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Decrease the Waste of Land and Other Natural Resources by Recycling

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Abstract *- America is in danger of being buried in tons of solid waste since the amount of waste we generate increases. The average American in 2018 produced about 292.4 million tons or 4.9 pounds of trash daily, and only 69 million tons were recycled, and 25 million tons were composted. Together, 93.9 million tons of solid waste were recycled and composted. Recycling plays an important role in the economy by ensuring that waste is re-used and reduced. Individuals who make recycling a part of their everyday lives can eliminate the waste of land, energy, forests, minerals, water, and other natural resources that occur when we fail to re-use what we already have. In turn, recycling reduces pollution, conserves resources, saves energy, promotes the economy, and creates jobs. This article discusses the significance of recycling on the environment, economy, and future generations; provides reasons to recycle; defines steps to recycling materials; and generates challenges, actions, and ideas about how to reduce and re-use.*

Keywords — *Recycle, Recycling, Reduce, Re-use, Waste Prevention*

Abbreviations: MSW: Municipal Solid Waste; NIH: National Institute of Health; US EPA: United States Environmental Protection Agency

I. INTRODUCTION

Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning that refuse into new products. Recycling can benefit your community, the economy, and the environment [1]. Recycling generates a positive impact on the world in which we live. Recycling is important to both the natural environment and all people. We must act quickly since the amount of waste we create is increasing all the time.

The amount of rubbish is constantly increasing because:

- Increasing wealth means that people are buying more products and creating more waste.
- Increasing population means that more people on the planet can generate waste.
- New packaging and technological products are being developed, and many contain materials that are not biodegradable.
- New lifestyle changes, such as eating fast food, means that we create additional waste that is not biodegradable [2].

The US EPA began collecting and reporting data on the generation and disposition of waste within the U.S. over 35 years ago. The Agency uses this information to measure the success of materials management programs across the country and characterize the national waste stream. In 2018. the entire generation of municipal solid waste (MSW) was 292.4 million tons (U.S. short tons, unless specified) or 4.9 pounds per person per day. Of the MSW generated, approximately 69 million tons were recycled, and 25 million tons were composted. Together, 93.9 million tons of MSW were recycled and composted, equivalent to a 32.1 percent recycling and composting rate.

Additionally, 17.7 million tons of food were managed by other methods. Other food-management includes the following management pathways: animal feed, bio-based materials/biochemical processing, co-digestion/anaerobic digestion, donation, land application, and sewer/wastewater treatment. Additionally, nearly 35 million tons of MSW (11.8 percent) were combusted with energy recovery, and more than 146 million tons of MSW (50 percent) were landfilled [3].

The following provides a detailed breakdown of the numbers [3]:

- 69 million tons of MSW were recycled in 2018, a 2.2 percent increase from the 67.6 million tons recycled in 2015.
- There was an increase from 23.4 million to 24.9 million tons of food and yard trimmings composted between 2015 and 2018.
- The recycling rate (including composting) was 32.1 percent in 2018, down from 34.7 percent in 2015.
- The per capita rates in 2018 were:
    - 1.16 pounds per person per day for recycling.
    - 0.42 pounds per person per day for composting.
    - 0.30 pounds per person per day for other food management.

SIGNIFICANCE OF RECYCLING ON THE ENVIRONMENT, ECONOMY, AND FUTURE GENERATIONS

Environmental, economic, and community benefits can be accomplished by recycling. According to the NIH Environmental Management System (2020), recycling is greatly beneficial to the environment, the economy, and future generations. Many individuals have questions about the benefits of recycling and its impact. Here are some data points about the significance of recycling [4].

Environmentally - recycling reduces the use of natural resources by reusing materials [4]:

- It is estimated that 94% of the natural resources used by Americans are non-renewable. Non-renewable, natural resource use has increased from 59% in 1900 and 88% in 1945.
- Recycling saves non-renewable resources.
- It takes 95% less energy to recycle aluminum than making a new product from raw materials.
- Making products from recyclables results in energy savings. Recycled steel saves 60% production energy, recycled newspaper saves 40%, recycled plastics saves 70%, and recycled glass saves 40%.
- Using scrap steel instead of virgin ore to make new steel uses 40% less water and creates 97% less mining waste.

Economy benefits by [4]:

- Incinerating 10,000 tons of waste creates one job while landfilling the same amount creates six jobs. Recycling the same 10,000 tons creates 36 jobs!
- The National Recycling Coalition reports that recycling businesses have created 1.1 million jobs, generated $236 billion in gross annual sales, and provided $37 billion in annual payrolls.
- By meeting the state's 50% recycling goal, California is expected to create about 45,000 recycling jobs, compared to 20,000 new jobs slated to be created for the manufacturing sector.
- Massachusetts employs more than 9,000 people in more than 200 recycling enterprises. About half of these jobs are in the recycling-based manufacturing sector. These businesses generate more than half a billion dollars in value to the state's economy.

Future generations benefit by [4]:

Natural resources are being depleted, and landfills are being filled at an increasing rate. Our current system of production, consumption, and disposal has become unsustainable. It is imperative for everyone -from individuals to large organizations -to rethink ideas about trash disposal. By reducing the amount of trash produced and reusing existing materials, we can all make a difference by protecting the environment, conserving natural resources, and sustaining the planet for future generations.

REASONS TO RECYCLE

Recycling is the process of turning old used materials into new products. Through recycling and reusing trash, energy, and raw materials are saved. We could reduce the exploitation of natural resources, save money, reduce pollution and waste, create jobs, and boost the economy [5].

Here Are Some Reasons to Recycle:

A. Recycling preserves natural resources and prevents habitat destruction

When we recycle, used materials can be converted into new products, reducing the need to consume natural resources. New products are made by extracting fresh, raw materials from the Earth through mining and forestry if used materials are not recycled. Recycling helps conserve important raw materials and protects natural habitats for the future [6]. Most of the world's natural resources are finite, meaning they are limited and will run out at some point. Preserving these natural resources is a primary concern for everyone concerned about the longevity of natural resources available for human use. We can reduce the consumption of natural resources by using recycled materials to make new products and packaging. Preventing waste through source reduction before it is generated can further reduce the need for disposal services and save more resources. Recycling can result in products that are superior to those made from virgin materials. For example, after being processed for recycling, the tin in bimetallic cans is more refined and is more valuable. For every ton of steel recycled, 40 pounds of limestone, 1,000 pounds of coal, and 2,500 pounds of iron ore are saved. By recycling tin, we can reduce the need for new raw material, which reduces mining and its associated pollution.

According to the Pennsylvania Department of Natural Resources, in 2005, the state saved 1.4 million tons of iron ore, 829,786 tons of coal, and 71,124 tons of limestone by recycling over 1.2 million tons of steel. For more information go to:
http://www.dep.pa.gov/Business/Land/Waste/Recycling/Benefits/Pages/NaturalResources.aspx.

By reducing land disturbances and the pollution associated with mining and the extraction of new materials, we can decrease natural ecosystems and wildlife habitats' degradation. Paper recycling plays a direct role in preserving and biodiversity of forests by lowering the demand for wood. A longleaf pine forest in the southern United States used to cover 90 million acres, but today less than five percent remains due to harvesting wood for paper products production. A longleaf pine forest is home to more than 20 endangered species. By recycling paper and paper products,

we are reducing the pressure on the remaining habitat to preserve it for these endangered species [5].

B. Recycling creates jobs

The US EPA released significant findings of the recycling industry's economic benefits with an update to the national Recycling Economic Information (REI) Study in 2016. This study analyzed the numbers of jobs, wages, and tax revenues attributed to recycling. In a single year, the study found that recycling and re-use activities in the United States accounted for 681,000 jobs, $37.8 billion in wages, and $5.5 billion in tax revenues. This equates to 1.17 jobs per 1,000 tons of materials recycled, $65.23 in wages, and $9.42 in tax revenue for every ton of materials recycled [7].

C. Recycling saves energy, reduces pollution, and preserves landfill space

Recycling conserves a lot of energy. Using recycled materials in the manufacturing process consumes considerably less energy than what is needed to generate new products from raw materials – even when comparing all of the associated costs, including transportation. There are also extra energy savings because more energy is required to extract, refine, transport, and process raw materials for industry, compared with providing industry-ready materials [6].

Recycling reduces pollution because manufacturers are re-using materials instead of creating new ones, saving energy, decreasing toxic chemicals, and releasing fewer greenhouse gases into the atmosphere through incineration in landfills. Recycling hazardous waste prevents it from going into landfills, potentially contaminating water sources through seepage. The US EPA estimates that 0.1% to 0.4% of surface aquifers are contaminated by landfills and industrial impoundments, leaching metals, minerals, bacteria, viruses, and other toxic substances. Anything more than 0% is unacceptable [5]

According to Stanford University, the amount of energy lost by throwing away recyclables such as aluminum cans and newspapers is the equivalent of the annual output of 15 power plants. For more information, you can go to http://bgm.stanford.edu/pssi_faq_benefits. For every ton of recycled newsprint, savings include 1.7 barrels of oil, 7,000 gallons of water, 4.6 cubic yards of landfill space, 601 kilowatts of energy saved, and 60 pounds of air pollutants. Recycling one ton of plastic saves 16.3 barrels of oil, 5,774 kilowatts of energy, and 30 cubic yards of landfill space. For every one ton of glass, savings include 0.12 barrels of oil, 42 kilowatts of energy, two cubic yards of landfill space are saved, and 7.5 pounds of air pollutants. Recycling one glass bottle saves enough energy to power a light bulb for four hours. When you recycle aluminum, 95% of the energy required to make the same amount of aluminum from its virgin source is saved. Recycling one ton of aluminum saves 40 barrels of oil, 14,000 kilowatts of energy, and 10 cubic yards of landfill space. [5].

D. Recycling reduces incineration

When we recycle, recyclable materials are reprocessed into new products, and as a result, the amount of rubbish sent for incineration is reduced [6].

E. Recycling helps protect the environment and reduces the usage of new raw materials

Recycling reduces the need for extracting (mining, quarrying, and logging), refining, and processing raw materials. All of these activities create substantial air and water pollution. As recycling saves energy and reduces greenhouse gas emissions, which helps tackle climate change [6]. Extracting raw materials from the environment is expensive. It also uses up a lot of water and energy. When we recycle, we extract less, which conserves many of our precious (and finite!) natural resources, including trees, water, oil, and metals. The more we recycle, the more we protect our natural resources [8].

F. Recycling paper saves water

Recycling paper products saves trees. For every ton of paper made from recycled scrap, about 7,000 gallons of water are conserved [9].

G. Recycling paper saves trees

The United States uses 85.5 million tons of paper a year, of which only 22% is recycled. If the US could start recycling the other 78%, we would save almost 800 million trees a year [9].

H. Save the cans

Recycling one ton of aluminum saves the equivalent energy of 2,350 gallons of gasoline. That is about the same as the amount of energy a typical home uses in 10 years. [9].

I. Recycling protects wildlife

If you eliminate the need for virgin materials, you also eliminate the need for mining and deforestation. This, in turn, has a direct impact on wildlife. [9].

J. Recycling improves water quality

Landfills directly impact the water tables built over, so the less waste, the better [9].

K. Recycling improves global health

Landfills generate some toxic, noxious gasses. Over time, exposure to those gasses can cause serious health problems, like asthma. Toxic liquids draining into water tables can also negatively impact health [9].

L. Recycling improves communities

Supporting American manufacturing conserves valuable

resources; This helps create jobs in the recycling and manufacturing industries in the United States [10].

STEPS TO RECYCLING MATERIALS

The recycling process may differ based on commodity and locality. However, the US EPA (2020) suggest that recycling includes essentially three main steps [7]:

Step 1: Collection and Processing
There are several methods for collecting recyclables, including curbside collection, drop-off centers, and deposit or refund programs. After collection, recyclables are sent to a recovery facility to be sorted, cleaned, and processed into materials that can be used in manufacturing. Recyclables are bought and sold just like other raw materials, and prices go up or down depending on supply and demand in the United States and the world.

Step 2: Manufacturing
More and more of today's products are being manufactured using recycled content. Common household items that contain recycled materials include the following:

- Newspapers and paper towels
- Aluminum, plastic, and glass soft drink containers
- Steel cans
- Plastic laundry detergent bottles

Recycled materials are also used in new ways, such as recovered glass in asphalt to pave roads or recovered plastic in carpeting and park benches.

Step 3: Purchasing New Products Made from Recycled Materials
You help close the recycling loop by buying new products made from recycled materials. There are thousands of products that contain recycled content. When you go shopping, look for the following:

- Products that can be easily recycled
- Products that contain recycled content

Below are some of the terms used:

- Recycled-content product was manufactured with recycled materials collected from a recycling program or waste recovered during a normal manufacturing process. The label will sometimes include how much of the content was from recycled materials.
- Post-consumer content is very similar to recycled content, but the material comes only from recyclables collected from consumers or businesses through a recycling program.
- Recyclable product - Products that can be collected, processed, and manufactured into new products after being used. These products do not necessarily contain recycled materials. Remember, not all kinds of recyclables may be collected in your community, so be sure to check with your local recycling program before you buy.

Here is a list of some of the common products you can find that can be made with recycled content:

- Aluminum cans
- Car bumpers
- Carpeting
- Cereal boxes
- Comic books
- Egg cartons
- Glass containers
- Laundry detergent bottles
- Motor oil
- Nails
- Newspapers
- Paper towels
- Steel products
- Trash bags

CURRENT CHALLENGES FACING THE RECYCLING SYSTEMS

While recycling benefits are clear, growing, and strengthening the US recycling system to create more jobs and enhance environmental and community benefits will require multi-stakeholder collaboration to address the challenges currently facing the system. Current challenges include [10]:

- Most Americans want to recycle, as they believe recycling provides an opportunity for them to be responsible caretakers of the Earth. However, it can be difficult for consumers to understand what materials can be recycled, how materials can be recycled, and where to recycle different materials. This confusion often leads to placing recyclables in the trash or throwing trash in a recycling bin or cart.
- America’s recycling infrastructure has not kept pace with today’s waste stream. Communication between the manufacturers of new materials and products and the recycling industry needs to be enhanced to prepare for and optimally manage new materials.
- Domestic markets for recycled materials need to be strengthened in the US. Historically, some of the recycled materials generated in the US have been exported. However, changing international policies have limited the export of waste materials. There is also a need to better integrate recycled materials and end-of-life management into product and packaging designs. Improving communication among the different recycling system sectors is needed to strengthen the development of existing materials markets and develop new innovative markets.

- Stakeholders across the recycling system agree that more consistent measurement methodologies are needed for measuring the performance and success of recycling programs. Standardized metrics could be used to create effective goals and track progress.

ACTIONS TAKEN TO ADDRESS THESE CHALLENGES

The US EPA and its stakeholders have taken several actions since November 2018 to address the challenges facing the US recycling system. In 2018, the US EPA conducted a series of roundtable conversations with key stakeholders involved in the recycling system. These roundtables were a chance to hear different perspectives about the challenges and opportunities within the system. These conversations led to identifying four key action areas, and stakeholders formed workgroups to explore further and develop actions around the areas. Within those areas, the stakeholders expressed ideas for future actions that federal, state, and local governments; industry associations; recyclers; waste haulers; material users; and non-governmental organizations could improve the US recycling system. The action areas are: promote education and outreach, enhance materials management infrastructure, strengthen secondary material markets, and enhance measurement [10].

The two reports that came out of these meetings were [10]:

1. The National Recycling Strategy identified strategic objectives and actions needed to create a stronger, more resilient, and cost-effective US municipal solid waste recycling system.
2. The National Framework for Advancing the US Recycling System (released in November 2019) was the product of a multi-stakeholder collaborative effort that began on November 15, 2018. This document summarizes the workgroup's activities and accomplishments and lays out the path forward for continued action in 2020. It also provides a foundation on which additional actions can be identified and taken.

IDEAS ABOUT HOW TO REDUCE AND RE-USE

According to the US EPA in 2018, only 32.1% of Americans regularly recycle [3]. Learning how to reduce, re-use, and recycling can help you, your community, and the environment by saving money, energy, and natural resources. Find out what you can do to help make a difference in our environment every day. Whether you are at home, on the go, in the office, or at school, there are many opportunities to reduce, re-use, and recycle. Recycling programs are managed at state and local levels. Contact your local recycling agency for more information on recycling in your community [11].

Here are some ideas on how to reduce and re-use products [12]:

- Buy used. You can find everything from clothes to building materials at specialized re-use centers and consignment shops. Often, used items are less expensive and just as good as new.
- Look for products that use less packaging. When manufacturers make their products with less packaging, they use less raw material. This reduces waste and costs. These extra savings can be passed along to the consumer. Buying in bulk, for example, can reduce packaging and save money.
- Buy reusable over disposable items. Look for items that can be re-used. For example, you can bring your silverware and a cup to work rather than use disposable items.
- Maintain and repair products, like clothing, tires, and appliances, so that they will not have to be thrown out and replaced as frequently.
- Borrow, rent, or share items that are used infrequently, like party decorations, tools, or furniture.

CONCLUSION

Recycling is more than just a good idea; it is for everyone. It is an important way to demonstrate our concern for preserving our natural resources and protecting clean air and water. Through recycling, you reduce pollution, conserving resources, saving energy, promoting the economy, and creating jobs. It is our responsibility to ensure that waste is recycled and to protect the environment for future generations. By instilling recycling morals into our own lives, community, and children, we can create increased awareness of the necessity to prevent waste and recycle used products. Contact your local or state recycling agency or organization to get involved.

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