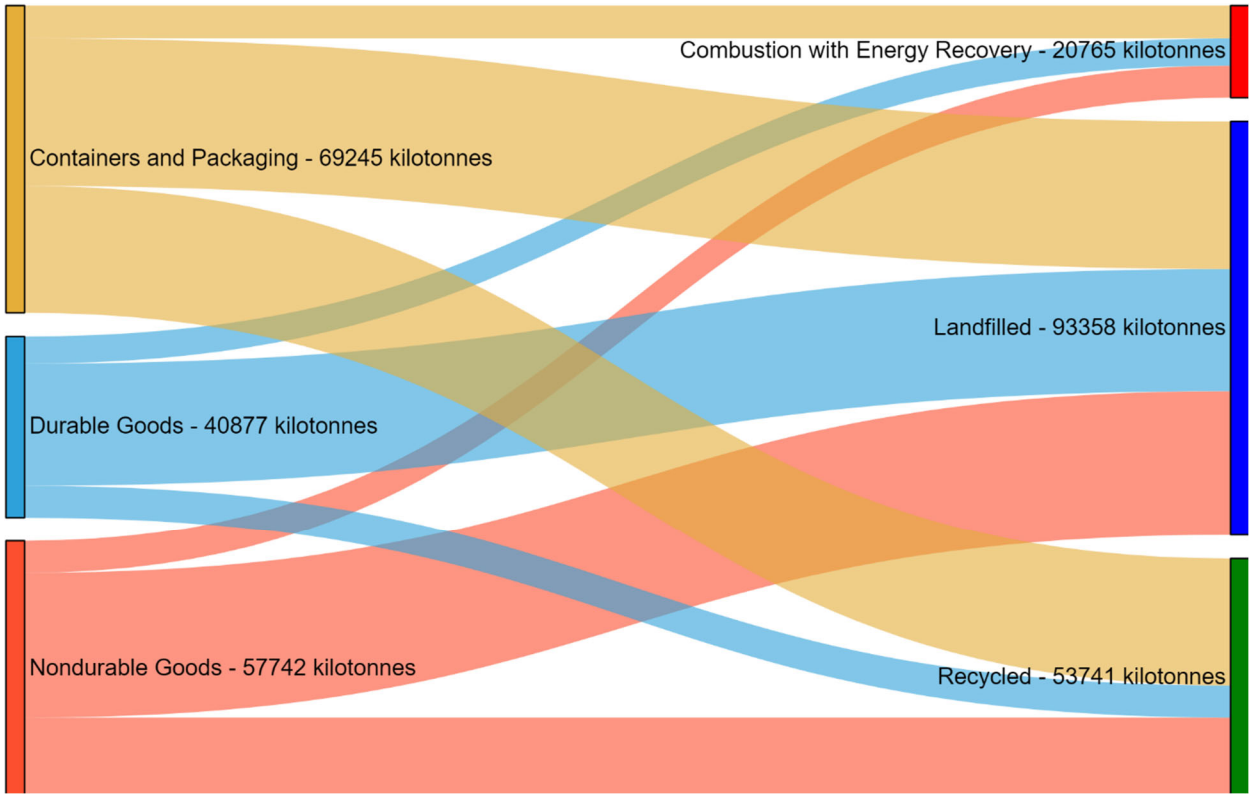
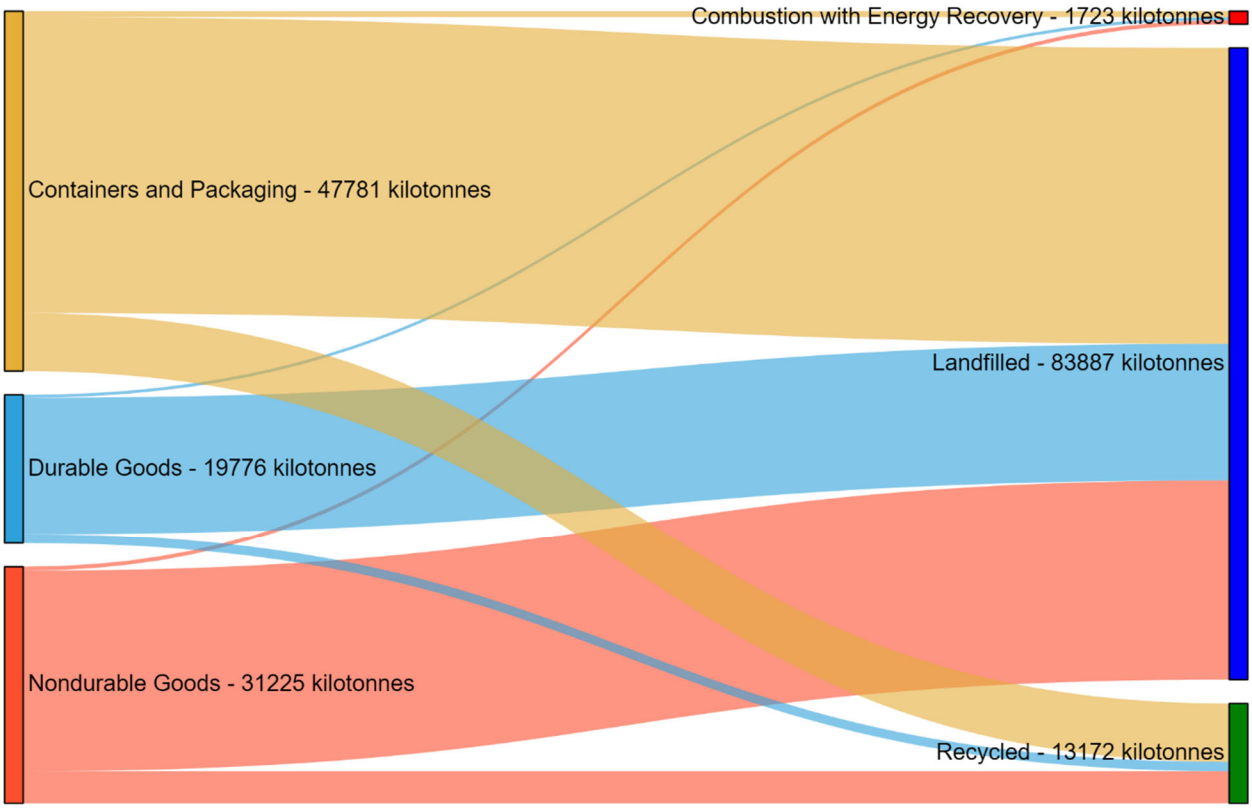
Supplementary Materials

Supplementary Materials S1. 1980 and 2005 MFAs



Products in the Municipal Waste Stream, in kilotonnes, year: 2005



Products in the Municipal Waste Stream, in kilotonnes, year: 1980

Supplementary Materials S2. MFAs of products included in broad categories: durables, non-durables, and containers and packaging

Change in the disposal method of waste materials in the US

1. Durable products

Sankey diagrams are shown in the end of the document.

In the late 1980s, recycling of durable products was mainly driven by the recycling of batteries, which indicated an amount of 1,510 ktons, out of 3,460 ktons of durable products

recycled in 1990, and the recycling of major appliances, with 1,070 ktons (out of 2,950 ktons total produced). Another 440 ktons was contributed by the recycling of rubber tires. The amount of miscellaneous durables recycled was very small compared to the total amount, 470 ktons (of 12,470 ktons total), in 1990. In the late 1990s, the situation changed with the increase in the recycling of major appliances, which almost doubled since 1990, to 2,000 ktons, out of 6,580 ktons in total in 2000, and the recycling of rubber tires, which almost tripled since 1990, to 1,290 ktons (of 4,930 ktons total produced). However, still batteries had the major share in the recycling of products in 2000, with 2,130 ktons (of 2,280 ktons total) recycled, which was a moderate increase, compared to the other two categories. Also, the recycling of carpets and rugs started in the 1990s, with a small amount of 250 ktons being recycled (of 2,460 ktons total) in 2000. The amount of miscellaneous durables recycled remained at a low level; 950 ktons (of 16,400 ktons) in 2000. The increase of recycling continued during the 2000s, although with lower rates of increase. In 2010, out of the 9,390 ktons of durable products recycled in the US, 2,980 ktons was the recycling of batteries, which indicated almost 100% recycling, followed by the recycling of major appliances, 2,610 ktons (of 4,020 ktons), and the recycling of rubber tires, which amounted to 2,270 ktons (of 5,130 ktons). The recycling of carpets and rags remained almost the same at 270 ktons (of 3,720 ktons) in 2010, and the amount of miscellaneous products recycled slightly increased, but remained at a very low level, to 1,130 ktons (of 20,810 ktons). The amount of major appliances recycled increased to 3,140 ktons in 2018, and surpassed the amount of batteries recycled, 2,870 ktons, which remained at almost 100% recycling. The recycling of rubber tires increased to 2,610 ktons (of 5,250 ktons) in 2018, and amount of carpet and rugs recycled slightly increased to 310 ktons (of 3,370 ktons). The amount of miscellaneous products recycled increased by a negligible amount, considering the subsequent increase in the total amount generated, to 1,480 ktons (of 24,810

ktons). The amount of small appliances recycled was negligible until 2010, but a slight increase is observed, which has remained the same from 2010 to 2018, at 120 ktons (of 2,160 ktons).

Landfilling of durable products is dominated by the landfilling of miscellaneous durables, which showed a steady increase from 9,450 ktons (out of 21,870 ktons total miscellaneous durables produced) in 1990 to 20,280 ktons (out of 37,410 ktons total) in 2018. Furniture and furnishing are the second highest, with an increase from 5,640 ktons landfilled (of 6,790 ktons) in 1990 to 9,680 ktons (of 12,080 ktons) in 2018. The amount of major appliances landfilled was slightly reduced from 2,240 ktons in 1990 to 2,110 ktons in 2018, which is associated with an increase in the recycling, as explained before. The amount of carpets and rugs landfilled increased from 1,370 ktons in 1990 to 2,460 ktons in 2018. Small appliances are mainly landfilled, and indicated an increase in the amount landfilled, from 360 ktons (out of 460 ktons total produced) in 1990, to 1,640 ktons (out of 2,160 ktons total produced) in 2018. As discussed before, a very small amount of small appliances is recycled, and the rest is combusted for energy, which increased from 90 ktons in 1990 to 400 ktons in 2018. The amount of rubber tires landfilled was significantly decreased during the 28-year period, from 2,770 ktons in 1990 to 1,210 ktons in 2018. This is associated with an increase in the recycling, 2,610 ktons in 2018 (440 ktons in 1990), but also with an almost equal increase in the combustion of rubber tires for energy; 2,710 ktons in 2018 (400 ktons in 1990). The amount of furniture and furnishings combusted for energy increased from 1,150 ktons in 1990 to 2,360 ktons in 2018, and the amount of miscellaneous durable products increased slightly from 2,550 ktons in 1990 to 3,050 ktons in 2018. The amount of carpets and rugs processed in combustion facilities almost doubled from 290 ktons in 1990 to 600 ktons in 2018.

2. Non-durable products

Other paper non-durable products is one of the major categories in non-durable goods. It was observed that both a reduction in the total amount produced, and also, a significant increase in the diversion of other paper non-durables from landfills occurred. This is mainly associated with achievements during the 2000s and the 2010s. The amount landfilled increased from 19,040 ktons of other non-durables (out of 25,940 ktons) in 1990 to 19,830 ktons (out of 32,270 ktons) in 2000. It then significantly decreased to 10,730 ktons (out of 23,690 ktons) in 2010, and to 9,350 ktons (out of 20,440 ktons) in 2018. The amount of other paper non-durables recycled indicated an increase from 3,000 ktons in 1990 to 7,680 ktons in 2000, to 10,650 ktons in 2010. However, a slight decrease is observed in 2018, with the amount recycled amounting to 8,810 ktons. The amount of other paper non-durables combusted for energy, increased from 3,900 ktons in 1990 to 4,760 ktons in 2000, but then more than halved, to 2,310 ktons in 2010, and 2,280 ktons in 2018. Similar to the other paper non-durables, newspapers/mechanical papers, showed a significant decrease both in the total amount produced, and the amount landfilled. In 1990, 7,360 ktons of newspapers/mechanical papers (out of 14,040 ktons total produced) were landfilled, compared to 1,430 ktons (out of 5,050 ktons) in 2018. Recycling is the main method used for processing newspapers/mechanical papers since 2000. In 1990, the amount recycled was 5,160 ktons, with another 1,520 ktons combusted for energy. In 2018, recycling amounted to 3,270 ktons, with 350 ktons combusted for energy. Clothing and footwear is one of the categories that emphasis should be placed on. Both the amount and the materials landfilled were significantly increased, with very small amounts of recycled, and combusted for energy production. In 1990, 2,900 ktons (out of 4,010 ktons total produced) of clothing and footwear were landfilled, compared to 9,070 ktons (out of 12,970 ktons) in 2018. The amount recycled increased from 520 ktons in 1990 to 1,690 ktons in 2018, and the amount combusted for energy increased from 590 ktons in 1990 to 2,210 ktons in

2018. Similar to the clothing and footwear, disposable diapers are products, which constantly increases in amount, and considering its problematic nature, it cannot be recycled, and thus indicates zero recycling. The amount landfilled increased from 2,240 ktons (out of 2,700 ktons) in 1990, to 3,300 ktons (out of 4,100 ktons) in 2018. Also, combustion of disposable diapers for energy increased from 460 ktons in 1990 to 800 ktons in 2018. Other miscellaneous non-durables indicated a slight increase in the amounts landfilled, with 2,770 ktons (out of 3,340 ktons produced) landfilled in 1990, and 3,160 ktons (out of 4,100 ktons) landfilled in 2018. Recycling started in 2015, with a small amount collected for recycling; 180 ktons in 2018. Combustion of other miscellaneous non-durables slightly increased from 570 ktons in 1990 to 760 ktons in 2018. Plastic plates and cups, towels, sheets and pillowcases, and trash bags, were and are mainly landfilled. In 1990, 540 ktons of plastic plates and cups (out of 650 ktons) were landfilled, compared to 830 ktons (out of 1,030 ktons) in 2018, and 110 ktons were combusted for energy, compared to 200 ktons in 2018. In 1990, 650 ktons (out of 780 ktons total) of trash bags, and 490 ktons of towels, sheets, and pillowcases (out of 710 ktons total) were disposed of in landfills. A small amount was used as fuel in combustion facilities, with towel, sheets, and pillowcases, amounting to100 ktons, compared to 250 ktons in 2018, and combustion of trash bags for energy, indicating an increase from 130 ktons in 1990 to 250 ktons in 2018. There is no recycling of plastic plates and cups, and trash bags, and small amounts of towels, sheets, and pillowcases recycling are reported. In 1990, 120 ktons of towels, sheets, and pillowcases were recycled, and the amount doubled to 240 ktons in 2018.

3. Containers and packaging

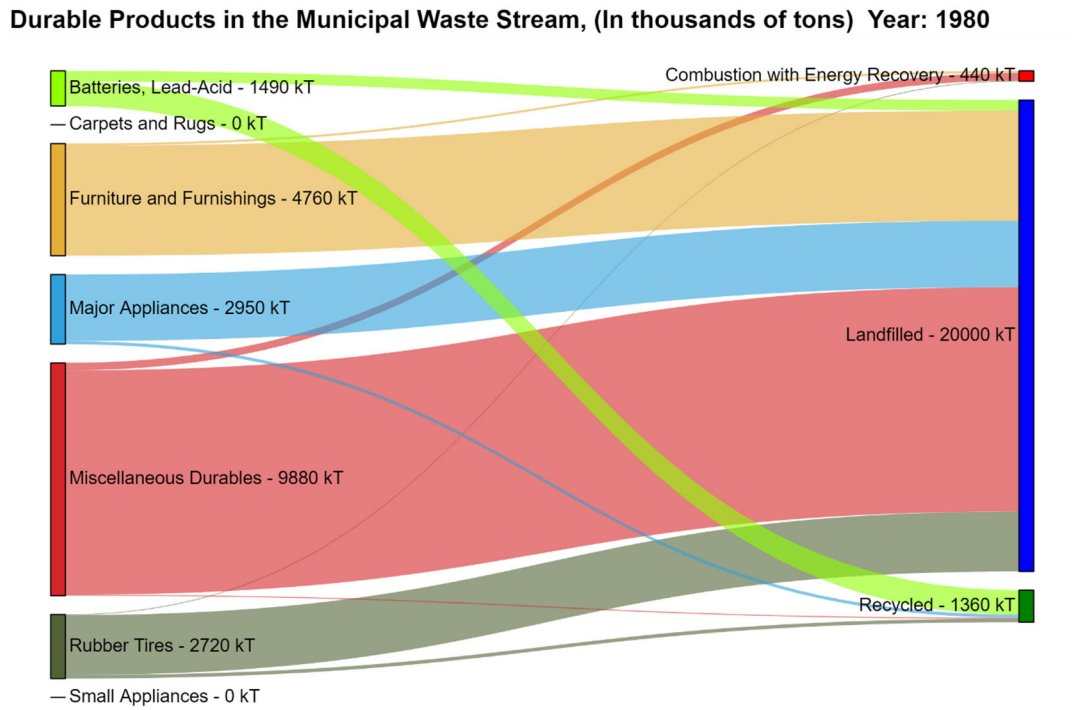
Paper and paperboard packaging is the major category in containers and packaging, which indicated significant reduction in the amounts landfilled. In 1990, 17,110 ktons (out of 32,680

ktons produced) were landfilled, whereas in 2018, 6,440 ktons (out of 41,900 ktons produced) were landfilled. At the same time, the amount of recycling increased from 12,070 ktons in 1990 to 33,890 ktons in 2018. The amount of paper and paperboard packaging combusted for energy decreased from 3,500 ktons in 1990 to 1,570 ktons in 2018. Wood packaging wastes are mainly landfilled during the 28-year period, but the amount landfilled decreased during the 1990s, and increased during the 2000s, and the 2010s. In 1990, 6,880 ktons (out of 8,180 ktons) were landfilled, the amount decreased to 5,840 ktons (out of 8,610 ktons) in 2000, increased to 6,160 ktons (out of 9,770 ktons) in 2010, and further increased to 6,780 ktons (out of 11,530 ktons) in 2018. Recycling of wood packaging significantly increased from 130 ktons in 1990, to 1,370 ktons in 2000, to 2,280 ktons in 2010, and 3,100 ktons in 2018. During the same period, combustion of wood packaging for energy, increased slightly from 1,370 ktons in 1990, to 1,650 ktons in 2018.

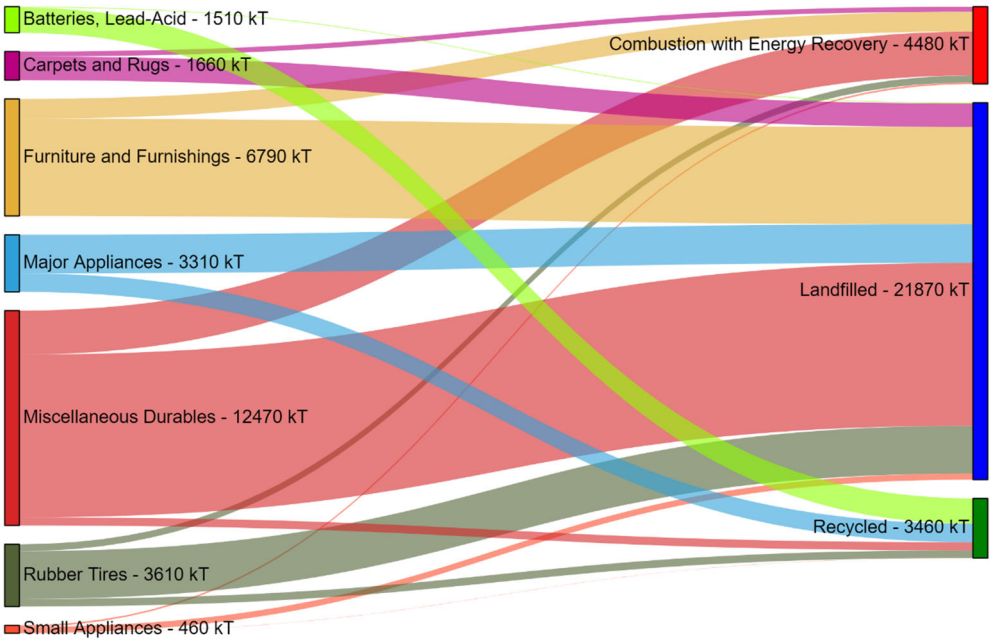
Plastics packaging is mainly landfilled. In 1990, 5,510 ktons (out of 6,900 ktons) were landfilled, with the amount almost doubled to 10,090 ktons (out of 14,530 ktons) in 2018. In 2018, 1,980 ktons of plastics packaging was recycled; an increase from 260 ktons, which was in 1990. Combustion of plastics packaging for energy more than doubled, from 1,130 ktons in 1990 to 2,460 ktons in 2018. Glass packaging is mainly landfilled, even if the total amount has been decreasing since 1990. In 1990, 7,640 ktons (out of 11,830 ktons produced) of glass packaging were landfilled, and 5,420 ktons (out of 9,790 ktons produced) in 2018. At the same time, the amount of recycling increased from 2,620 ktons in 1990 to 3,060 ktons and the amount combusted for energy slightly decreased from 1,570 ktons in 1990, to 1,310 ktons in 2018. Other packaging materials are mainly landfilled with the amount slightly increased from 130 ktons (out of 150 ktons produced) in 1990, to 270 ktons (out of 340 ktons) in 2018. The amount combusted for energy increased from 20 ktons in 1990 to 70 ktons in 2018.

In 1990, steel packaging was mainly landfilled, however, after 2000, the product is mainly collected for recycling. 1,830 ktons (out of 2,890 ktons produced) of steel packaging products were landfilled in 1990, whereas this amount dropped to 470 ktons (out of 2,210 ktons) in 2018. Recycling of steel packaging increased from 690 ktons in 1990 to 1,630 ktons in 2018. Combustion for energy decreased from 370 ktons in 1990 to 110 ktons in 2018. Recycling of aluminum packaging decreases gradually since 1990, with 1,010 ktons (out of 1,900 ktons) recycled in 1990, and 670 ktons (out of 1,920 ktons produced) recycled in 2018. Landfilling increased from 740 ktons in 1990 to 1,000 ktons in 2018, and combustion for energy increased from 150 ktons in 1990 to 250 ktons in 2018.

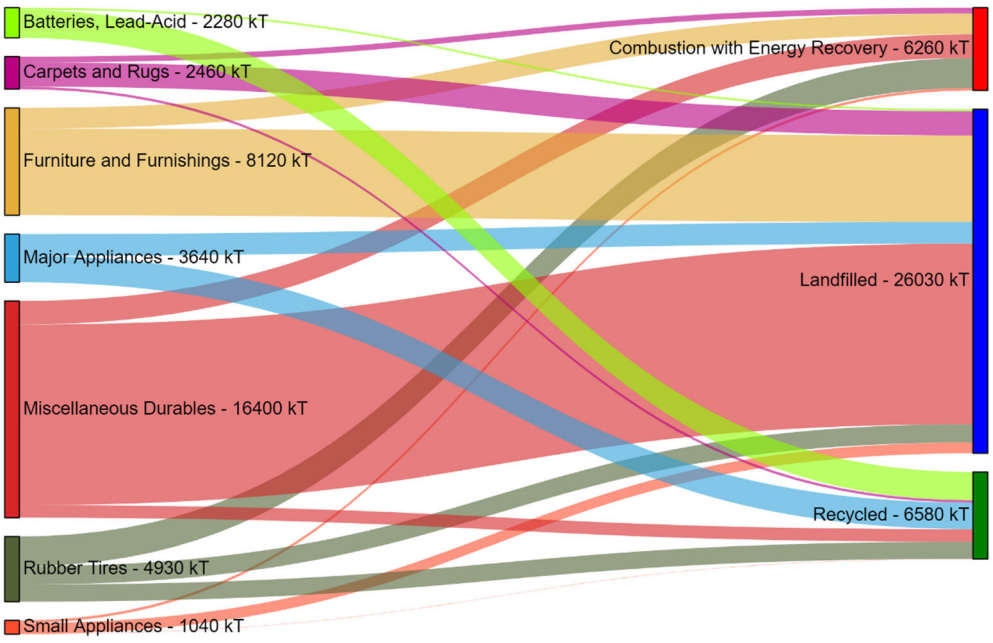
i) Durable products:



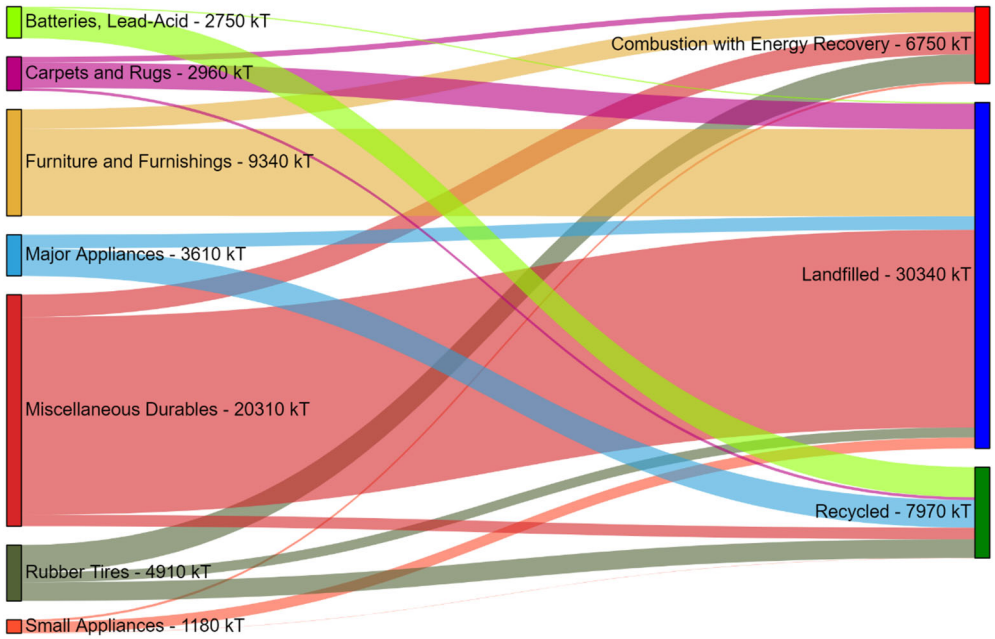
Durable Products in the Municipal Waste Stream, (In thousands of tons) Year: 1990



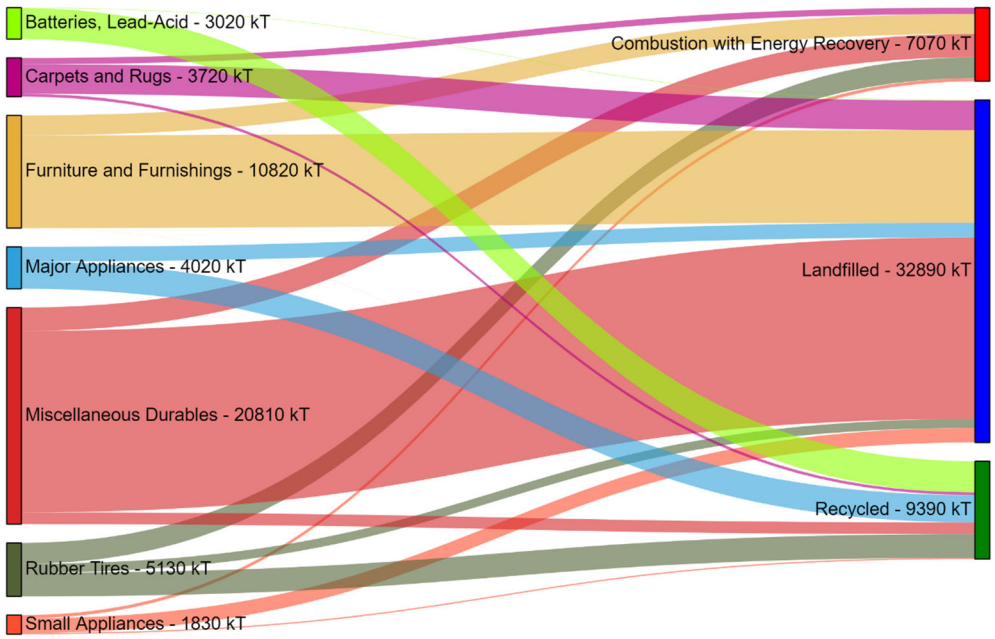
Durable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2000

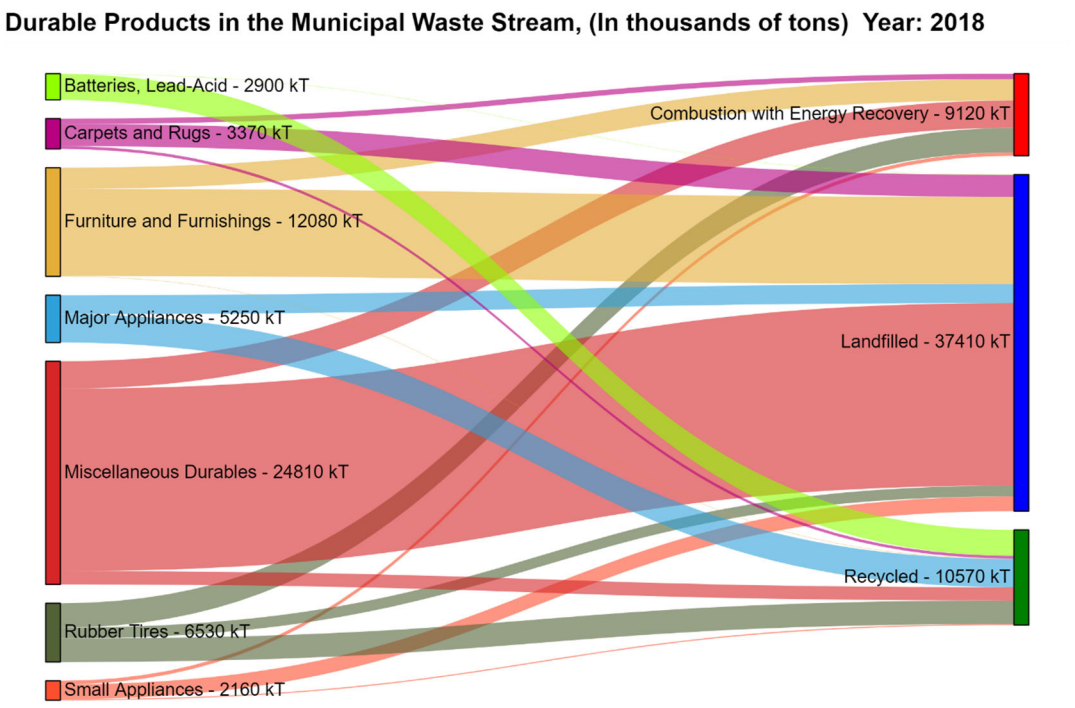


Durable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2005



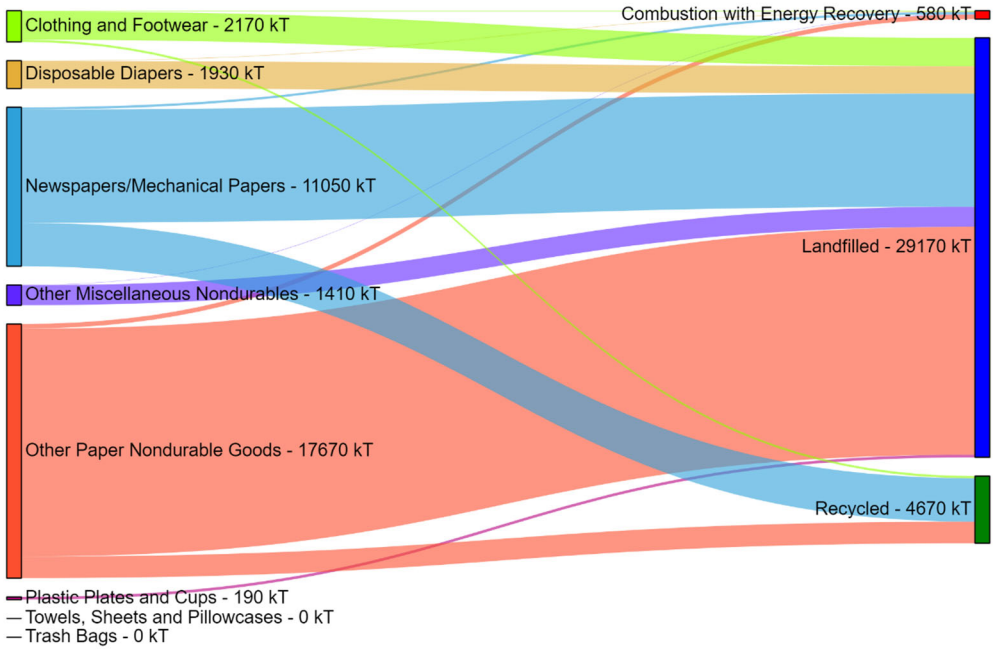
Durable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2010



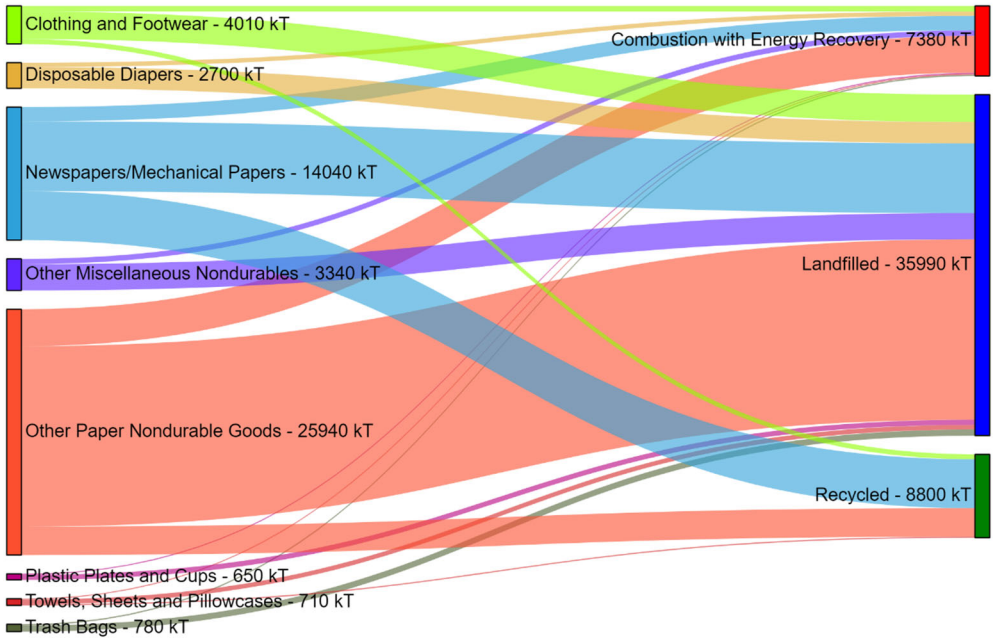


ii)non-durable materials

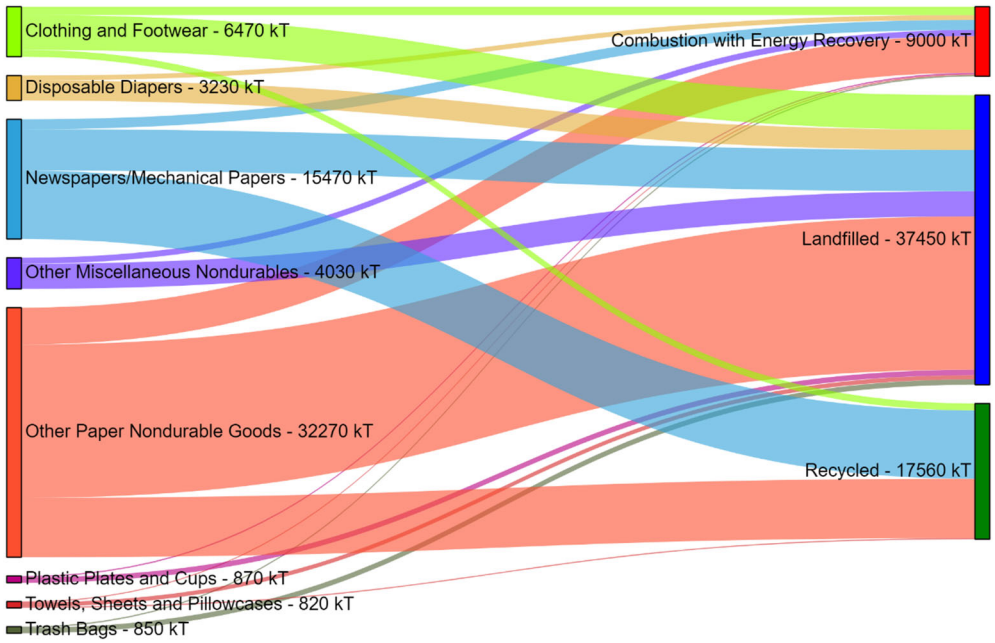
Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 1980



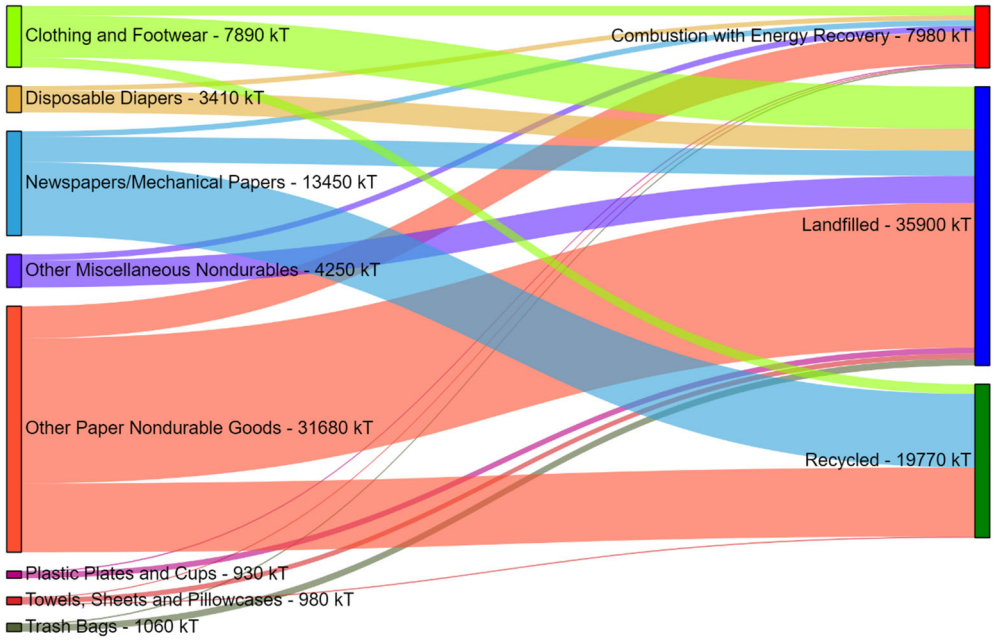
Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 1990



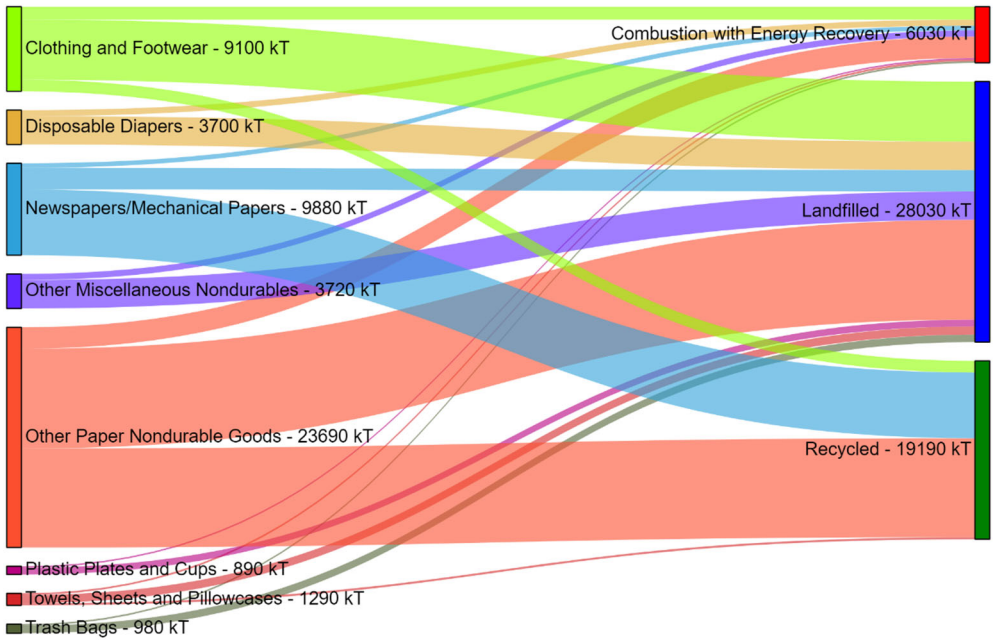
Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2000



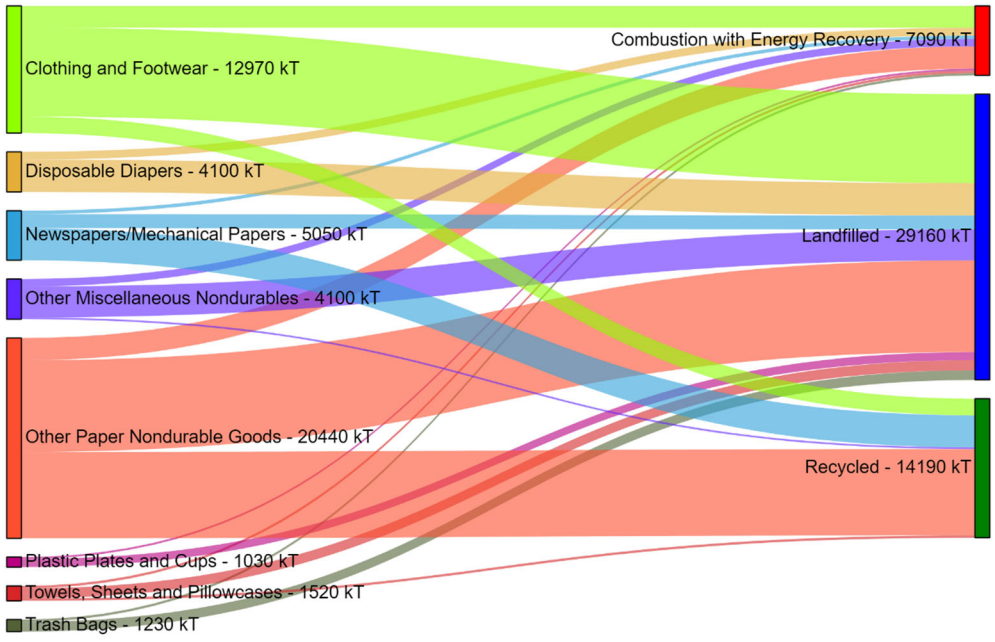
Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2005



Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2010

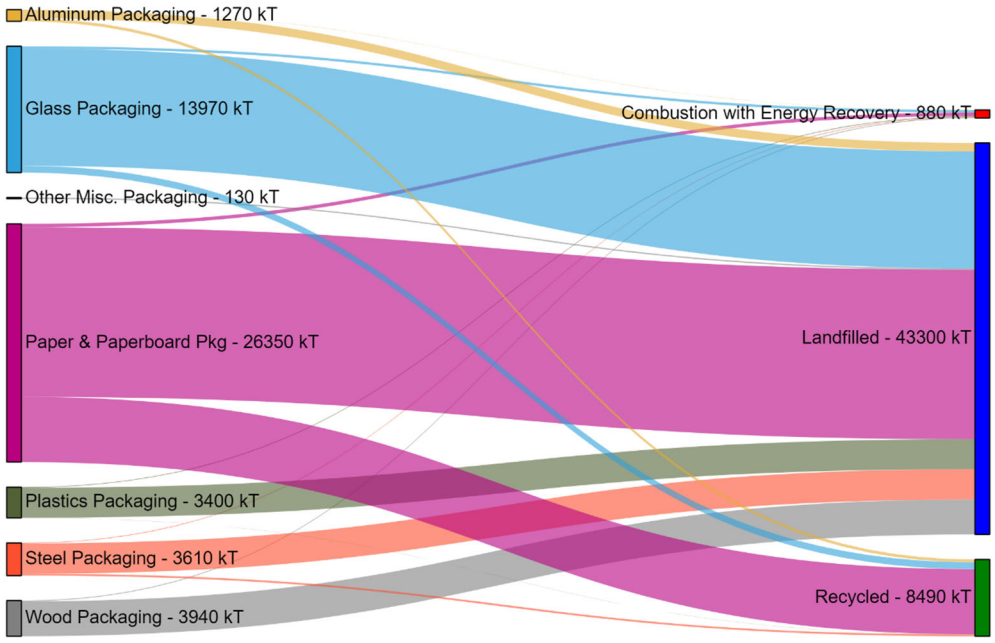


Nondurable Products in the Municipal Waste Stream, (In thousands of tons) Year: 2018

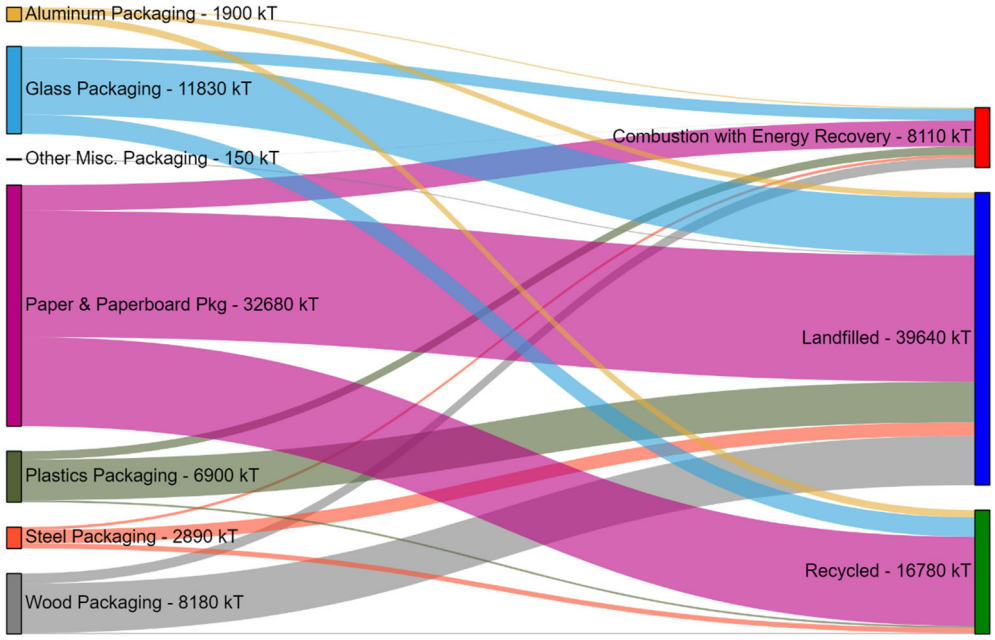


iii)Containers and packages

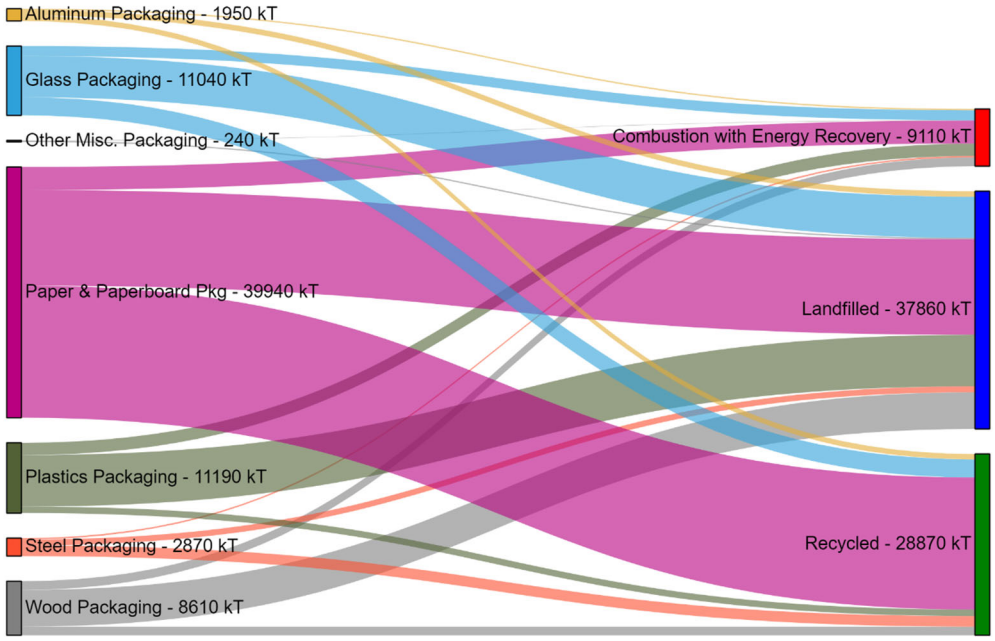
Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 1980



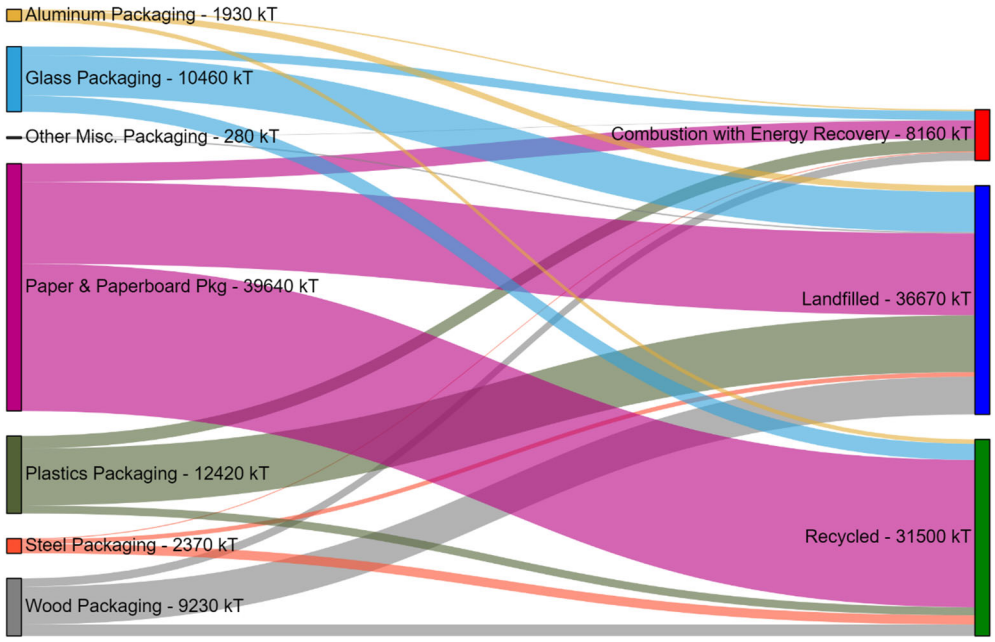
Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 1990



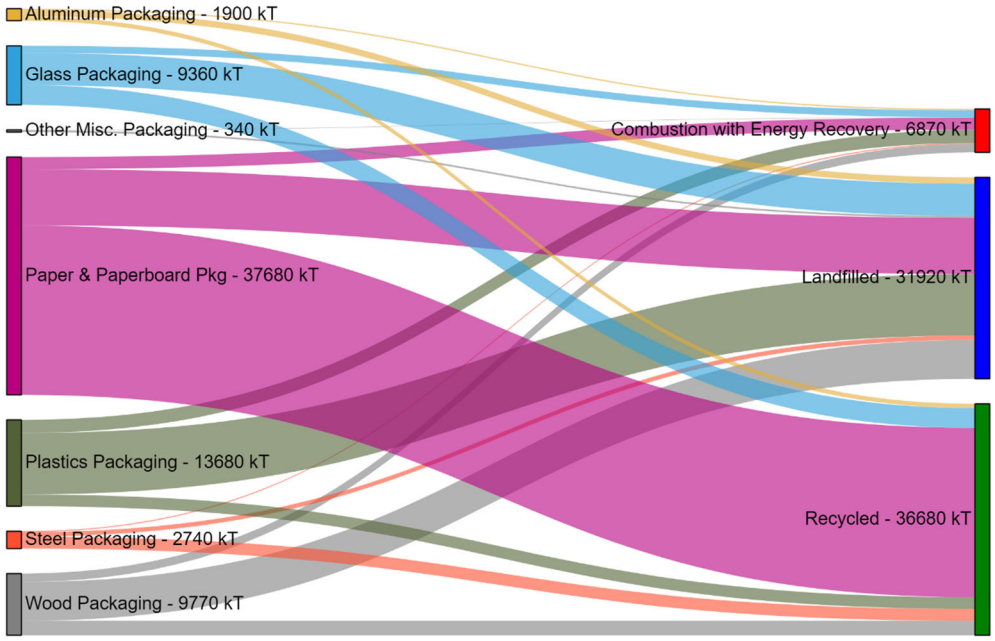
Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 2000



Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 2005



Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 2010



Containers & Packages in the Municipal Waste Stream, (In thousands of tons) Year: 2018

