WATER LOG

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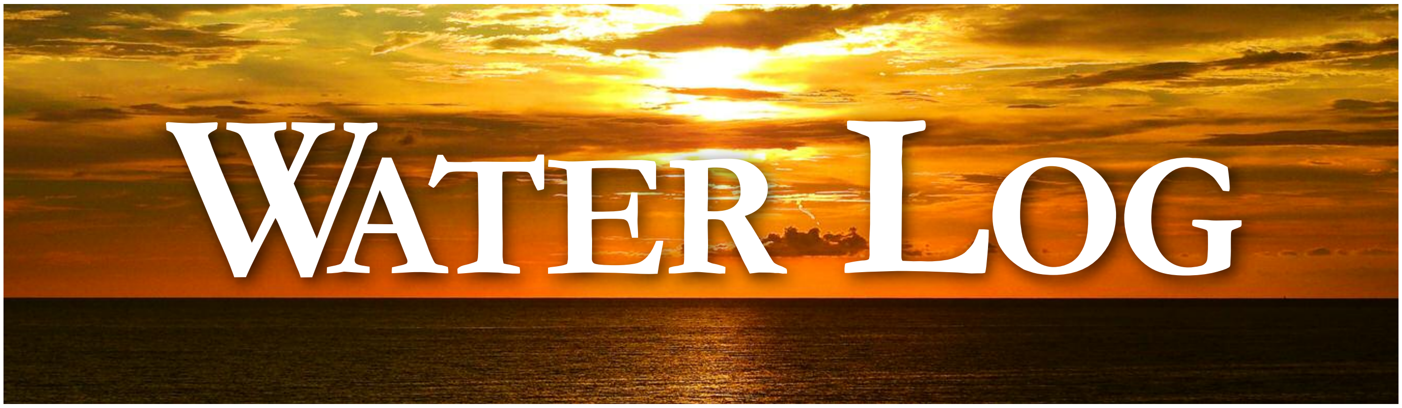

Inside This Issue . . .

• UPCOMING EVENTS •

Gulf TREE Climate Tool Workshop

Pensacola, FL

December 13, 2017

http://gulftree.org

The Science, Business, and Education of Sustainable Infrastructure: Building Resilience in a Changing World

Washington, DC

January 23-25, 2018

https://ncseconference.org

Louisiana Environmental Education State Symposium

Baton Rouge, LA

February 23-24, 2018

http://bit.ly/lees-symposium

Cover imagery courtesy of Lokarta Media, Pump Aid, and Lex McKee. Combined by the MASGLP.

Contents: Sunset over Siesta Key in Sarasota, FL. Photograph courtesy of Jim Mullhaupt.

Plastic: Nuisance on Land, Menace at Sea

Kristina Alexander

Photograph courtesy of Kate Ter Haar.

Water flows downhill. As does everything in that water. Therefore, in Mississippi and Alabama, any pollutant, trash, or debris dropped into a creek or a stream – unless it gets stuck – will go to the Gulf of Mexico. The straw from a drink, the plastic pull-tab from the pack of cigarettes, and all those plastic water bottles – unless recycled or placed in a landfill – will end up in the Gulf. There the plastic will trap, impede, or otherwise harm the fish, turtles, dolphins, seabirds, and whales who depend on the ecosystem.

At least 80 percent of the plastic pollution found in oceans and seas is first dropped on land.[1] It becomes marine pollution by being blown in, or caught up in a river, or when stormwater flushes debris downstream. The greatest mass of marine plastic pollution is known as the Great Pacific Garbage Patch, which is formed as ocean debris is shunted about by different currents until it stalls in the center of that vortex in the Pacific Ocean. According to National Geographic, the size of the Great Pacific Garbage Patch is too large to measure. That is how big it is.

Photograph courtesy of Paul Williams.

Both federal and state laws make littering illegal. While most pollution enforcement focuses on punishing the act of dumping plastics directly into water, most plastics come into the water after a purposeful (or careless) disposal on land. Legislation exists to punish common littering and illegal dumping, but it is not linked to the goal of preventing plastic contamination of marine waters. With almost half the world's population within 50 miles of a coast, passive legislation is not a solution.

Federal Water Law Prohibits Putting Trash in Water

The Clean Water Act (CWA) makes it illegal to dump things into the "waters of the United States,"[2] a term that has been interpreted to mean waterbodies that are or meet up with navigable waters. The act is enforced by the U.S. Environmental Protection Agency (EPA), and enforcement is focused on discharges into the water from direct sources (such as pipelines) and indirect sources (such as stormwater runoff).

The CWA identifies anything that changes the quality of the water it is put into as a "pollutant." The statute's definition of pollutant includes "garbage" and "solid waste." The focus of the CWA, however, is not on trash dumped into creeks so much as preventing businesses and municipalities from pumping contaminants into people's drinking water or fish habitat. One way the law does that is by requiring states to establish a total maximum daily load (TMDL) for what municipalities discharge into water. A TMDL is set for each pollutant, and the EPA, or the state, if designated, will issue a discharge permit for those amounts. A TMDL can be set for trash.

While the EPA has set health-based limits for other pollutants, none have been established for trash. This gives some flexibility to states and municipalities in establishing TMDLs. When health-based water quality standards are not met, the law requires states to identify those waters as "impaired." In the most recent reports to EPA on impaired waters of the states, neither Alabama nor Mississippi identified any waters as impaired due to trash.

According to EPA records, in 2016 Mississippi had designated over 3,764 miles of rivers and streams, nearly a mile of shoreline, and 45,593 acres of ponds and lakes as "impaired," meaning those waterbodies have pollutants in them, primarily excess nutrients, oxygen depletion, pesticides, and mercury.[3] In 2017, Mississippi brought 17 of those waterbodies into full attainment with water quality standards, including two waterbodies that had been listed as impaired since 2008. Alabama had one impaired body of water in 2017 but it reached full attainment during the year.

Photograph courtesy of Ingrid Taylar.

Without a goal to meet for trash TMDLs, it is impossible to fall short. In fact, only two states have trash TMDLs: California and Hawai'i. In Los Angeles, to meet the state's zero trash goal, the city installed $75 million in trash capture devices. Hawai'i's goal is to have zero trash in its waters by 2034.

State Litter Laws Are Ineffective

While neither Alabama or Mississippi has set a trash TMDL, both states have laws that prohibit dumping. In Mississippi, state law makes it illegal to dispose of "any type of plastics ... into marine waters."[4] A first violation is punishable by up to a $500 fine and community service. Subsequent violations may bring a fine up to $10,000 and/or revocation of boating licenses. Additionally, the state's Air and Water Pollution Control Law makes it illegal to "cause pollution of any waters of the state or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any waters of the state."[5]

Alabama also prohibits littering. It makes criminal the act of littering, or knowingly putting litter on land or water without permission.[6] Dumping more harmful waste, such as oil, sewage, or litter from a boat into state waters or dropping hazardous material on a highway does not have to be intentional to be a crime.

While a strict reading of these laws shows that littering is a crime, nobody is going to be prosecuted for dropping a candy wrapper near a stream. But it is just those mindless actions that contribute to a massive problem. According to the World Economic Forum, 8.8 million tons of plastic enter the oceans each year.[7] Efforts to enforce littering laws could help slow the pollution.

Litter on Land Harms Oceans

Decades ago, the focus of plastic trash was on the harm a six-pack ring could do to marine life, but microplastic harm is more insidious. For one thing, despite the fact that there is so much plastic in the ocean, microplastic is not floating on top. According to National Geographic, 70% of marine debris sinks to the bottom, making cleanup even harder. This is because plastic, when exposed to sunlight, dries out, cracks, and begins decomposing. It breaks down into little bits, characterized as microplastics if smaller than 5 mm. Unlike larger pieces of plastic that float on top, microplastics are found throughout the water, even at great depths. Microplastic is hard to see, harder to pick up, and unfortunately, it is more likely to look like food. Those little bits can resemble zooplankton in size and smell, and fish, turtles, and birds can eat it by mistake. A study in the Gulf of Mexico found that 42% of the fish caught along the coast of Texas had ingested plastic.[8]

Another study found that even 1.25 miles below the surface of the ocean, half of the deep sea starfish and sea snails living there had ingested plastic.[9]

According to the EPA, "trash in waters can prevent beneficial uses, degrade habitats and harm wildlife, and may endangered people's health." As we are learning, many fish eat microplastic because it emits a food-like odor. This is problematic as waterborn plastic absorbs toxins, which in turn exposes the fish who mistakenly eat the plastic to concentrated levels of those toxins, not to mention plastic. That is bad for the fish and possibly bad for those who eat the fish.

Research on the presence of plastics in the Gulf of Mexico revealed microplastic concentrations that could fairly be described as alarming: the Gulf has one of the highest concentrations of plastics in the world. The concentrations of microplastics "were greater than the abundances of all but four of the five most abundant [species]..." in one form of capture, and were "not statistically different" from species caught in a different manner.[10] Thus, depending on what method used, the odds of pulling a piece of plastic out of the northern Gulf versus a living species is one out of five.

What to Do

The obvious solution to this problem is to prevent plastic trash from getting to the sea. EPA recommends trash capture devices that can be installed at three different spots: at storm drain inlets to stop the trash from entering the water system; in the water pipelines to capture the trash in the system; or in the water to capture trash already there. One European company, Ocean Cleanup, is developing a large device to remove floating plastic in the ocean before it biodegrades into microplastic. Its pilot project is testing a floating boom to capture trash that is pushed naturally into it by the currents of the ocean. The plan is to have specially designed ships pick up the captured plastic and bring the waste to shore. An early prototype of the floating boom was damaged during its two-month trial period in the North Sea in late summer of 2017 and was brought back to the Netherlands for redesign. Ocean Cleanup hopes to install a collector in the Pacific Ocean and thinks it is possible to clean up 50 percent of the Great Pacific Garbage Patch in five years.[11]

If trash is not stopped at the source, for example by making recycling more available and reducing the amounts of plastic consumers use each day, it can be picked up along the coast before it biodegrades into more harmful microplastic. Both Alabama and Mississippi host coastal cleanups. In 2017, the Alabama Coastal Cleanup was held on the same day as the International Coastal Cleanup, and some Mississippi groups also participated. In 2016, the International Coastal Cleanup hoisted 9,200 tons of trash from shorelines worldwide. Mississippi postponed its 2017 Coastal Cleanup after Hurricane Nate.

As is clear from the data, a cleanup does not have to be on the coast to help the oceans. Efforts upstream would help. A group that sponsored an annual trash cleanup along the Upper Mississippi picked up nearly 300 tons of trash in five years. Along those lines, even establishing moderate trash TMDLs would reduce contamination. Devices over storm drains to catch smaller trash would make a difference. Cheaper, less regulatory measures such as placing more trash cans near food service locations, recycling more, and littering less also would help. This is a massive problem caused by lots of tiny things; helping a little could have a big impact.

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Endnotes

1. Matthew Cole *et al.*, *Microplastics as Contaminants in the Marine Environment: A Review*, Marine Pollution Bulletin, 2588, 2590 (Dec. 2011).
2. 33 U.S.C. §§ 1251 *et seq.*
3. EPA, *Mississippi Causes of Impairment for Reporting Year 2016*.
4. Miss. Code. Ann. § 51-2-3(1).
5. Miss. Code Ann. § 49-17-29(2). *See e.g.*, Gray v. Mississippi Comm'n on Environmental Quality, 174 So. 3d 956, 960 (Miss. Ct. of App. 2015) (assessing $62,500 for repeatedly disturbing dirt and adding fill in wetlands without a permit).
6. Ala. Code Ann. § 13A-7-29.
7. World Economic Forum, *How Much Plastic Is There in the Ocean?* (Jan. 12, 2016).
8. Colleen A. Peters, *et al.*, *Foraging Preferences Influence Microplastic Ingestion by Six Marine Fish Species from the Texas Gulf Coast*, Marine Pollution Bulletin (July 2017).
9. Winnie Courlene-Jones, *et al., Microplastic Pollution Identified in Deep-sea Water and Ingested by Benthic Invertebrates in the Rockall Trough, North Atlantic Ocean*, Environmental Pollution, Vol. 231, Part 1, pp. 271-280 (Dec. 2017).
10. Rosana Di Mauro, *et al., Abundant plankton-sized microplastic particles in shelf waters of the northern Gulf of Mexico*, Environmental Pollution, Vol. 230, pp. 798-809 (Nov. 2017).
11. The Ocean Cleanup, www.theoceancleanup.com.

$1.9 Million Fine for Dumping Waste into the Gulf

William Bedwell

Photograph courtesy of Carlos Vega.

Dumping plastic from ships into the ocean is outlawed under the international MARPOL Convention. Despite the illegality, plastic pollution fouling the ocean has steadily increased. That increase has proportionally garnered the attention of the media and the environmental community. The world puts almost 19 billion pounds of plastic garbage into the ocean annually according to the World Economic Forum. That amount is anticipated to double by 2025.[1] The plastic degrades into smaller and smaller pieces, known as microplastics, and presents myriad environmental threats to aquatic species.

Efforts to control plastic pollution in the sea are not new. In fact, such pollution has been explicitly prohibited for decades. The MARPOL Convention sets international standards for discharges of wastes from ships. MARPOL is an abbreviation for marine pollution, and the Convention is a combination of two treaties. The first agreement was the 1973 International Convention for the Prevention of Pollution from Ships. The second was the Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution. They are respectively known as “MARPOL 73” and “MARPOL 78” and are made up of six annexes. The first of these annexes came into force in late 1983, and all were in effect by 2005.

Both conventions and the annexes were created under the International Maritime Organization, a specialized agency of the United Nations. Over 150 countries, including the United States, are parties to MARPOL, and account for 99% of the world's merchant shipping tonnage. Member countries are responsible for certifying that a ship registered in that country is in compliance with MARPOL. A country can inspect ships at its ports from other member countries to verify compliance. Countries can even detain foreign ships found to be significantly out of compliance.

MARPOL prohibits ships from dumping oil, noxious liquids, garbage, sewage, and harmful substances in transit, and regulates ships' air pollution. MARPOL's Annex V specifically deals with the regulation of garbage from ships. It requires ships to keep logs describing all disposals of bilge waste and garbage. It specifically bans ships from dumping plastic into the ocean. According to the Annex, garbage, such as incinerator ash, steel, plastic, and other non-organic waste, must be stored onboard and only disposed of via onshore facilities.

MARPOL also bans dumping fluids. Oil-contaminated bilge water must be processed with specific chemicals before it can be discharged into the sea. Oily bilge water is created when water in the bottom of a vessel mixes with oil leaking from its engines.

The Act to Prevent Pollution from Ships ("APPS") became law in the United States on October 21, 1980, and criminalized knowingly violating MARPOL. APPS substantially penalizes those caught dumping plastic in the ocean. The act gives the U.S. Coast Guard authority and responsibility to enforce MARPOL standards. Violating the act is a felony, prosecution of which is conducted by the U.S. Department of Justice. Beyond being criminally prosecuted for violating MARPOL, a violator can face civil penalties. The maximum penalty is $25,000 per day per violation, with each day counting as a separate violation. Any false or fraudulent statements carry a maximum penalty of $5,000 per statement.

A significant APPS prosecution was conducted in 2017 for MARPOL violations in the Gulf of Mexico. Estimated concentrations of microplastics in the Gulf of Mexico are already among the highest reported globally.[2] The resulting investigation culminated in two shipping companies from Egypt and Singapore pleading guilty to dumping oily bilge water and plastic bags of garbage from their ship near the National Wildlife Refuges in East Texas. The companies also pleaded guilty to obstruction of justice because the captain of that ship attempted to cover up the dumping.

The captain ordered the crew to attach a special bypass pump to circumvent the ship's pollution prevention equipment meant to process its oily bilge water. He also ordered them to throw plastic garbage bags filled with metal and incinerator ash overboard. He then produced false documents to the Coast Guard in order to cover up the crime. The ship's records did not include either the oily bilge water discharge or the garbage jettisoning, both recordkeeping violations contrary to APPS.

Unbeknownst to the captain, however, a crewmember photographed and videotaped the illegal dumpings. The crewmember provided the evidence and a written statement to the U.S. Coast Guard once the ship was docked in Port Arthur, Texas. Whistleblowers like this crewmember are integral to enabling prosecutions under APPS. In fact, a special provision of APPS authorizes whistleblowers to receive up to half of the monetary penalty imposed on the violators.

In recent years roughly one-third of MARPOL prosecutions reportedly have resulted in awards to whistleblowers, some topping $1 million.[3] According to the Department of Justice, APPS violations "take[] place in the middle of the ocean and usually at night" meaning only the crew members are "likely to know about the conduct and the falsification of ship records...."[4] Whistleblowers, therefore, are key to enforcing the law: "The government's success in identifying the activity and obtaining sufficient evidence to support investigations and prosecutions is dependent on the willingness of lower level crew members to step forward."

The Coast Guard investigated after receiving the incriminating evidence and discovered the special bypass pump hidden in oil in the bottom of the ship – the means of the illegal discharge. The companies ultimately pleaded guilty to illegally dumping the untreated bilge waste and the metal, ash, and plastic garbage. In addition, the companies pleaded guilty to obstruction of justice for providing false documents to the Coast Guard.

The companies must pay a $1.9 million penalty and fulfill a four-year probation as terms of their plea bargain for violating APPS. The terms include marine and coastal restoration efforts at three National Wildlife Refuges near the locations of the dumpings and a comprehensive plan to ensure future compliance with all marine environmental regulations. The plan will be audited by an independent company and supervised by a court-appointed monitor.

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Endnotes

1. Jenna R. Jambeck, *et al.*, *Plastic Waste Inputs from Land into Ocean*, Science, Vol. 347, pp. 768-771 (Feb. 2015).
2. R.D. Mauro, *et al., Abundant Plankton-Sized Microplastic Particles in Shelf Waters of the Northern Gulf of Mexico*, Environmental Pollution, Vol. 230, pp. 798-809 (Nov. 2017).
3. Marine Defenders, *Rewards for Whistleblowers.*
4. United States v. Overseas Shipholding Group, Inc., No. 06-CR-10408 (D.C. Mass. 2007), Government's Amended Motion for Whistleblower Awards, p. 2.

Cities in Mississippi and Alabama with Populations Greater Than 15,000 that Don't Offer Plastic Curbside Recycling

Source: Mississippi-Alabama Sea Grant Legal Program, based on information gathered by web and phone inquiries. Size of the city's name on the chart is proportionate to the size of the city's population, to the nearest 5,000, based on 2010 census data. Thirty-five percent of Alabama cities and twelve percent of Mississippi cities with populations greater than 15,000 do not offer residential curbside recycling for plastic. The three cities from Mississippi are: Brandon, Clarksdale, and Pearl. All other cities in the cloud are located in Alabama.

The Mississippi-Alabama Sea Grant Legal Program wishes to thank Morgan Stringer, an Intern from the University of Mississippi School of Law, for her research assistance.

Studying Microplastics in the Gulf

Mandy Sartain, Eric Sparks, and Caitlin Wessel

Plastic has quickly stolen the show as the focal marine debris item. Marine debris is a global issue that is reducing the quality of life in coastal environments. It is defined by the National Oceanic and Atmospheric Administration as "any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes." Common examples include trash such as food wrappers and other single-use items; derelict vessels; and abandoned fishing gear such as nets and fishing line. Marine debris typically originates on land, although some marine debris comes from recreational and cargo vessels. Dumping, littering, and flooding are all routes trash can take to the ocean. Marine debris is harmful to the marine environment because it can entangle marine animals, be mistaken for food and ingested by animals, and destroy habitats.

The magnitude of the plastic problem is escalating quickly. Companies are producing plastic much faster than consumers are conscientiously disposing of it. Scientists estimate that by 2050, there will be more plastic in the ocean than fish. Although humans value plastic because it is cheap and disposable, the situation is completely different for the environment. Nature cannot breakdown plastic. Plastic is man-made, and as it "breaks down" it is really just breaking up into smaller and smaller pieces, known as microplastics. Microplastics are plastic pieces smaller than 5 mm in size. Microplastics are a growing environmental problem, prevalent in coastal sediments of the northern Gulf of Mexico.[1] They are often mistaken as food and ingested by marine animals, affecting animals of all sizes, from tiny copepods to huge whale sharks. Plastic absorbs toxins in the water column, and once ingested, the toxins are introduced into the marine food web.

There are two categories of microplastics: primary and secondary. Within these categories, microplastics are usually separated into four forms: microbeads, microfibers, films, and fragments. Primary microplastics include plastic particles that are purposefully made as small plastic pellets, beads, and fragments. Many everyday cosmetic products including face wash, toothpaste, exfoliates, deodorant, and make-up contain plastic microbeads. However, a U.S. law banned the manufacture of personal care products and cosmetics that contain microbeads as of July 2017,[2] limiting continued contamination by that plastic.

Microplastics.
Photograph courtesy of the Florida Sea Grant.

Another common form of primary microplastics is "nurdles," small plastic pellets that serve as raw material in the creation of plastic products. Throughout the transportation and handling process, nurdles can get carelessly spilt and lost into the environment. Their size, shape, and color make them easily mistaken as food to many marine animals.

Secondary microplastics are the result of the degradation of larger plastic pieces. Chemical and physical processes

Microplastics Concentrations in the Surface Water of the Gulf of Mexico

Background: In September 2016 and 2017, Caitlin Wessel, a scientist with the Dauphin Island Sea Lab and University of South Alabama, participated in the NOAA Fisheries Southeast Monitoring and Assessment Program (SEAMAP) plankton sampling along the Gulf Coast to collect pieces of plastic smaller than 5 mm, known as microplastics. Scientists use the same methods to sample for microplastics as they do for plankton. One of these methods is collecting whole water samples from the surface, middle, and bottom of the water column using a niskin bottle (a type of bottle that has openings at both ends). The water samples are filtered onto a grid, and then, using a microscope, the scientists count the number of microplastics found in each liter of water. This map shows the average numbers of microplastics found in surface waters throughout the northern Gulf of Mexico based on that one type of sampling: an overall average of 7 bits of microplastics per liter.

like wave action, heat, UV radiation, and animal grazing cause plastics to break down into smaller and smaller pieces. For example, laundering causes synthetic clothing fibers such as nylon, polyester, and acrylic to shed microfibers in the wash that then flush to sea.

In 2016, Mississippi State University (MSU) received a Gulf Star grant from the Gulf of Mexico Alliance to study plastic pollution in the Gulf of Mexico. It has partnered with 12 coastal organizations[3] to collect and analyze microplastic data in the Northern Gulf across two years. Citizen scientists – encompassing a wide range of volunteers with an interest in data collection but not necessarily any formal scientific training – will be taught by the project partners to collect and process samples. Two processes are used to count the bits of plastic, depending on whether the samples are of water or sediment. Using the water-filtration technique, water samples are vacuum-pumped through porous filter paper. The paper catches the plastic for counting. Sediment samples are processed using density separation, a method created by engineers at the Dauphin Island Sea Lab in Alabama. In density separation, salt water is pumped through the sediment sample, and because microplastics are less dense than the salt water and sediment, they float to the top where they can be counted. This project will give a first look at microplastic abundance in the Northern Gulf of Mexico. The 12 project partners – spanning from Corpus Christi, Texas to Key Largo, Florida - will give scientists the ability to see data on microplastic abundance for the entire Gulf. Additionally, the study will narrow down what type of microplastic (bead, fiber, fragment, or film) is the most prevalent in the Gulf. Based on the data received thus far, microfibers are the most commonly found microplastic in water samples.

During the grant's two-year period, there are only two mandatory sample dates for each partner and citizen scientist: the local International Coastal Cleanup dates of 2017 and 2018. The 2017 International Coastal Cleanup was held on September 16; Mississippi's planned October date was postponed after Hurricane Nate. The two specific dates will give a Gulf-wide snapshot of microplastic abundance at a particular time, helping to eliminate any seasonal variations between samples. Sampling at other times is at the discretion of the participants and is encouraged, and many participants sample throughout the year.

Using GIS software, MSU will use this data to create maps exhibiting the most current microplastic abundance levels in the Gulf of Mexico. The data from this study will generate strategies to prevent microplastics from entering our oceans. It is still early in the project timeline, but due to the proactive partners and dedicated citizen scientists, data is currently pouring in not just from the first round of mandatory samplings, but from all other samplings. The hope is that the more data on microplastic are gathered, the more easily they'll be eradicated in the future.

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Caitlin Wessel is the Gulf of Mexico Regional Coordinator for NOAA's Marine Debris Program and works at the Dauphin Island Sea Lab.

Endnotes

1. Pub. L. No. 114-114 (Dec. 28, 2015).
2. Caitlin Wessel, *et al.*, *Abundance and Characteristics of Microplastics in Beach Sediments: Insights into Microplastic Accumulation in Northern Gulf of Mexico Estuaries*, 109 Marine Pollution Bulletin, pp. 178-183 (2016).
3. Those partners are: University of Florida, Institute of Food and Agricultural Sciences Marine Lab; Nature's Academy; Charlotte's Harbor National Estuary Program, Key Largo Marine Lab - Marine Resources Development Foundation; Florida A&M University, Apalachicola National Estuarine Research Reserve (NERR), Turtle Island Restoration Network, Texas Parks and Wildlife Department, Barataria-Terrebonne National Estuary Program; Texas State Aquarium, Weeks Bay NERR, Grand Bay NERR.

IN SUM.

A Summation of the Facts and Figures of Interest in this Edition

★ *Tons of plastic that end up in the ocean each year*	8.8 million tons
★ *Rank of the Gulf of Mexico for highest plastic concentrations in the world*	2nd
★ *Amount of the fine paid for dumping oil and plastic bags of trash from a ship into the Gulf*	$1.9 million
★ *Percentage of cities in Mississippi (pop. > 15,000) that do not offer residential curbside plastic recycling*	12.5%
★ *Percentage of cities in Alabama (pop. > 15,000) that do not offer residential curbside plastic recycling*	32.4%
★ *Of bead, fiber, fragment, or film types of microplastic found in the Gulf, the rank of microfibers*	1st
★ *Number of years it takes a new energy-efficient building to overcome the climate change impacts of that new construction*	10-80 years

The Value of Aged Buildings

Stephen Deal

Older commercial structures, such as this old Kress Building in Montgomery, Alabama, are great candidates for adaptive reuse due to their character and well chosen materials.

Buildings are the puzzle pieces that interlock to form urban life. They are cluttered, complicated and can change almost as often as the residents or shop owners who care for them. But old buildings have value, not just in relating urban history, but in offering environmental benefits. Those benefits can be found in reusing existing materials, but also may be more hidden.

In the best circumstances, a building constantly evolves. In an era dominated by sprawl, however, the expectation is that a new building will be constructed for a specific user with little consideration given to the structure's capacity to adapt to changes in the building's tenants and use. According to the National Trust for Historic Preservation (National Trust), the United States demolishes approximately 1 billion square feet of existing buildings and replaces those structures with new construction each year. However, older buildings have value: they embody decades of trial and error refinement and experimentation with types of materials and construction techniques, surviving because somebody determined what materials and configuration linked the tenants with the city.

Older buildings can be marvelous engines of efficiency because of the concept of embodied energy. Embodied energy represents the energy required to complete a building.[1] It includes all the processes used to build a structure, from mining and timber harvesting, to manufacturing, transportation, and installation of the materials, as well as the demolition and disposal of old materials. The concept of a building's energy use includes not only embodied energy, but the operational energy needed to run its building systems over its life span, and the transportation energy needed to bring its occupants to and from the building. For example, the National Trust reports that Seattle's 80,000-square foot Grand Central Arcade constructed in 1890 was estimated in 1979 to have 131 billion BTUs stored in the existing structure, considering its embodied energy.[2] Conservationists argued that conserving the building would save an equivalent amount of BTUs, and it was converted into retail and not destroyed.

The National Trust studied the embodied energy of old buildings against newly built energy-efficient structures.[3] The researchers discovered that it takes between 10 and 80 years for a new energy-efficient structure to overcome the negative climate change impacts related to new construction, even when that new building is 30 percent more efficient than an average-performing existing building. The study found that reuse of materials and retrofitting offered the most benefits to the climate. To quantify the environmental savings even further, the National Trust study found that if the City of Portland retrofitted just 1 percent of its office buildings and single family homes over the next 10 years it would help meet 15 percent of that county's total carbon dioxide reduction targets over the next decade.

Building reuse and salvage not only have significant environmental savings, they are also an important resilience component for geographically isolated communities. What once was considered salvage, now may be thought of as recycling. For example, the Village of Ocracoke on a North Carolina barrier island reclaimed old structures and building materials for village use, primarily because large trees were not available for framing.[4] This local building tradition continued even in the modern era, with notable reuse projects occurring in the 1940's and 50's. When the old Coast Guard station and Navy base were abandoned following the 1944 Great Atlantic hurricane, enterprising residents moved many of the structures closer to town and converted them into residences. A former Navy chapel became a vacation rental duplex and an old Navy barracks was converted into a fellowship hall for a church. It was also not uncommon for shipwreck salvage to be used as framing for new residences and buildings.

Building reuse and salvage not only have significant environmental savings, they are also an important resilience component for geographically isolated communities.

This type of materials recycling was common in New Orleans prior to the Civil War, when many New Orleans homes were constructed from barge board. Barge board, as the name indicates, was wood taken from river barges, which were generally broken up once they had completed their haul down the Mississippi River.[5] The rough-hewn wood was once a cheap building supply, but now is in demand for the history it tells.

These historical accounts show that many cities have a history of incorporating building salvage into refining their community. Clever workarounds and locally sourced materials lends older buildings a freedom and flexibility that is seldom found in newer structures; old does not always equate to inferior.

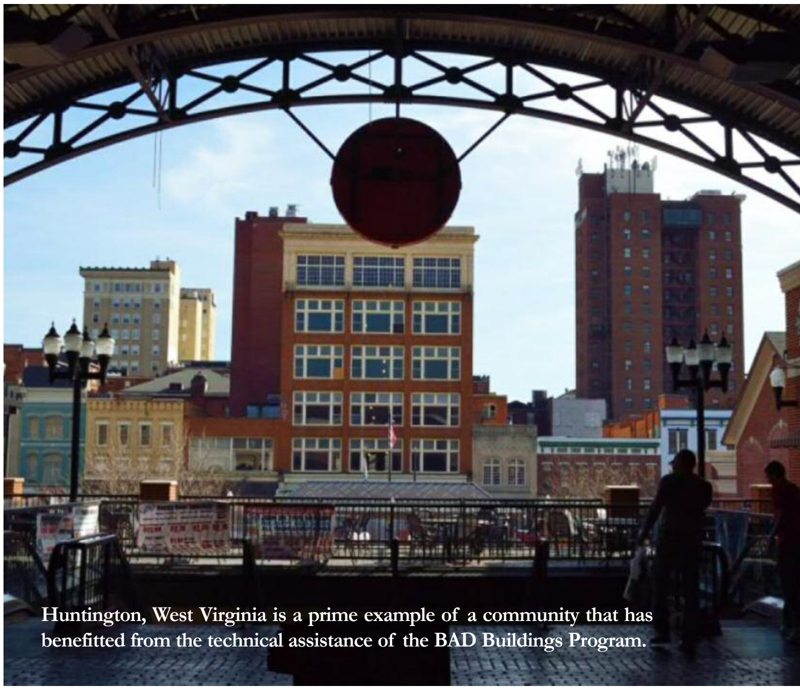
The value of older structures extends beyond the basic proposition that it is generally more efficient to reuse than build new. Many older buildings simply perform better than newer structures and quite a bit of that can be attributed to the traditional building materials and methods employed. According to the National Trust, "data from the U.S. Energy Information Administration demonstrates that commercial buildings constructed before 1920 use less energy, per square foot, than buildings from any other decade of construction."[6] Part of this can be attributed to the fact that older structures in urban areas frequently have more shared walls, reducing heating and cooling expenses.

The superior performance of older buildings was on display in a 2014 report compiled by the City of New York, which summarized the water and energy use of 23,000 buildings in the city.[7] The data showed that the buildings that displayed the least energy use per square foot were at least 70 years old.[8]

Building materials also should be credited. According to one expert, "what you want in building material is a quality of forgiveness."[9] Older structures and their materials succeed in large part because they are highly malleable. Also, traditional materials such as wood and brick age in such a way that their problems manifest themselves on the surface and so are easily identified. In other words, "they look bad before they act bad." Some newer materials, such as plastic or aluminum siding, may effectively hide problems under a slick veneer, until a major maintenance problem exists.

Also, older buildings may perform better because they often employ superior construction materials which, either due to poor resource management or stock depletion, simply are not viable for large construction ventures anymore. In the Gulf Coast region this is especially true for older structures prized for their use of longleaf pine and cypress, two types of wood that were abundant in the past but rare today. The durability and lasting beauty of these materials is still highly prized by homeowners and other craftsmen. In fact, a small industry is devoted to recovering old pine and cypress "sinker wood" that is embedded in riverbanks and lake bottoms.[10] Many of these old logs can be worth up to a couple of thousand dollars due to their size and their tightly packed grain.

While building reuse seems like a net positive for communities looking to become more resilient, it can be difficult to induce developers, who are often accustomed to greenfield development, to step in and restore old buildings. To encourage private parties to undertake these actions it is necessary for cities and towns to step up and take the guesswork out of adaptive reuse. In order to do that cities must create a systematic framework with a comprehensive inventory of blighted structures to help match viable, older structures with developers and entrepreneurs who can capitalize on those assets.



Huntington, West Virginia is a prime example of a community that has benefitted from the technical assistance of the BAD Buildings Program.

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Endnotes

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