</p>	Municipality; Civil society (informants)
Better	Better intelligence and surveillance is needed to understand and dissolve	Municipality

<p>monitoring/ enforcement of sanctions on distributors and suppliers of plastics</p>	<p>the channels through which plastic bags are being distributed to shops. Our interviews indicate that businesses were not sourcing plastic bags directly from manufacturers or wholesalers but from small vendors. It should not in theory be difficult to identify these vendors as outlets appear to be in regular contact with them. The municipality should monitor and work closely with these vendors to help them sell degradable alternatives, and enforce tough financial penalties on those who breach legislation.</p> <p>If all businesses transition together towards degradable bags, there is no competitive disadvantage to individual businesses incurred by the higher cost of sustainable alternatives. Businesses will all incur similar costs and can if necessary pass this on to consumers, who may in turn be more inclined to reuse bags to save money. At present, even if businesses are keen to switch to degradable bags, they are fearful of the ‘first mover’ disadvantage whereby they would be incurring higher costs than their non-compliant competitors (whilst enjoying no increase in customers).</p>	
<p>Punitive financial sanctions</p>	<p>The municipality needs to enforce a strict no tolerance policy on plastic carrier bags, which is backed by much more prohibitive sanctions. Unless businesses and distributors are financially penalised for breaching legislation, there may be little appetite for change.</p>	<p>Municipality</p>
<p>Sustained awareness-raising campaigns</p>	<p>Whilst there have been some efforts to raise public awareness undertaken by the municipality and NGOs, these campaigns have neither been sustained nor have sufficiently captured the hearts and minds of the population. There is a real need to develop creative new awareness-raising strategies that reach all social groups and trigger lasting behavioural change. A multi-pronged strategy could include:</p> <ul style="list-style-type: none"> <li>● Door-to-door engagement</li> <li>● Business-to-business engagement e.g. individual engagement with shopkeepers/ sectoral engagement, helping coordinate outlets within a sector to work together to phase out plastic (avoiding competitive disadvantages)</li> <li>● Awareness raising events in popular areas e.g. educational film screenings/ talks/ workshops</li> <li>● Engage high profile individuals such as celebrities to help raise awareness</li> <li>● Engage media more effectively</li> <li>● Mass distribution of free reusable degradable bags</li> <li>● Organise regular communal litter picking events led by the municipality</li> <li>● Engage religious leaders to promote messages in religious gatherings, sermons (religion is at present a massively under-utilised lever of influence that if properly harnessed can be used to build more constructive attitudes to the environment).</li> <li>● Embed waste awareness in school curriculums (if right attitudes to waste are instilled in children at an early age it can have knock-on effects on parents and families). Children can also be encouraged to bring plastic waste from home to recycling collection points at school in return for awards and prizes (e.g book vouchers).</li> <li>● NGOs can adopt neighbourhoods with significant waste related concerns, in which to target environmental awareness campaigns, address concerns and support local businesses in their transition to eco-friendly practices.</li> </ul>	<p>Municipality; NGOs</p>

Improved public information signs	The municipality must develop more striking and understandable public signage to promote awareness of waste issues. Whilst there has been some progress in this regard, there is scope for more inspiring signs. It is important that messages are not only in English but also in Kashmiri and Urdu to win public sentiments more effectively. There are also opportunities for example to give more public prominence to religious, scriptural and poetic quotes stressing the importance of environmental protection and cleanliness.	Municipality
Business-to-customer training	The municipality can train businesses to implement measures that improve waste awareness amongst their customers, for example: <ul style="list-style-type: none"> <li>• Checking with customers whether they absolutely require a bag rather than automatically distributing them</li> <li>• Not distributing bags unless specifically asked by customers</li> <li>• Distributing free reusable bags</li> </ul>	Business; municipality
Proactive role of consumers	It is the duty of the public to take degradable bags and refuse plastic bags when offered. The enforcement of legislation is the not the remit of authorities and businesses alone. Customers should urge shopkeepers who are breaking the law not to do so, and boycott businesses who are not taking the environment seriously. It is important that the municipality, as part of its awareness programmes, informs citizens of their civic rights and responsibilities and urge the public to report breaches of legislation.	Public; municipality

## 6.2. Creative campaigns: a holy war on waste



Awareness programmes on waste can be improved by harnessing traditional levers of influence in society. An important aspect of local life in the Valley is Islam. There is considerable scope for the municipality to engage with religious leaders more effectively to promote environmental messages through sermons, discussions and religiously-themed poster campaigns. Using religious channels can be a powerful way to capture hearts and minds. Our

surveys suggest that residents consider litter to be an important issue, although a large majority also admit to dumping litter on the streets if no bin was available nearby. Waste was deemed a major social concern, but for a lot of people, this ranked behind other priorities such as economic survival and a resolution to the political conflict. Given these priorities, public awareness campaigns need to be designed carefully so that they strike a deeper moral chord in society and connect the inseparable links between economic prosperity and environmental protection. There is public support for more religious engagement on environmental issues. Religious leaders also felt that Islam had a lot to say on respect for environment and cleanliness, and were willing to emphasise these messages for the public good.

### 6.3. Leadership and multi-stakeholder engagement



There is considerable scope for the municipality to work more closely with NGOs and organisations with relevant expertise to develop and improve its awareness raising strategies. Urban municipalities which have tackled litter and waste-related issues most successfully, place significant emphasis on well-developed awareness-raising strategies. There are examples of successful anti-littering campaigns and polythene bans, especially in areas which depend heavily on tourism, whose identity and income is linked to the landscape. This includes Ladakh and other parts of India such as Himachal Pradesh. These areas have benefitted from well-coordinated strategies involving wide support from grassroots NGOs and above all, strong municipal leadership.

In order to change public attitudes it will be equally important that the municipality itself is seen to be implementing a coherent waste management strategy and is taking waste-related issues seriously. This will necessitate significant improvements to waste collection, improved cleanliness of streets, tougher policies to reduce litter and stricter enforcement of environmental legislation. Without winning public confidence, municipal efforts to tackle waste will inevitably be compromised.

## **7. Water pollution**

Terrestrial pollution is inseparably linked to aquatic pollution. The pollution of waterways in Kashmir is well-documented but needs to be viewed in conjunction and incorporated fully in the development of solid waste management plans.

### 7.1. Dal Lake: a paradox in paradise

The environmental tragedy that is unfolding in Dal Lake is emblematic of the ecological challenges facing Kashmir Valley more widely. The lake is besieged by unprecedented levels of pollution, which if left unaddressed will spell certain death to this fragile ecosystem within our lifetime. Water quality has declined drastically within the span of a few short decades.

*As one resident recalls:*

***“Less than a generation ago, water in the lake was drinkable. In the decades that followed, it could no longer be consumed, but was nonetheless bathe-able. Now, that too, is not possible. What will be left for future generations?”***

The huge amount of leachates entering the lake is fuelling eutrophication at a rapid rate, causing the unchecked proliferation of lilies and invasive species such as azolla. The main body



of the lake was once crystal clear. Aquatic vegetation in lakes and wetlands are estimated to have increased by 110 percent during the past four decades.<sup>14</sup> The increase in surface vegetation has been significantly reducing the penetration of oxygen and sunlight into the lake and altering the delicate balance of the ecosystem. Numbers of fish, waterfowl and bird species have all declined. The small spectacle of flora and fauna that is evident on the lake today is a fragment of the lost glory of Dal's biodiversity.

The lake has been embroiled in a blame game between the municipality and houseboat owners over the primary causes of pollution to the lake. In reality there are multiple sources of pollution which are affecting the lake.

#### 7.1.1. Drainage and sewage system



Image: Sewage Treatment Plant, Foreshore Road, Srinagar, Kashmir.

Officials at a sewage treatment plant (STP) interviewed for this report, estimate that around thirty per cent of the city's wastewater outflows are not connected to the drainage system. Whilst new developments are well-connected to the sewage system, the connection is poor in parts of the old city, where there are also additional problems relating to open sewers. The city is presently served by four sewage treatment plants, which can only treat wastewater that is captured by the drainage system.

Wastewater that does not enter the drainage network finds its way into the city's waterways as untreated sewage. Wider studies that aim to assess the sources of pollution affecting waterways in the Valley point to a bleak picture. An estimated 100 cusecs of untreated waste is discharged into the River Jhelum each day through 80 small and large dewatering stations in and around Srinagar. Concentrations of nitrates and nitrogen in the river have increased over two and a half times in the past four decades due amongst other reasons to sewage discharges, industrial effluent and run-offs from the rampant use of agrochemicals on farmland.<sup>15</sup> Until this fundamental problem of drainage is addressed, it will not be possible to redress the tide of pollution devastating Dal Lake and neighbouring water bodies. Effluent from the STPs is discharged into the waterways once chemically treated. The level of nitrates and chemicals in treated sewage was deemed by officials at the STP to be within legal limits and was not considered damaging to the ecosystem. Samples are routinely sent to reference

<sup>14</sup> Romshoo et al., 2016. *Massive land system changes impact water quality of the Jhelum River in Kashmir Himalaya.*

<sup>15</sup> Ibid.

laboratories to verify the quality of water. Nonetheless STP officials acknowledged that chemical and nutrient loads of even the treated effluent was still above levels naturally present in the water bodies. The full impacts on the ecosystem are unknown. Improving the quality of the treated effluent will require more advanced wastewater treatment technologies or alternative remediation measures.

#### 7.1.2. Pollution from houseboats

There are an estimated thousand houseboats on Dal Lake, this number having declined in recent years due to government pressure to reduce their numbers. There is at present no system to manage black and grey water from houseboats. Human waste from all of these houseboats (black water) is discharged directly into the lake without any treatment. As too is grey water from baths, showers and sinks containing harsh synthetic chemicals and non-degradable wastes from cleaning products. Long-term residents informed that in decades past, before the introduction of western style flushing latrines, all boats had in place dry compost loos. This waste was collected from each houseboat for use as compost by local individuals. Since the advent of modern toilets however, houseboats have been unable to find a solution to dealing sustainably with wastewater. Numerous efforts over the years have all failed, due in part to engineering challenges, mismanagement of funding, a deficit of technical knowledge (on the part of domestic contractors) and not least a lack of political will.

#### 7.1.3. Litter in waterways

There is an ongoing problem of litter on Dal Lake and other waterways. This problem has been addressed to some extent on the main body of the lake, due to awareness-raising programmes. Nonetheless there is evidence of litter hotspots scattered throughout the backwaters, surrounding waterways and periphery of the lake, closest to adjoining roads, which if not managed, could deter tourism. Litter is being thrown by those directly on the lake, pedestrians and motorists on adjoining roads, and to some extent from littering further upstream in the feed waters of the lake.



Some progress on combating litter has been made in recent years. Weekly door-to-door collections, introduced privately in the early 1990s (and later taken over by the municipality) have ensured that rubbish from houseboats is for the most part, no longer dumped into the lake, as was the case in preceding decades. Houseboat owners considered domestic and local tourists from India and Kashmir to be chiefly responsible for litter on the lake. Owners informed that foreign tourists however tended to be more conscious of waste and did not contribute to pollution. Environmental awareness amongst locals is in some cases

alarmingly low, as clearly seen in incidences of flagrant environmental disregard such as the disposal of intestinal detritus and bloated remains of animals in Dal Lake found after the Eid sacrifices.

#### 7.1.4. Remediation

In spite of some success in managing the most visible forms of pollution, recent efforts by authorities appear to be focused on the symptoms rather than the causes of pollution. In a bid to manage the effects of eutrophication, authorities have employed contractors to curtail algal blooms and the spread of lilies on the lake. Locals feel that these measures, in particular the use of machines in some cases, have not uprooted these plants fully, merely inducing more vigorous regrowth instead. There is also little direct use for these weeds except as cattle fodder. Cleared weeds are taken to the shore and transported to a dumping site in the city. As the organic matter decomposes, some of it is collected by local growers to be used as compost. There are ways to remediate the lake and surrounding waterways more naturally, avoiding both the need for harsh water treatment chemicals and heavy engineering of the landscape, whilst creating opportunities to increase biodiversity in the process.

It is useful to consider the entire water catchment holistically when developing strategies to mitigate water pollution, rather than looking to treat visibly polluted water bodies in isolation. Effective mitigation of water pollution thus begins with careful management of upstream feedwaters in upland areas. It is important to ensure that these upland gradients are sufficiently vegetated to slow down the flow of water and enable it to percolate gradually downstream. This process helps filter the water more than would otherwise be possible if the flow was unhindered over barren slopes.

Alongside upland reforestation programmes, the remediation of downstream waterways can also be supported through using specific vegetation such as macrophytes to absorb pollutants, excess nutrients and bacteria (phytoremediation). Simple engineering features (such as gabions, artificial meanders, riffles and baffles) can be incorporated at specific points along waterways, slowing the flow of water to facilitate the sedimentation of pollutants, and changing the speed of flow to help aeration and proliferation of beneficial organisms which decompose pollutants. Through the use of vegetation and less energy-intensive engineering interventions, these natural remediation options are also more cost-effective, aesthetically pleasing and enriching for biodiversity.

Alongside these natural remediation options, it is important that the municipality develops a comprehensive strategy to address the multiple causes and effects of aquatic pollution:

- The municipality must ensure better drainage and sewers across the city so that all wastewater effluent is channeled to sewage treatment plants. There are plans to build a large new sewage treatment plant, significantly expanding the city's sewage treatment capacity. Whilst such developments are important, they will be redundant if wastewater is not being channeled appropriately to these plants. Authorities have in recent years addressed some of the problems associated with wastewater from local businesses and households on the lakeshore through improved drainage and connections to treatment plants. Similarly, the municipality must now summon political

will to ensure that the entire city is adequately connected to proper drainage and wastewater treatment facilities.

- The municipality can explore partnerships with international experts, companies and research institutions to find technical solutions to managing wastewater effluent from houseboats. This should be well within the technical competence of companies and specialists working in the domain of wastewater management. Moreover, research priorities in domestic institutes are not presently focused on developing practical solutions to local environmental problems. The municipality must work with research institutions and relevant funding bodies to redirect research priorities towards solving local challenges.
- Whilst the municipality collects household rubbish from houseboats, there are no recycling provisions for houseboats. The municipality can encourage and support private recycling operators to extend the scope of their collections to the lake.
- The growth in organic matter on the lake holds significant potential for composting, subject to testing to ensure that pollutants absorbed by these plants are within acceptable limits. If this organic matter can be composted faster, it can be sold or provided freely as an abundant natural fertiliser to reduce farmers' reliance on harsh agrochemicals, as well as to support more local food growing. Some research along these lines, is underway in academic circles. The municipality can support this research, and work with organisations such as Green Kashmir, to improve public awareness of composting and promote the use of local aquatic resources as organic matter to enrich the soil. These closed-loop solutions offer a better way to utilise an abundant temporary resource in the interim, whilst the causes of pollution are being addressed.

#### 7.1.5. Eco-tourism

There are opportunities for the municipality to work with houseboat owners, ambitious new entrepreneurs and research institutions to promote ecotourism on Dal Lake by supporting and incentivising houseboats to adopt more eco-friendly practices. There is rapidly growing demand for ecotourism among international tourists (typically from developed countries) who are environmentally conscious and willing to pay more to stay at places that are actively reducing their ecological footprint. The municipality can for example, promote a concept of 'eco-houseboats' which trial and implement innovative solutions to manage human and other waste. There is no reason why this cannot also include trials to re-introduce more traditional solutions such as compost loos. If successful in tapping into the market for ecotourism, these houseboats can inspire others to follow suit and engender a positive knock-on effect.

### 7.1.5.1. Case study: Kerala houseboat eco-certification

Sustainable practices can be supported and incentivised through environmental certification schemes. One example of this is the 'green palm' certification for houseboats in Kerala, developed by the State's Department of Tourism.<sup>16</sup> The certification was introduced in a bid to ensure the quality and safety standards of houseboats and address both the extensive pollution of Kerala's waterways and social impacts resulting from rampant growth in tourism.

Alongside minimum quality and safety requirements, all houseboats are also obliged under state laws to obtain permits from the Pollution Control Board, ensuring that they have implemented measures to prevent the discharge of sewage waste into waterways. In practice, minimum regulations stipulate that houseboats must have in place holding tanks or other systems to collect waste water and sewage before disposal at onshore treatment plants. Houseboats that do not have in place minimum waste management systems are not granted an operating license. Operators who voluntarily adhere to higher sustainability standards prescribed by the Department of Tourism are awarded a 'green palm' certificate. In order to achieve this status, houseboats must:<sup>17</sup>

- have in place alternate arrangements to discharge solid wastes and sewage by providing scientifically designed septic tanks or bio-chemical toilets;
- use alternate sources of energy such as solar power for fuel, heating and lighting;
- have in place segregation system for recyclable and non-recyclable rubbish, and organise the disposal of non-biodegradable waste in a sustainable manner;
- minimise use of plastic carrier bags;
- use recycled paper for stationery and other publicity materials;
- use locally available materials for construction of houseboats and furniture;
- employ at least 75 percent of staff from local districts;
- acquire a pollution control certificate every three months from a competent authority if a board engine is used.

In spite of this scheme, only a small fraction of houseboats appear to have achieved 'green palm' certification as the costs of adopting sustainability measures are high, particularly for smaller operators. There are also significant concerns over the number of houseboats operating illegally without licenses, which continue to dump wastewater and sewage into the waterways.<sup>18</sup>

There are some plans to address these challenges and encourage wider adoption of

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<sup>16</sup> Government of Kerala, 2000. *Department of Tourism - Scheme for approval/ classification of Houseboats Approved. Orders issued.*

<http://keralatourism.gov.in/classificationofhouseboats/Houseboat.htm>

<sup>17</sup> Ibid.

<sup>18</sup> Green Hotelier, 2015. *Sustainable tourism in Alleppey.* <http://www.greenhotelier.org/destinations/asia-pacific/india-sustainable-tourism-in-alleppey/>

sustainable practices. A noteworthy example is an initiative being led by Tourism Concern, an international NGO working to promote responsible tourism. The initiative is focused on the Allapuzha district of Kerala, situated on the Vembanad Lake - the largest wetland ecosystem in south India. Tourism Concern is building a collaborative partnership that brings together a wide spectrum of stakeholders including houseboat owners, fishing and farming communities and authorities to develop a meaningful code of practice for houseboat businesses.<sup>19</sup> The initiative aims to encourage all houseboats to subscribe to sustainability principles; seek ways to monitor compliance effectively; raise awareness amongst tourists to adhere to and support eco-friendly practices; and provide training and assistance to facilitate behavioural change. Tourists and tour operators are also encouraged to choose holidays from businesses who adopt the code.



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<sup>19</sup> Tourism Concern, 2015. *Alleppey Backwaters Tourism - A New Way Forward*.  
<https://www.tourismconcern.org.uk/alleppey-backwaters-tourism-a-new-way-forward/>

## **8. Summary findings and recommendations**

Srinagar is facing a growing waste crisis that necessitates the immediate implementation of a comprehensive and sustainable waste management strategy if it is to be averted.

The municipality has in place door-to-door waste collections, taking household waste to landfill. There is considerable scope to improve the effectiveness and widen the reach of collections, as some parts of the city do not appear to be receiving this service. Additionally, a notable fraction of households do not subscribe to municipal collections, citing amongst other reasons, a lack of confidence and value for money of the service. These households represent a persistent cause of roadside litter and harmful open burning of waste. **The municipality must identify and engage these households, by winning public confidence, increasing awareness and imposing sanctions where necessary.**

The municipality is not proactively supporting the city's long standing informal system of private recycling collections. This network of rag pickers and wholesalers are performing a vital public service, but do not have resources to raise the profile of their activities. **The municipality must work with these waste management businesses to launch a sustained campaign to promote recycling and financially incentivise the collections of materials that are not presently taken.** There is greater need for the public to be informed of the implications of waste and what is presently happening. Awareness campaigns must capture hearts and minds, and be creative and hard-hitting in their approach. There is public consensus that litter is an important issue, but entrenched habits are a barrier to change. There are opportunities to better harness existing levers of influence such as religious leaders to prompt behavioural change. To change public attitudes, the municipality must win credibility by strict monitoring and enforcement of existing legislation such as the polythene ban.

**There is need for a clear strategy to manage biodegradable waste, including the introduction of food waste collections and efforts to promote home composting.** There is enormous potential to turn this waste into organic matter to support local food growing. Knowledge of composting must be disseminated widely. There are also additional benefits of increased food security and access to fresher, chemical-free foods. Green Kashmir can greatly support the municipality in this regard to develop closed-loop permaculture solutions to waste.

Managing the impacts of pollution on waterways is as important as terrestrial waste management; both are invariably inter-linked. **It is critical that the municipality ensures that the entire city is well-connected to the drainage and sewage network** to prevent the discharge of untreated sewage into waterways. There is considerable scope **to remediate waterways naturally through simple engineering and phytoremediation.**

The municipality will also need **to engage a wide spectrum of stakeholders including houseboat owners, new entrepreneurs, research institutions and global companies to find technical solutions to managing human waste from houseboats.** Waste management innovations on eco-houseboats in Kerala provide some examples of how this can be achieved.

In so doing, municipality can help foster innovation and new models of ecotourism on Dal Lake that tap into growing international demand for eco-friendly holidays.

It will be important that the municipality does not fall victim to short-sighted approaches to waste management but instead moves up the waste hierarchy to support efforts that prevent, reuse and recycle waste. **The scale of new energy from waste infrastructure that is being considered must not undermine more sustainable options by depending on feedstock materials that could otherwise easily be recycled or reused.**

The waste management challenges confronting Srinagar are similar to those facing urban municipalities in other developing countries, but doubly urgent, given the delicate ecosystem of the region. Srinagar can draw on examples from countries and areas that have established sustainable waste management solutions. Sustainable waste management demands cooperation and coordinated action from all stakeholders including authorities, businesses and the general public, but will first and foremost require **strong leadership from the municipality**. If the environmental challenges can be surmounted here, Srinagar can pave the way for other areas in need of environmental hope.

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