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RESEARCH ARTICLE

# From Nature Conservation to Resource Conservation: How Recycling Developed into an Environmental Issue in the US During the 20th Century

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## Abstract

This article examines how the idea that recycling conserves natural resources developed and stabilized into a matter of fact in modern U.S. history. Influential figures like Herbert Hoover reframed the focus of conservation from nature protection to production, efficiency and waste management. The conservation idea was used by the industry to emphasize its societal value, externalize waste management costs, divert attention away from resource extraction, and engage the public in sorting that would yield materials back to the industry. The 1970s energy crisis opened up possibilities to symmetrically compare different processes and materials by a unified metric: energy consumption. As a result, recycling came to conserve resources not only in the waste itself, but also in nature. The significant energy savings from recycling, compared to extraction, were emphasized and communicated, and the idea of displacement vanished in the underlying calculations and was thereby institutionalized into everyday language.

**Keywords** Conservation · Institutionalization · Genealogy · Circular Economy · Recycling · History

## Introduction

The circular economy represents a distinct, but unconventional approach to natural resource conservation. Traditional conservation strategies typically take one of two forms: preservation, which seeks to protect nature by designating areas as reserves, and conservation, which manages resource extraction to remain within replenishable limits (Norton, 1986). The circular economy, however, introduces a fundamentally different and more complex logic of conservation, based on indirect effects. The circular economy thus offers, through its practices, such as recycling, a third alternative for natural resource conservation.

At the heart of the circular economy's promise for sustainability and climate-savings lies the idea that its practices shall displace and shrink the linear economy and thereby conserve natural resources. Recycling paper is said to save trees (Porter, 1974). Recycling secondary metals and plastics is assumed to avoid the extraction of virgin ores and fossil sources (Ayres, 1997). The reuse of second-hand clothing is believed to offset the production of new garments (Cooper & Gutowski, 2017). If these claims hold, the circular economy could indeed limit nature exploitation, preserve natural resources, ecosystems, landscapes, and habitats for future generations.

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However, to date, there is little empirical evidence demonstrating that the production and consumption of recycled materials prevent resource extraction in specific locations. Instead, studies on the resource-conserving effects of recycling primarily rely on models (Zink et al., 2018; Wiebe et al., 2019; Safarzynska et al., 2023; Bianchi & Cordella, 2023), rather than tangible cases of nature being spared. Hence, within the traditional field of conservation studies, the question of indirect conservation through recycling is largely absent and rarely considered.

At the same time, recycling, i.e. the process of converting waste and products into raw materials, is commonly understood as a resource-conserving strategy. The idea that recycling conserves resources is a natural part of our conceptual world, something we take for granted. The idea is so widely accepted that it underpins policy documents aimed at transforming entire regions into recycling economies (EPA, 2021) and corporate environmental communication about the environmental benefits of recycling (Corvellec et al., 2022). It also shapes people's everyday practices of waste sorting and sustainable consumption (McCarty & Shrum, 1994), as well as scientific models such as life cycle assessments (Geyer et al., 2016).

Given these gaps, this article asks: when, how, by whom and why did recycling become a resource conservation strategy? By understanding recycling's capacity to conserve resources as an idea, opportunities arise for a purposeful historical analysis of how this assumption developed and stabilized into a matter of fact.

This study contributes to the conceptual debate on a circular economy. A debate that is typically limited to listing its intellectual roots in industrial ecology, ecological economics, systems thinking and the transition movement. Understanding *resource conservation* and *recycling* not as practical concepts, but as historically and politically shaped ideas, invites new perspectives. For example, on the role of nature, conservation, lobbyism, scientific methods, symbolism, contestation, and value conflicts in the making of a recycling economy. It also opens possibilities to reimagining new relations between humans and nature and ultimately what kinds of conservation strategies a strong circular economy (Johansson & Henriksson, 2020) might require.

## Method

This article draws on a *genealogical approach* (Foucault, 1977) to trace how the idea that recycling conserves resources developed, circulated, and eventually stabilized. The analysis is situated within the field of *discard studies* (Liboiron & Lepawsky, 2022), which emphasizes how knowledge, meanings and practices surrounding waste are shaped by cultural, political, and material relations.

A genealogical approach seeks to destabilize what appears naturally given by revealing the historical struggles that underpins its formation. Hence, this study delves into four pivotal events throughout U.S. history where recycling became a *matter of concern* (Latour, 2004). These conflict zones, centered around events and debates, reveal the actors, relationships, power structures, materials, interests, and various approaches that have all played a role in constructing recycling as a strategy for conservation. The selection of cases is thus intended to be illustrative, rather than exhaustive or linear, to capture re-stabilizations of the relationships between recycling, waste and conservation.

In each episode, the involved actors, their reasoning, and how they are portrayed in both public and institutional contexts are analyzed. The aim is not to establish causality between the cases. Instead, through *discourse analysis* (Hajer & Versteeg, 2005), the study examines how the notion of conservation was introduced, negotiated, developed, and stabilized in the recycling discourse, through linguistic representations, rhetoric, propaganda, symbols and lobbying. Discourse analysis is concerned not only with what is explicitly said, but also with what is omitted or silenced.

A genealogical approach is necessarily interpretive and shaped by the researcher's positionality. However, focusing on the U.S. provides a degree of analytical distance, as the author is not an US citizen. Moreover, the use of English and the openness of U.S. archives make the United States a particularly accessible case. However, not being a US citizen may limit the access to informal discourses and sources. Therefore, the selection of cases relies on well-documented narratives rather than those that have not reached public attention.

To mitigate these limitations, the analysis combines primary sources, such as contemporary newspaper articles, propaganda materials, congressional hearings, and secondary sources, where historians have retrospectively interpreted the events. The period of analysis spans from the early 20th century, when conservation emerged as a political principle, to the institutionalization of recycling in the environmental politics of the 1970s.

## Establishing

Utilizing waste materials were well-integrated into pre-industrial economies, from the Western world (Woodward, 1985; Fennetaux et al., 2015; Fontaine, 2008) to the Far East (Ochiai, 2007). Raw materials were expensive and difficult to access, which forced societies to maximize the use of the available resources. Some production processes depended entirely on waste-based materials. For example, rags, or textile waste, were the primary raw material for paper production until the end of the 19th century (Craig, 2019). Hence, there was rarely a clear distinction between new and waste-based resources.

As the demand for raw materials increased and the extraction shifted towards nature during the industrialization, debates emerged about how nature and its resources should be protected. In the U.S., as in many other Western countries, the early environmental movement was marked by a schism between two distinct ideals: *conservation* and *preservation* (Norton, 1986).

On one side stood the animist John Muir (1838–1914), Figure 1, who co-founded the Sierra Club in 1892 and became its first president (Fox, 1985). Muir argued that nature had intrinsic values and should be preserved, protected from exploitation. On the other side was Gifford Pinchot (1865-1946), the first head of the US Forest Service in 1898 (Miller, 2001:138). He argued that resources should be extracted but managed prudently to prevent over-exploitation.

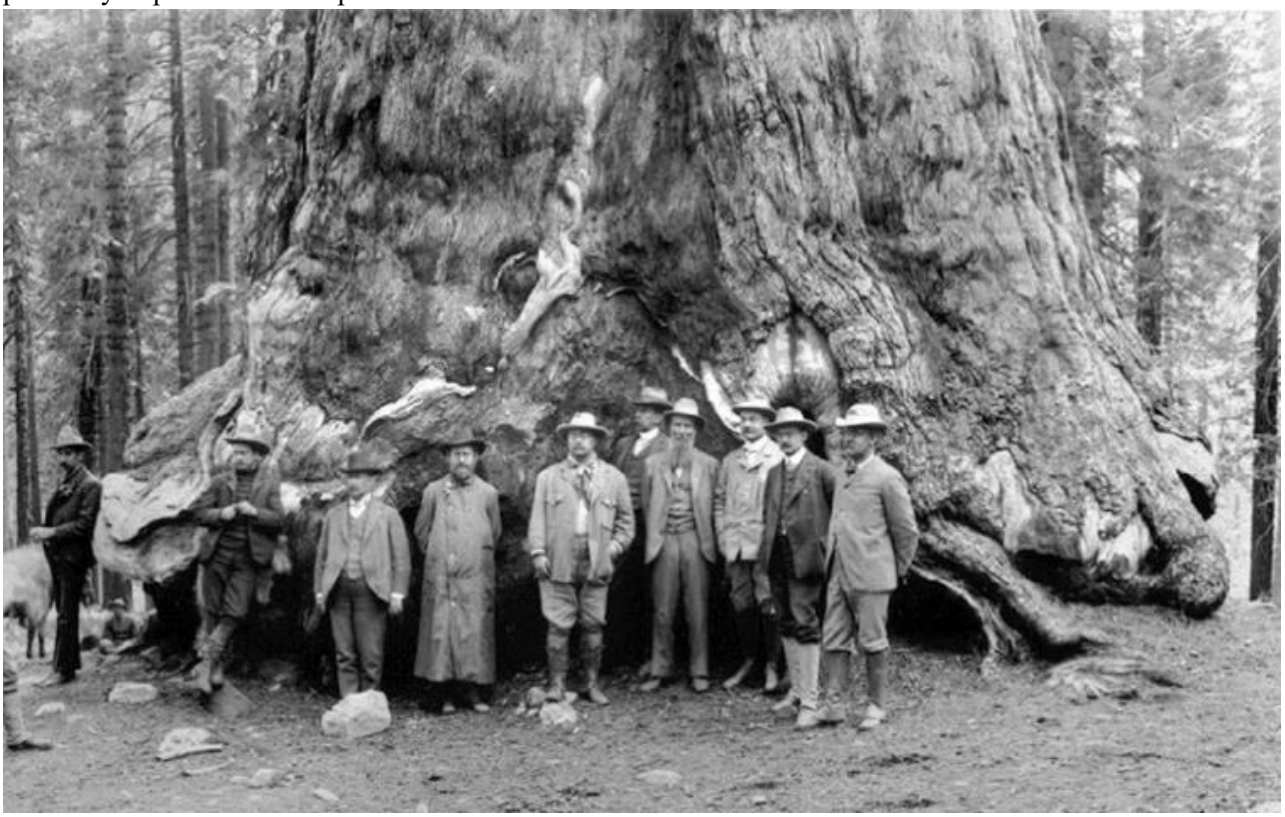


**Figure 1** Theodore Roosevelt (fifth from the left), Gifford Pinchot (sixth), John Muir (seventh), at the Grizzly Giant, Mariposa Big Tree Grove, Yosemite National Park, California, 1903. Source: Photograph by Joseph N. LeConte

## The Conservation Conflict in Yosemite

Historians often trace the schism between these ideals to a single dramatic event in the early 20th century: the damming of the Hetch Hetchy valley in Yosemite National Park (e.g., Richardson, 1959; Righter, 2005). Inspired by transcendentalism, Calvinism, and British nature romanticism (Muir, 1913; Simonson, 1978), John Muir saw God in nature or at least considered Hetch Hetchy to be an irreplaceable natural treasure. Muir (1912) argued that damming the valley was akin to destroying the world's great cathedrals, "for no holier temple has ever been consecrated by the heart of man."

Pinchot, on the other hand, saw the necessity of building a dam to secure the water supply for the growing city of San Francisco (Richey, 2021). His position was grounded in progressivism, utilitarianism, and European natural resource management, characterized by scientific rigor and rational planning (Miller, 1992; Balogh, 2002). From this perspective, the benefit to San Francisco's population of flooding the valley outweighed the local advantages of preservation (Nash, 1973:170-171). In retrospect, these two positions have symbolized two fundamentally different views of nature: *biocentrism* and *anthropocentrism*, respectively.

The bitter controversy over the Hetch Hetchy valley was decided in favour of the dam proponents in 1913 when the Senate passed the Raker Act by a vote of 43 in Favor, 25 opposed, and 27 abstaining (Picker & Sprain, 1988). This outcome highlighted how the preservation of natural areas became an exception, expressed through a few national parks with uncertain protection status. The conservation ideology, on the other hand, gained increasing political traction and grew into a national movement in the early 20th century with many influential supporters (McConnell, 1954).

Gifford Pinchot (1910) initially had significant influence on the conservation movement and formulated, for example, its three guiding principles. The first and third principles stated that (1) natural resources should be used for "people who live here now" (p.43) and (3) "for the benefit of the many, and not merely the profit of the few" (p.46). The latter principle entailed that Pinchot, as head of the US Forest Service, advocated federal control and regulation of natural resources.

The second principle (2) finally introduces the issue at the focus of this article, *waste*, in conservation: "In the second-place conservation stands for the prevention of waste" (p.44). Pinchot argued against the waste of natural resources, considering waste to be an unnecessary leakage and loss, which simply reduced the amount of natural resources available for use (National Conservation Commission, 1909).

## Industrial Conservation

The conservation ideal was institutionalized in various ways during the early 20th century, not least by Pinchot's friend, the "conservation president" Theodore Roosevelt (Dorsey, 1995), Figure 1. By the 1920s, many U.S. departments had agencies dealing with conservation issues (Clements, 1984:67). Another later president, particularly significant for the development of *indirect* conservation, where the saving of natural resources is an assumed side effect of consumption, was Herbert Hoover (1874–1964). Hoover developed the concept of *industrial* or *progressive* conservation (Clements, 2000) during his tenure as the head of the US Food Administration, the Secretary of Commerce and later as the US President.

Hoover grew up in a rural, religious household in close contact with nature. However, before his political career, Hoover worked as a mining engineer around the world, an experience that deeply influenced his views on conservation. His "experience as an engineer and a businessman led him," according to Clements (2000:39), to shift the focus of conservation to "*after* raw materials were extracted as well as in the mining process" [italics in the original quote]. This meant focusing conservation measures solely on the use of resources, Pinchot second principle, and the elimination of waste. Thus, nature was no longer "conserved" through limitations, but by using its products more efficiently.

The focus of conservation shifted thus from nature to increasingly manageable aspects, that is, improving production processes. Hoover believed that a conservation agenda with a focus on manufacturing would benefit everyone (Clements, 2000:64). By making industry more efficient and reducing waste, the nation's economic and social problems would be solved. Industry would be lifted out of the prevailing depression, and prices of consumer goods would decrease (Clements, 1984:81; Department of Commerce, 1924).

The "gospel of efficiency" (Hays, 1959) was an industrial movement launched in many countries to revive their economies after the First World War (Shearer, 1995: Tsutsui, 1998). For example, in Mussolini's Italy as well as in Lenin's Soviet, the fight against waste in factories became part of broader projects to shape a new type of human being; standardized, disciplined, and efficient (Bailes, 1977; Maltese, 2025).

In the US, however, industrial conservation relied on the market rather than state coercion. By focusing on waste, Hoover, unlike the government official Pinchot, believed that the market itself was best suited to conserve resources (Clements, 1984:67). This is since manufacturing processes varied, and each industry knew best how to reduce its specific waste. Hoover argued that a conservation agenda focused on waste had sufficient inherent incentives, such as saving money and labour, to attract industry interest without government pressure.

Hoover focused the conservation agenda on waste, and thus on what happens after resources are extracted. This framing enabled politicians and industry to present a united front, showing that natural resources were being managed responsibly and "conserved". Such a conservation strategy faced little opposition, as both the extractive industries and the increasingly material-intensive economy could continue to expand unhindered. Thereby, Hoover's manufacturing-centred conservation legitimized not only ongoing, but also increased resource extraction.

## Waste Recovery and Conservation

The idea of industrial conservation opened up possibilities for many companies to align themselves with the popular conservation movement (McCarthy, 2006: 310). The idea of industrial conservation had a particularly strong influence on the waste recovery industry. Waste recovery, at least in the form of collecting and separating metals and rags, was a job that did not require extensive prior knowledge, networks, or investments. Hence, the waste sector was an accessible occupation for newly arrived immigrants, particularly Jews from Eastern Europe (Carlson & Gow, 1936:181). Margins were limited and competition was fierce, which meant that waste dealers rarely questioned the origin of the materials. This created a perception that waste dealers were involved with criminals.

In the early 20th century, the term "recycling" was not used to describe the industrial transformation of waste into raw materials. Instead, this practice was referred to as "recovering," "utilizing," "salvaging," "reworking" or "reclaiming" (Carlson & Gow, 1936; Foster, 1916; Sherman, 1920; Spooner, 1918; Talbot, 1920).

Although the waste recovery profession involved true entrepreneurs, their work was considered un-American, dirty, unethical, and outdated, a view reinforced by the antisemitism of the time (Zimring, 2004:88). Waste recovery facilities, such as junkyards, thus shared physical and moral space with other undesirable activities on the outskirts of cities, such as prostitution, gambling, and crime. Waste dealers were even accused of spreading diseases, a threat to public health and welfare (Mockett & Meymott, 1884:675). Consequently, waste dealers faced restrictions, discrimination, and harassment around the turn of the 20th century, in the US (Zimring, 2004:86) as well as in other countries (Ratcliffe, 1992; Sjöstrand, 2020).

As resistance grew, the need for collaboration became increasingly clear among the waste dealers. The negative perception of their profession was common across different types of waste materials, such as scrap, rubber, wastepaper, and rags (Kiser, 1993). Consequently, the diverse group of waste dealers formed their first business association, the *National Association of Waste Material Dealers* (NAWMD), in 1913.

One of the first initiatives by NAWMD was to reshape the image of the profession. To counter restrictions of commercial waste handling due to sanitary risks (Leavitt, 1980; Melosi, 1981a), the association strategically embraced an increasingly influential discourse: conservation.

This rhetorical move contrasted with the strategies of European waste dealers, who faced similar regulatory pressures. In France, for example, waste dealers defended their activities by emphasizing their social necessity, the foundation for the livelihoods of the poor, and by invoking their historical right to waste as a commons (Compagnon, 2017; Faure, 1996). In the US, by contrast, the first president of the NAWMD, Theodore Hofeller, stated in his opening speech in 1913:

*"The waste material dealers are the true conservationists. They have reclaimed millions of dollars from the dump heaps throughout the country" (NY Times, 1913).*

By applying the conservation rhetoric, NAWMD positioned waste recovery not as a relic of the past, but as a modern, forward-looking, patriotic contribution. Recovering waste was thereby cleverly transformed, from a low-status business, handling dirty and low-value junk into a responsible, honest, and patriotic agent of conservation (Zimring, 2004:93).

Conservation was a modern and far more successful argument than emphasizing political injustices. The rhetorical differences between Europe and U.S. help to understand why the commercial waste industry assumed in the US a more integrated role in the formation of modern waste management systems. In contrast, public monopolies became more dominant in Europe.

In the US, the conservation rhetoric continued to evolve, primarily in symbolic terms. Conservation became, according to Zimring (2005:94), standard "rhetoric in the industry's lobbying efforts" to enhance the sector's reputation, prevent government interference and encourage policies that allowed the waste industry to expand and gain legitimacy.

Thus, waste dealers developed the focus of natural resource conservation to also include the management of resources *after* production or consumption. The focus shifted and expanded the aim of industrial conservation at preventing waste, to also include the management and recovery of waste as central conservation strategies. Waste was no longer an unwelcome endpoint of resource use, but a potential material beginning for conservation. Hence, by applying the conservation agenda, waste famously transformed into natural resources.

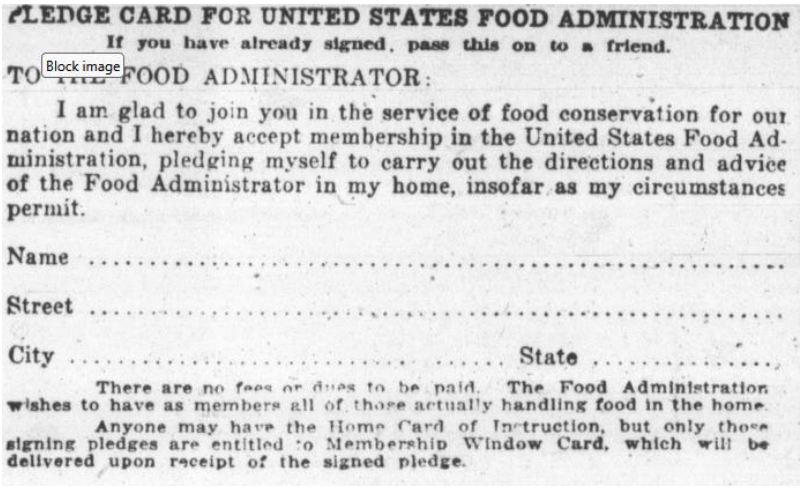
## Conservation During Wartimes

During the world wars, when natural resources became a pressing issue, the conservation ambitions shifted to individuals, and the role of consumption was emphasized. When the U.S. entered World War I in April 1917, years of war in Europe had led to reduced food production, depleted food reserves, and sharply rising food prices. To address the urgent food issue, President Woodrow Wilson (1856-1924) established the U.S. Food Administration in August 1917, appointing Herbert Hoover, well known for us, as its head.

Due to the natural limitations of agriculture, such as the slow pace of cultivation, it was difficult for farmers in the U.S to quickly increase food production. Therefore, other strategies were needed to quickly supply food to American troops as well as the starving allies in Europe. The popular ideal of conservation came in handy and was presented as a crucial strategy by Hoover (1917:925): "Wars are not paid for out of the capital of a people; we must pay for them out of our savings".

As previously noted, Hoover (1917:925) did not support government-imposed measures, such as rationing, nor did he favour regulating at the production stage of natural resources. To encourage Americans to conserve food, the U.S. Food Administration launched a propaganda campaign in 1917 under the slogan "Food will win the war" (Eighemy, 2010).

The propaganda campaign consisted of various tools, but most visible in the urban landscape were different types of flags, signs, and propaganda posters from the U.S. Food Administration. They proclaimed messages such as "Wheat is needed for the allies, waste nothing," "Save wheat, meat, fats, sugar and serve the cause of freedom," and "Food is ammunition, don't waste it" (Library of Congress, 1917). To encourage people to follow the advice, citizens were urged to sign a pledge card, as shown in Figure 2.



PLEDGE CARD FOR UNITED STATES FOOD ADMINISTRATION

If you have already signed, pass this on to a friend.

TO THE FOOD ADMINISTRATOR:

I am glad to join you in the service of food conservation for our nation and I hereby accept membership in the United States Food Administration, pledging myself to carry out the directions and advice of the Food Administrator in my home, insofar as my circumstances permit.

Name .....

Street .....

City ..... State .....

There are no fees or dues to be paid. The Food Administration wishes to have as members all of those actually handling food in the home.

Anyone may have the Home Card of Instruction, but only those signing pledges are entitled to Membership Window Card, which will be delivered upon receipt of the signed pledge.

**Figure 2** During World War I, U.S. citizens were encouraged to sign a pledge card to create identities as conservation agents. Source: San Luis (1917). According to the U.S. Food Administration, one-third of American families signed the conservation pledge (NY Times, 1917).

Although the access to other materials was a concern during World War I, and thus intended to be conserved (Ackerly, 2020:456), the main focus was on food. Four specific food items were particularly targeted for conservation: wheat, meat, fats, and sugar (Hoover, 1917). Wheat was focused because it was suitable for storage and shipment to Europe (Hoover, 1917:923). Meat was conserved both for canning and because it was "a very wasteful process," produced "at the expense of grain" (Rose, 1918: chapter 3).

An essential strategy of conserving food was *substitution* (Hoover, 1917:923-924; San Luis, 1917). For example, since fruits and vegetables were less suitable for shipment, a vegetarian diet was encouraged. Wheat was to be replaced with cornmeal. Vegetable oils were to be used instead of butter. Honey was to be used instead of sugar, and so on.

Inspired by European countries, where, for example, Bulgaria had three meatless days and Italy two (BMJ, 1917), Hoover introduced Meatless Tuesdays, Wheatless Wednesdays, and Sweetless Saturdays during World War I, Figure 3. These days of absence later inspired the contemporary idea of Meatless Monday (Semba et al., 2024).

However, while rationing in Europe was more coercive, in the U.S., the campaign relied on persuasion. Including, for example, cookbooks (e.g., Rose, 1918; Goudiss & Goudiss, 1918) for "patriotic housewives" with recipes excluding the targeted food. One of the books, "Foods That Will Win the War and How to Cook Them", presents nine alternative recipes for pancakes and waffles, in which flour is completely or partially excluded (Goudiss & Goudiss, 1918:27–28). For example, by using soaked stale bread.


**Figure 3** A sign that food establishments displayed in their windows during World War I to show their support for the conservation ideal and membership in the U.S. Food Administration. Source: U.S. Food Administration (1917).

## World War II

During World War II, resource conservation once again became a central political issue. However, this time the focus was not on food, but on a variety of other materials, as the army became increasingly mechanized and metal-intensive. Consequently, the responsibility no longer fell on the Food Administration, but primarily on the temporary war agency, the War Production Board (O'Brian & Fleischmann, 1944).

One of the War Production Board's most important tasks was to transform the society into a war economy. Therefore, the production of non-essential wartime products was limited or prohibited. Initially, some companies could adapt their production by replacing strategic materials with less critical alternatives (Henderson, 1942a). For example, car manufacturers began using a new and promising material for interiors: plastic (Jardine, 1942).

However, substitution alone was insufficient, and many metal-intensive products had to be banned from civilian use, including the beloved automobile (Flamm, 2006). This was partly because metals were better needed for military purposes, but primarily because of the very car factories and their workforce. The factories offered the space, expertise, and assembly lines required to produce large volumes of big objects, quickly (Flink, 1972:467). Thus, car factories in the U.S. were repurposed to mass-produce tanks, airplanes, and bombs.

Consumers were set to conserve resources. For example, the American war agency tried to revive the knowledge of care, reuse, and frugality that had been lost with the modernization and throwaway mentality. In a series of brochures, citizens were informed about “The War on the Home Front” and how to care, repair, and save various types of resources (Bureau of Home Economics, 1942; Henderson, 1942b).

However, the industry believed that the efforts towards frugality risked creating lasting, negative habits for the consumption culture, prolonging after the wars. Therefore, the American industry pressured the war agency to focus on waste recovery rather than saving, as means to increase the availability of resources (Durr, 2006).

Through campaigns like “Salvage For Victory”, households were encouraged to collect critical materials such as metals, rubber, kitchen fat, wood, rags, and even nylon stockings (War Production Board, 1942). Household items, sometimes still in-use, were turned in for material recovery into more important military products. This meant, to the advantage of the industry, that people often had to buy the same items again. Thus, recycling, or rather, as it was called then, *salvage*, became a form of conservation that did not challenge, but partly benefited, the industries.

Collections were ongoing during the war. For example, cooking fat was turned into butchers in exchange for financial compensation. In 1942, Walt Disney released a cartoon to promote conservation, showing how Minnie Mouse and Pluto learn to save waste fats (Prodöhl, 2016:31).

However, materials were mainly collected through special drives, focusing on a specific material, for a limited period. One of the most discussed collection drives was for aluminum, which was needed for the mobilization to manufacture airplanes (Goodwin, 1994:260; Evenden, 2011:73).

In July 1941, a two-week collection drive was launched to quickly gather aluminum (NY Times, 1941). According to the campaigners, two thousand toasters would be enough to manufacture one additional airplane. The response was enormous, and American cities began competing. Everything from coffee pots, frying pans, skillets, stew pots, cocktail shakers, ice-cube trays, cigar tubes, watchcases, radio parts, to artificial legs was collected (Goodwin, 1994:260).

The salvage drives were materially successful (Kirk, 1995; Durflinger, 2006:87). For example, the Wall Street Journal reported in 1941 that 3,200 tons of aluminum were collected during the aluminum drive (Rockoff, 2007:9). According to the campaign's own logic (cf. NY Times, 1941), this amount of aluminum would add about 600-700 planes to the US air fleet.

## War, Salvage and Conservation

War mobilized not only armies but also households, which became decentralized nodes in the war economy. This had a significant impact on the relationship between recycling and conservation.

The resource-conserving dimensions of recycling, or as it was called during wartime to emphasize its conserving nature, *salvage*, were widely communicated to the public through various information campaigns. During the wars, salvage, saving, and conserving became everyday practices. They were promoted through brochures and posters, Figure 4, that emphasized the individual's duty to support, sacrifice, and supply the nation and its soldiers with essential materials. The wars thus shifted the responsibility for conservation to individual consumers, often women, who became agents of conservation, a role so strongly emphasized that it was even formalized through signed pledges, Figure 2.

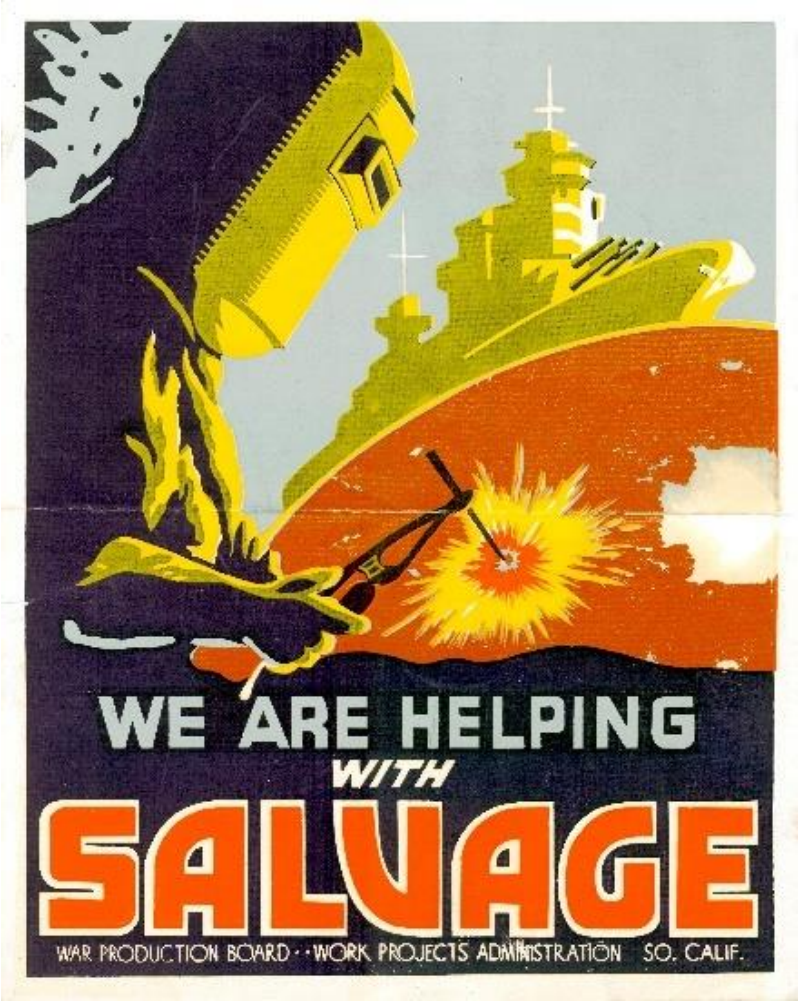



**Figure 4** A poster from World War II, encouraging U.S. citizens to collect materials for recycling. Source: Office of War Information (1943). Other conservation posters during WW2 proclaimed messages such as "Serve our fighting men abroad. Conserve these services at home", "He needs fighting weapons made from your junk", "Win with tin" and "Defense needs rubber" (cf. Witkowski, 2003).

The wars forged also new institutional arrangements between households, the state, and the industry. The state build collection systems, with the help of the industry, for salvage (Durr, 2006). The responsibility for collection shifted thereby from itinerant collection entrepreneurs to households and individuals. Not least by offering a full-scale test for a recycling system that would later push individuals to voluntarily turn in waste for material recovery.

Through the rhetoric of conservation, individual actions were linked to broader collective purposes. Conservation was symbolically framed as a noble and patriotic act (Kimble, 2014), transforming everyday waste into tools and weapons for victory. However, we must also recognize that this symbolic framing, and the material emphasis on collection and saving within the home, served to increase the national support for the war. At the same time, the conservation focus obscured the potentially violent consequences of these efforts

and material uses. Particularly during the Second World War, the donated materials could, directly or indirectly, be repurposed into military equipment to kill people, enemies as well as civilians.

For this reason, salvage campaigns, in other countries, were boycotted by the resistance movements. For example, one of Sophie Scholl's leaflets distributed by the White Rose in Munich read: 'Do not contribute to the collections of metal, textiles, and the like' (Scholl, 1970: 84). Consequently, refusing to participate in Nazi Germany's salvage drives became an anti-fascist act, a threat to the regime (Berg, 2015: 17).

As the war shifted the focus of conservation to consumption, substitution emerged as a central element of the conservation ideal. This included using vegetable fats instead of animal fats in cooking, or relying on scrap aluminium rather than newly mined, virgin aluminium in manufacturing. Substitution became a central issue during the war, due to the paradoxical relationship between the wars and natural resources.

The mobilization for war required a rapid increase in production and redirection of natural resources: "We will need more and more materials as long as the war lasts." (War Production Board, 1942:2). At the same time, the availability of resources decreased due to war-related factors such as trade disruptions, destruction of exploitation areas, and labour shortages as workers were conscripted. This scarcity turned materials in the *technosphere* (Johansson et al., 2013), in the form of household products, into a possible alternative source that could substitute and be used instead of virgin materials.

While the extraction workforce was largely sent to the front, women and children remained at home with access to materials within the households (Kirk, 1995). As the War Production Board (1942:1) emphasized: in dumps, backyards, attics, cellars, stores, and on farms "millions of tons of materials are lying idle and useless. We must now work this mine."

Unlike frugality, where someone's reduced use increases the availability of resources for someone else, the salvage ambitions, especially during the war periods, led to a total ontological redefinition of the raw material base. The technosphere, just like the lithosphere and nature, became a raw material base. Resource scarcity thus opened up a new understanding of waste, as an overarching alternative that can substitute for virgin materials from nature.

The world wars demonstrated, and this is important, that the reduction came first. That is, the availability and production of virgin natural resources decreased first. Only then did the extraction of raw materials from products become an alternative, contrary to how the conservation logic of recycling is assumed to play out. In other words, recycling, or rather, salvage, as it was called during war time, did not decrease the demand or extraction of resources and thereby conserved resources. Salvage became a supplement to meet the demand, after that extraction had already stopped.

Additionally, World War II demonstrated that waste recovery could not always substitute virgin materials in use. For example, the secondary aluminum salvaged during the 1941-case highlighted above was of too low material quality to be used for airplanes (Lingeman, 1970:16). The salvaged aluminum was instead used to produce new frying pans, which households had just turned in for recycling (O'Neill, 1993:131). Hence, as noted before (Kimble, 2014:156), recycling during the world wars played a largely symbolic rather than a material role.

War is and was, as we all know, catastrophically resource-inefficient. Battlefields were littered with scrap, and both cities and families were left in ruins. The amount of raw materials recovered from waste therefore peaked after, rather than during, the war (Rockoff, 2007:19).

Refuse became an essential resource for rebuilding the demolished infrastructure devastated by the war (Berg, 2020: 13-15). The access to virgin materials for reconstructing the bombed-out economies after the war was limited. The ruins, however, offered an important alternative source of material for rebuilding the infrastructure. The fact that many countries, such as Japan, depended on salvaged materials after the war may have contributed to their greater openness toward recycling and reuse during the 1950s and 1960s (Siniawer, 2018). In contrast, in the US, most waste ended up in landfills during the post war period (Melosi, 1981a; 1981b).

Simultaneously, wartime economies increased the demand for disposable materials. For example, 15% of all beer brewed in the U.S. during World War II was destined for shipment to the armed forces (US Congress, 1974: 111). Since this beer was transported across the oceans, lightweight, disposable containers were required,

rather than the refillable bottles that had dominated the market before the war. The wars thus contributed to the transition to, and normalization of, disposable packaging.

## Environmentalism, Recycling and Conservation

Between 1920 and 1970, the volume of waste in the U.S. grew five times faster than the population (Melosi, 1981b). Littering became an increasingly visible societal problem, especially with the rise of single-use packaging (Fenner & Gorin, 1976). To address the mounting waste and litter crisis, as well as the increasing costs of waste management and cleanup, various legislative proposals were debated in the U.S. Senate. For example, the "Nonreturnable Beverage Container Prohibition Act" of 1974 (US Congress, 1974), also known as the "Ban the Can" (Rogers, 2005).

Industry and commerce had strong incentives to preserve the use of disposable packaging. By avoiding the need to manage and clean reusable containers, they could, through single-use packaging, externalize the costs of waste management and efficiently reach new markets (Elmore, 2012). The waste and litter crisis demanded nonetheless a solution. According to several historians (Strasser, 1999; Rogers, 2005; MacBride, 2011; Elmore, 2012; Friedel, 2014), recycling emerged as an industry-friendly compromise, allowing continued production and consumption of single-use materials.

Similar patterns could be observed in Europe, where disposables were also institutionalized rather than banned, often justified by promises of recycling. In countries like Sweden, however, the emergence of the *polluter pay principle* led to the imposition of significantly stronger producer responsibilities in connection to the recycling activities, such as deposit-return systems and packaging fees (Johansson, 2024).

In contrast, in the U.S., manufacturers, producers, and retailers were reluctant to fund the cost of establishing recycling systems. To persuade the state, environmental movements, and citizens to invest in recycling systems, the notion of conservation once again played a critical role. But this time, concealed in the details.

There were environmental challenges associated with the recovery of resources from waste, as the process itself has negative impacts. However, as energy became a central issue in the early 1970s due to supply shortages and rising oil prices, different processes and materials began to be rationally compared using a single metric: energy consumption. As a result, the energy required to recover resources from waste, was in the early 70ies contrasted with the energy needed to extract the same amount of resources from the earth's crust (Bravard & Portal, 1971).

This focus on energy established a theoretical link between resource recovery from waste, which then was starting to be referred to as *recycling*, on the one hand, and conventional resource extraction, on the other hand. The sheer energy comparison revealed that there was a choice between two alternatives: recycling or exploiting nature. By presenting it as a choice, the symbolic relationship appears so direct, materially accurate and precise that every recycled kilogram is assumed to avoid mining, and conserve a corresponding kilogram in nature, according to what can be referred to as the displacement logic.

Given that metal extraction from the earth's crust is incredibly energy-intensive, the energy-saving argument for recycling, based on the displacement logic, became highly persuasive. For instance, Robert Testin, from Reynolds Aluminium, representing The US Aluminum Association, testified before the Senate during the discussions to ban single-use products, by stating:

> *"Each time aluminum is recycled, we save 95 percent of the energy that would be needed to make primary metal, and aluminum can be recycled over and over again" (US Congress, 1974: 212).*

Just before that, William May, chairman of the American Can Company, emphasized recycling's conservation potential of single-use packaging, by promising: "We are on the threshold of closing the circle" (US Congress, 1974: 195).

A method that symmetrically compared entirely different processes was introduced, which would later become known as *Life Cycle Assessment* (LCA). Through this method, not only was the notion of displacement

introduced, but it also became black-boxed (obscured) within the underlying calculations. Recycling 1 ton of a material is assumed to displace the extraction of 1 ton virgin material from nature. In this way, LCA translated symbolic relations based on theoretical assumptions into empirical, physical results.

The results of these comparisons could then be communicated in ways that made the indirect conservation logic of recycling disappear in the language. For example, by emphasizing material and energy savings, which semantically encapsulated the displacement within a complex, yet invisible, conservation logic.

These results were especially convincing to the modern environmental movement of the 1970s, which primarily focused on pollution reductions. Recycling did not only conserve resources, as estimations also showed that various emissions from the production and extraction were avoided (Bravard & Portal, 1971). Consequently, both older conservation groups like the Sierra Club, as well as modern environmental organizations like Friends of the Earth and Environmental Action, supported that the state should fund the recycling programs during the 1970s (Elmore, 2012: 493).

The symbolic capacity of recycling to save energy, reduce pollution, and conserve natural resources convinced the public to sort their waste and establish recycling centers, often run by volunteers, across the U.S. Providing a cheap source of raw materials for the industry. Waste sorting became fundamental for the civic engagement for the environment in the 1970s and the construction of the ecological citizen. Donna Riblet, a local representative of the environmental committee in Philadelphia, expressed in the debate to ban single-use products that: “Both the volunteers and the contributors [to the recycling centers] come back month after month because they realize recycling is the way to save our natural resources for the future” (US Congress, 1974: 224).

## The Naturalized Discourse of Recycling

The emergence and popularization of the concept, *recycling* in the early 1970s must be understood in relation to its proclaimed ecological dimensions. The term recycling had been used in the oil industry since at least the 1920s to describe the reintegration of oil residues into the refining process (cf. Harbin, 1926). In the early 1970s, however, it acquired new cultural and political meanings.

In the official handbook for the first Earth Day, held on April 22, 1970, which mobilized millions of Americans, the editor Garret De Bell (1970) devoted a chapter to the emerging notion of “Recycling”, a term that had not yet “appear[ed] in most dictionaries” (p. 214). The ecological benefits of this new concept were clearly stated from the outset: “each ton of paper, aluminum or iron reclaimed from waste is a ton less needed from our forests and mines” (pp. 214–215).

However, with the term recycling, extracting raw materials from waste was now not only associated with conservation and resource savings. Inspired by Boulding’s (1966) “The Economics of the Coming Spaceship Earth”, re-cycling was framed as part of nature itself: “resources be used over and over again […] analogous to the cycles of elements […] in natural eco-systems” (De Bell, 1970:214).

Following the Earth Day, the American packaging company *Container Corporation of America* announced a student competition to design a recycling symbol “for the love of Earth” (Jones & Powell, 1999). In practice, however, the aim was to label products and capitalize on the growing environmental awareness.

In September 1970, Gary Anderson’s iconic symbol with folded arrows, Figure 5, chasing one another in a triangle, won the contest. According to the company’s own press release, the symbol was launched with the hope of “spread[ing] awareness […] that wastepaper recycling is an important and effective method of conservation” (Packaging Design, 1970). The well-known symbol effectively visualizes the naturalized discourse of recycling as an ecological flow of resources, mimicking nature’s endless cycles. Hence, a closed loop with no need of “one-way” (De Bell, 1970: 214) extraction from forests or mines. A model that, both visually and discursively, presents the conservation of natural resources as self-evident.

**Figure 5** Gary Anderson's iconic recycling symbol from 1970. Source: Wikipedia Commons

During the early 1970s, the ecological dimensions of recycling became part of everyday life (Elmore, 2012: 493–494). A proclaimed Native American was shedding a tear over the contemporary and dystopian throwaway mentality, in a widely discussed and award-winning advertisement from Keep America Beautiful (1971). In contrast, recycling centers in places like Michigan were launched as *ecology centers* (Irwin, 1971). In advertising, companies such as Reynolds Aluminium (1974) promoted their disposable cans by highlighting that recycling generates money and "conserves one of America's most valuable resources—energy […] because recycling takes only 5% of the energy needed to create aluminum from virgin ore".

The scientific and cultural framing of recycling as ecological conservation laid the groundwork for its rapid institutionalization. The same logic that had circulated in handbooks, symbols and industrial campaigns was soon written into law. In 1976, the Resource Conservation and Recovery Act (USC, 1976) was enacted, still one of the most important legislative frameworks for waste management in the United States.

Through this Act, as signalled by its very name, the primary purpose of waste management shifted from merely mitigating the harmful effects of waste to actively conserving natural resources through an explicit emphasis on recycling. This policy shift is clearly articulated in the act's opening section (§6902), which states that its objectives are "to promote the protection of health and the environment and to conserve valuable material."

While the regulation clearly articulates how people are to be protected from the harmful emissions of waste, through requirements on how waste shall be collected, transported, treated, stored, and disposed. It is far less clear, however, how recycling is supposed to fulfil the other core objective of conserving resources. The lack of concrete measures suggests that conservation was simply assumed to be an inherent outcome of recycling, rather than a challenge to address. This allowed the recycling industry to claim that their activities conserved resources without any corresponding obligations to demonstrate the conservation effect.

After conservation had been institutionalized in the recycling discourse, it gradually lost its explicit rhetorical and political prominence as a distinct objective. However, it grew instead as an implicit assumption that shaped our conceptual understanding of environmental actions.

For example, advocates of recycling still stress that they handle resources rather than waste, which is a direct continuation of the conservation legacy. It reflects the early 20th-century semantic shift, when the waste recovery industry's adoption of the conservation ideal placed the emphasis on the management of natural *resources*, rather than waste, to reframe public perceptions (Chapter 4).

The embeddedness of conservation was reinforced as climate change rose to prominence in the 1990s. The link between recycling and climate rests precisely on the old conservation idea. If recycling is assumed to displace an equivalent amount of primary resource extraction, then the emissions from their extraction are assumed to vanish as well.

Based on this logic, though now reframed in a new context and language, rest sweeping, but widely communicated claims, such as that a circular economy could cut global emissions by 45% (EMF, 2021). The conservation ideal has thus moved so far into the background that it can be invoked endlessly, without scrutiny, by corporate representatives, politicians, and academics. It works just as well to legitimize recycling as it does to market contemporary ideas of the sharing economy or the circular economy.

# Concluding Discussion

The purpose of this article is to examine how recycling became a resource-conserving strategy. The idea of conservation has played various roles, functions, and meanings in the recovery of raw materials from waste throughout history. Different actors have symbolically linked conservation with waste recovery to fulfill their respective purposes.

Waste was a central element in Gifford Pinchot's original formulation of the conservation ideal, at the turn of the last century. However, the conservation focus was initially on preventing the generation of waste, aiming to reduce material loss and increase the efficiency in the use of available resources.

Herbert Hoover then shifts the focus of conservation solely to manufacturing, completely away from the management of nature. By shifting the focus of conservation further down the value chain, the extraction industry was relieved from the conservation agenda.

The waste industry, on the other hand, adopts the conservation idea symbolically to improve the profession's reputation and overshadow the industry's negative impacts. Hence, they strategically develop the conservation idea from preventing the generation of waste to also incorporating the management and recovery of already generated waste. Through the conservation ideal, their materials were famously transformed from waste into natural *resources*. Conservation was obviously no longer perceived as a burden, but rather as a symbolic marketing strategy for the industry.

During the world wars, the individual consumer and the conserving dimensions of consumption were emphasized. Due to raw material shortages during the wars, household products became an important alternative raw material base. For example, scrap metals were intended to replace virgin metals through salvage campaigns. The wars centralized thus the role of substitution for conservation.

With the energy crises of the 1970s, waste recovery and raw material extraction began to be compared using a single common metric: energy consumption. By presenting the symbolic comparison as an exact choice between two material processes, every gram of recycling was assumed to substitute mining. Thus, the actual resource-conserving effect of recycling never needed to be empirically and materially proven. By incorporating the assumption that recycling always conserved resources into underlying calculations, scientific models like Life Cycle Assessment further embedded the idea of recycling as a conservative strategy in our language.

With the help of advertising campaigns, handbooks, symbols and scientific models, the idea of recycling's conserving capacity was stabilized to the extent that the rhetoric statement "recycling saves 95% energy" is now considered a material truth. It has become an axiom that is fully integrated in modern recycling policy.

This fundamentally changed the aim of waste management policies, to no longer solely focusing on protecting people from the harmful emissions of waste, but also to conserve natural resources. However, since this assumption has evolved into a self-evident outcome of recycling, concrete measures to achieve that objective have, to the benefit of the industry, become superfluous.

## Rethinking Recycling Conservation

Overall, the conservation ideal has evolved from a largely material, practical, direct and ecology-driven protection of nature to an increasingly symbolic, technical, assumed, indirect and industry-driven "protection". This shift is articulated and obscured through notions such as climate savings, resource efficiency and, above all, the circular economy and recycling.

The conservation dimensions of recycling are based on an ontology that requires neither time nor space. In other words, the conservation ambition of recycling is not tied to any particular moment or place. Yet conservation plays a central and legitimizing role in framing recycling as a sustainable and ethical mode of consumption and production.

Conceptually, the conservation ideal aspires to bring recycling closer to nature. There is undoubtedly a conserving potential in recycling. However, the space between recycling and nature is filled with a modernist and optimistic reliance on the capacity of the market to solve problems. Where shifts in demand for recycled

materials are expected to lead to proportional reductions in primary production across the entire value chain, trickling all the way down to the extraction and cultivation of natural resources.

The long causal chain required for recycling to conserve resources in an increasingly global market makes it exceedingly difficult to verify where, when, or how natural resources are conserved. Nature, instead, becomes a symbolic reference point in the recycling discourse, abstracted into kilowatt-hours, carbon equivalents, or kilograms saved, thereby stripping it of ecology. Conserving through recycling is thus more about technology, and technical expressions, than about nature. This logic of abstraction stems from studying the environment as a system of flows, rather than nature as an ecology of situated relations. The relationship between recycling and nature is thereby marked not by protection, but by a growing distance.

Paradoxically, nature appears to contribute more to recycling, as justification, metaphor, and moral anchor, than recycling contributes to nature, despite the material intention behind the conservation ideal. As long as this relationship is sustained more by rhetorical symbolism through technical metrics than by material evidence, the ideal conservation risks becoming a discursive veil. One that obscures rather than repairs the growing rift between humans and nature.

If the circular economy is to realize its promise as a new mode of conservation, can we envision a form of recycling that engages more directly, empirically, materially and responsibly with the ecologies it claims to protect? Achieving this will require more than reliance on market mechanisms alone to bridge the gap between recycling and nature. Encouragingly, current technical developments, such as digital traceability and product passports, may enable new ways of measuring and governing material flows. In which conservation is no longer symbolically taken for granted but rigorously measured and materially enacted.

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