badvertising

Advertising's role in climate and ecological degradation

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Executive Summary

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Many industries have been recognized as directly and indirectly causing climate and ecological degradation. So far, however, the advertising industry has largely escaped accountability. This report attempts to remedy the omission by looking at four ways that advertising indirectly causes such harm. Specifically, it reviews scientific literature showing that materialistic values and goals, the consumption-driving work & spend cycle, and the consumption of two illustrative products (namely beef and tobacco) are each a) encouraged by advertising and b) implicated in causing various forms of environmental damage. It seems likely that similar dynamics occur for other products, services, and experiences. This body of empirical evidence therefore supports the conclusion that if humanity hopes to make progress in addressing and reversing climate and ecological degradation, it would be prudent to rein in and change the practices of the advertising industry.

Introduction

Many industries have been identified as sources of the climate and ecological crises currently facing Earth's inhabitants. Evidence makes it clear that the actions of the coal, oil, gas, automobile, airline, chemical, plastics, and agricultural industries (among others) directly cause climate and ecological damage, sometimes through their greenhouse gas emissions, sometimes through their pollution of air, water, and soil, and sometimes through their destruction of forests and other life-sustaining ecosystems.

Other industries have been identified as indirect sources of Earth's climate and ecological crises because of the support that they provide to industries that have more direct effects on climate and ecological degradation. For example, some banks provide capital that companies need in order to explore for oil, to engage in hydraulic fracking, to build factories that churn out plastics and polluting cars, etc. Similarly, some mutual funds offer investors the opportunity to purchase shares of companies that engage in unsustainable actions, thereby enhancing the financial value of those companies.

There is another industry that is an indirect source of Earth's current climate and ecological crises but that has, so far, mostly escaped accountability for its actions. This is the advertising industry.

Advertisements are a key feature of 21st century capitalist economies, with their nearly inescapable drum beat encouraging consumption. The advertising industry provides support to businesses by developing messages to entice people to spend money on the panoply of goods, services,

and experiences offered in the marketplace. These messages have become increasingly ever-present, targeted, and sophisticated with the advent of social media and the efforts of advertising researchers to better understand consumers' minds and brains.

This report is not aimed at reviewing how the advertising industry plies its trade. Instead, this report argues that enough sound empirical evidence exists to support the conclusion (depicted in Figure 1[1]) that the advertising industry indirectly contributes to climate and ecological degradation through its encouragement of materialistic values and goals, the consumption-driving work & spend cycle, and the consumption of two illustrative products, namely beef and tobacco. Perhaps as more research accumulates, additional pathways can be added to Figure 1, but, at the time of writing, these four pathways appear to be the ones best supported by science.

As such, this body of evidence also supports the conclusion that changing the practices of the advertising industry holds promise as a way to address climate and ecological degradation.

Fig. 1: A General Model of Four of the Advertising Industry's Indirect Effects on Climate and Ecological Degradation.

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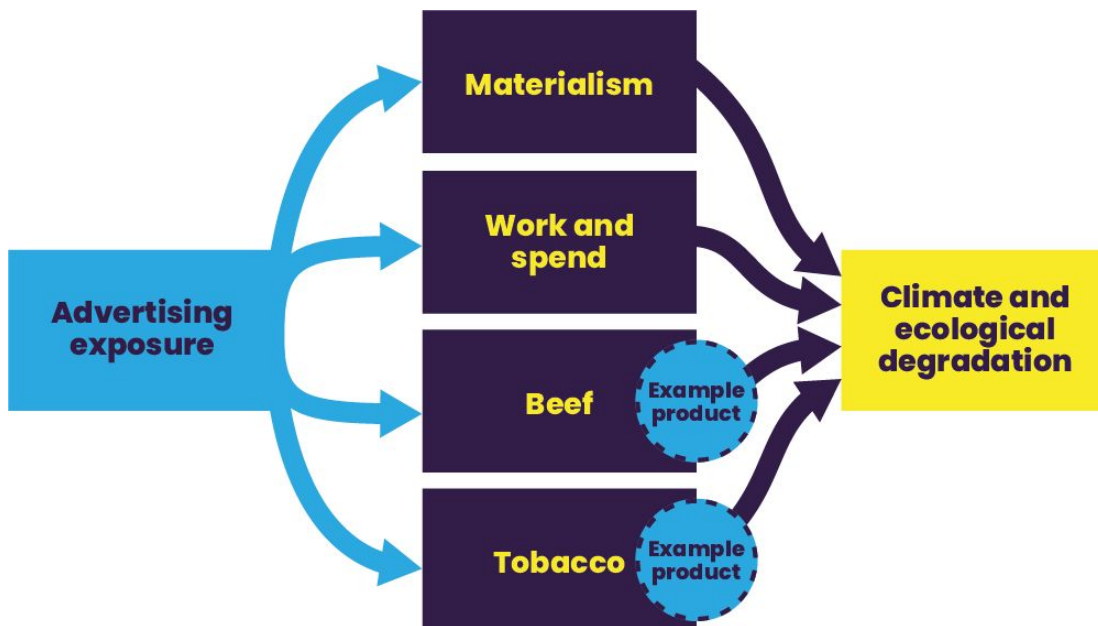
[1] The model depicted in Figure 1 is not meant to encompass all possible pathways through which advertising might lead to climate and ecological degradation, nor is it meant to guide any future statistical or empirical tests. It is presented purely for descriptive purposes to show the four pathways that had sufficient scientific evidence to be included in this report.

Materialism

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> **"Values and goals aimed at maximizing one's wealth, status, and image tend to be in conflict with prioritizing the transcendent, 'larger-than-self' aims involved in caring about the environment."**

The word "materialism" has been used in a variety of ways by philosophers, economic historians, and other scholars. For this report, we follow the lead of researchers in psychology, marketing, and consumer studies by using "materialism" to reflect the priority that individuals place on values and goals to be wealthy, to have many possessions, and to obtain the status and appealing image that often come with wealth and possessions.[2] One of the most important factors leading people to prioritize such aims is "social modeling," i.e., exposure to messages in their environment which suggest that happiness and a good life depend upon wealth and consumption. For example, when people see parents, siblings, and peers act in materialistic ways, they are themselves likely to imitate those social models. Media messages are an additional source of materialistic social modeling, as the profitability of both traditional and social media companies typically depends on revenue obtained from presenting users with advertisements that encourage consumption.

It is therefore not surprising that many studies (reviewed in Table 1) find that materialism levels are positively correlated with both how much people view television and their exposure to advertising. In addition, experimental studies show that when research participants are briefly exposed to the types of messages seen in advertisements, they respond (at least temporarily) by increasing the priority that they place on materialistic values and goals. Findings that show

[2] Kasser (2016)

increases in materialism as a result of exposure to advertising have been reported across a range of age groups and in various nations around the world.

Research shows that when people "buy into" the materialistic values and goals encouraged by advertising, they report lower levels of personal well-being, experience conflictual interpersonal relations, engage in fewer pro-social behaviours, and have detrimental academic and work outcomes.[3] In addition, many empirical studies show that the more that people prioritize materialistic values and goals, the less they espouse positive attitudes about the environment (for example, by saying that they don't care much about environmental degradation) and the less often they engage in pro-environmental behaviours (for example, by being less likely to recycle, to vote for pro-ecological politicians, etc., and by being more likely to live in large houses, to drive gas-guzzling automobiles, etc.). As Table 2 reviews, support for these conclusions has been forthcoming from studies that include children, adolescents, college undergraduates, and adults from a variety of nations around the world. These basic findings have also been reported when investigators use various methods and means of testing the hypothesis (e.g., longitudinal and experimental studies, examination of regional differences in materialism and energy use). The fact that the negative associations of materialism with pro-environmental attitudes and behaviours is replicated consistently (although admittedly not always) is probably best understood as occurring because values and goals aimed at maximizing one's wealth, status, and image tend to be in conflict with prioritizing the transcendent, "larger-than-self" aims involved in caring about the environment.[4] Said differently, in order to successfully pursue one's materialistic values and goals, one by necessity has to consume, consume a lot, and consume products, services, and experiences that convey status and an appealing image; such actions are usually difficult to reconcile with living in an ecologically-sustainable fashion.

The numerous studies presented in Tables 1 & 2 support the conclusions that:

1. exposure to advertising heightens the priority people place on materialistic values and goals; and

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[3] Kasser (2016)

[4] Grouzet et al.(2005); Schwartz (1992)

2. materialism is associated with negative ecological attitudes and unsustainable behaviours.

Two additional studies have explicitly examined whether advertising has an indirect relationship with ecological degradation (see Figure 1) by statistically testing what are known as mediational models. In brief, a mediational model allows a researcher to test whether the relationship between two variables is statistically explained (or mediated) by a third variable (see Glossary for further information). In samples of both American[5] and Peruvian[6] adults, results suggested that television viewing is associated with less concern for ecological degradation, and that this association occurs, at least in part, because television viewing leads to high levels of materialism, which, in turn, lead people to care less about ecological degradation.

In summary, a large and growing body of scientific evidence is consistent with the conclusion that advertising indirectly causes climate and ecological degradation through its encouragement of materialistic values and goals.

[5] Good (2007)

[6] Guillen Royo (2019)

The Work & Spend Cycle

"...advertising leads people to place higher value on consumption of what they see advertised and lower value on having more time available for non-work activities."

Individuals who live under consumer capitalism are subjected to numerous pressures to work long hours. While some of these pressures come from individuals' employers and peers, and others from religion and gender roles, another source is the desire to consume. While recent decades have created a substantial financial infrastructure which allows (and encourages) people to go into debt in order to pay for the products, services, and experiences that they desire, another solution is to work more hours in order to earn more money that can be spent on consumption. This is commonly referred to as the "work & spend cycle."

Because advertising is designed to stimulate people's desire for and eventual consumption of products, services, and experiences offered in the marketplace, exposure to advertising may be another source of long work hours. While only a few studies have tested this hypothesis, and while those studies rely primarily on data collected from the USA and the UK, the available evidence supports the conclusion that advertising has its role to play in increasing people's work hours (see Table 3). The fundamental explanation given by researchers who study this topic is that advertising leads people to place higher value on consumption of what they see advertised and lower value on having more time available for non-work activities. Said differently, in the presence of a large volume of advertising, many people come to want to work, shop, and consume relatively more than to rest, recreate, and relate with others.

The decision to work more hours rather than spend one's time in other ways comes at a price. For example, compared to those who decide to work shorter hours, those who work longer hours have lower physical and psychological well-being, as well as less satisfying interpersonal relationships.[7] Further, as reviewed in Table 4, numerous studies demonstrate that long work hours are associated with higher ecological footprints, greenhouse gas emissions, and overall energy consumption. These findings generally replicate whether analyses are conducted on individual people, on households, on US states, or on nations; some evidence suggests, however, that high work hours are more damaging to the environment in more economically-developed nations than in less economically-developed nations.

Two explanations have been put forward for the positive association between work hours and ecological damage. The *scale effect* suggests that when individuals work more hours, they earn more money that they then spend on consumption; scaled up, many people working many hours leads to high levels of overall economic and ecologically-damaging activity. The *composition effect* suggests that when people work long hours, they have less time to engage in ecologically-sustainable activities that are relatively time intensive, like riding one's bicycle instead of driving one's car or growing one's food instead of buying it pre-packaged at the grocery store. Clearly these two explanations are not mutually exclusive, and both have obtained some empirical support.

In summary, scientific evidence is consistent with the conclusion that advertising indirectly causes climate and ecological degradation through its encouragement of the work & spend cycle.

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[7] See Devetter & Rousseau (2011, section 4.1) for a review

Beef

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> **"...evidence is consistent with the conclusion that advertising indirectly causes climate and ecological degradation through its encouragement of the consumption of beef."**

Advertisements do not usually explicitly promote materialism or the work & spend cycle, even though they often implicitly encourage these psychological and behavioural attributes. Instead, advertisements typically aim to promote specific products (like pizza), services (like automobile repair), and experiences (like visiting a theme park) that are available in the marketplace. Some of these products, services, and experiences also play a role in climate and ecological degradation. Beef is one product whose consumption has been shown to be associated with advertising and to result in climate and ecological degradation.

Several studies (reviewed in Table 5) report that advertising expenditures on beef are positively associated with beef consumption levels. Such results have been obtained in the USA, Canada, UK, Australia, and South Korea. Researchers have reported positive associations of beef consumption with both branded and generic forms of beef advertising, although generic advertising yields somewhat less consistent results across and within studies. It should also be noted that studies have found inconsistent results about the relationship between beef advertising and consumption during periods when people are also exposed to relatively large amounts of media information warning them that consuming beef may make them sick (e.g., from Bovine spongiform encephalopathy (BSE), commonly known as mad cow

disease, which crosses species to become the variant Creutzfeldt-Jakob disease (CJD)).[8]

Of course, consuming beef has been associated with other negative health outcomes besides CJD, including heart disease and colorectal cancer. And, compared to other ways of obtaining protein in one's diet, consuming beef also plays an outsized role in ecological degradation. Specifically, as reviewed in Table 6, numerous studies make it clear that raising cattle for beef relies on unsustainable water usage, causes destruction of habitat-providing and carbon-capturing forests, and emits high levels of both greenhouse gases and chemicals such as phosphorus and nitrogen that cause excessive growth of algae in bodies of water.

In summary, scientific evidence is consistent with the conclusion that advertising indirectly causes climate and ecological degradation through its encouragement of the consumption of beef.

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[8] For studies reporting weaker results, see Boetel & Liu (2003), Kinnucan et al. (1997), and Verbeke & Ward (2001)

Tobacco

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> **"Each stage in the life cycle of a cigarette, from growing the tobacco to manufacturing the cigarette to smoking the cigarette to disposing of the cigarette, is associated with specific climate and ecological risks."**

Tobacco is another product whose consumption has been shown to be associated both with advertising and with climate and ecological degradation.

Given the many physical health risks caused by smoking tobacco, substantial research has been conducted on the associations between the advertising of tobacco and its consumption. Although some have argued that the data are equivocal,[9] the overall body of research linking advertising with the consumption of tobacco is strong enough that Article 13 of The World Health Organization's (WHO) Framework Convention on Tobacco Control begins with the statement that "… a comprehensive ban on advertising, promotion and sponsorship would reduce the consumption of tobacco products."[10] As such, WHO includes enforcing tobacco advertising bans as one of the six components of its policy suggestions (i.e., the E in its MPOWER program).[11] Table 7 summarizes some additional recent scientific studies that have examined the link between advertising and the consumption of tobacco, adding further weight to the conclusion that people are more likely to smoke tobacco products when they are exposed to advertising of those products.

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[9] Capella et al. (2008)

[10] https://www.who.int/tobacco/control/measures_art_13/en/

[11] https://www.who.int/tobacco/mpower/en/

While the physical health risks of smoking tobacco are well-known, less so are the many climate and ecological risks associated with what is, in its own right, a major, global agricultural commodity. As reviewed in Table 8, each stage in the life cycle of a cigarette, from growing the tobacco to manufacturing the cigarette to smoking the cigarette to disposing of the cigarette, is associated with specific climate and ecological risks: deforestation, chemical pollution of water and soil, CO_2 and other noxious emissions, and on and on.

In summary, scientific evidence is consistent with the conclusion that advertising indirectly causes climate and ecological degradation through its encouragement of the consumption of tobacco.

Other damaging products, services, and experiences

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> **"Two recent studies also support the idea that the advertising industry indirectly contributes to climate and ecological degradation because it encourages the consumption of SUVs and of leisure airline flights."**

As noted at the outset, this report has focused on four examples for which substantial scientific evidence exists to support the claim that advertising has indirect but real effects on climate and ecological degradation. It seems likely that similar dynamics occur for other products, services, and experiences.

For example, it is well-established that Sports Utility Vehicles (SUVs) are among the most highly carbon-emitting means of personal travel and that airline flights are much more carbon intensive means of distance travel than taking trains or buses, or than staying home.[12] Further, SUVs have become an increasingly large percentage of the overall automobile market (as shown in Figure 2[13]) and flying has become an increasingly frequent way for people to travel (at least until the pandemic began, as shown in Figure 3[14]). Two recent studies also support the idea that the advertising industry indirectly contributes to climate and ecological degradation

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[12] https://www.badverts.org/the-problem

[13]

https://www.iea.org/commentaries/growing-preference-for-suvs-challenges-emissions-reductions-in-passenger-car-market

[14]

https://www.iata.org/en/iata-repository/publications/economic-reports/air-passenger-monthly-analysis---august-2020/

because it encourages the consumption of SUVs and of leisure airline flights.

Fig.2: Increases from 2010-2018 in the share of SUVs as a percentage of total car sales (Source: IEA)

Source: IEA, Share of SUVs in total car sales in key markets, 2010-2019, IEA, Paris
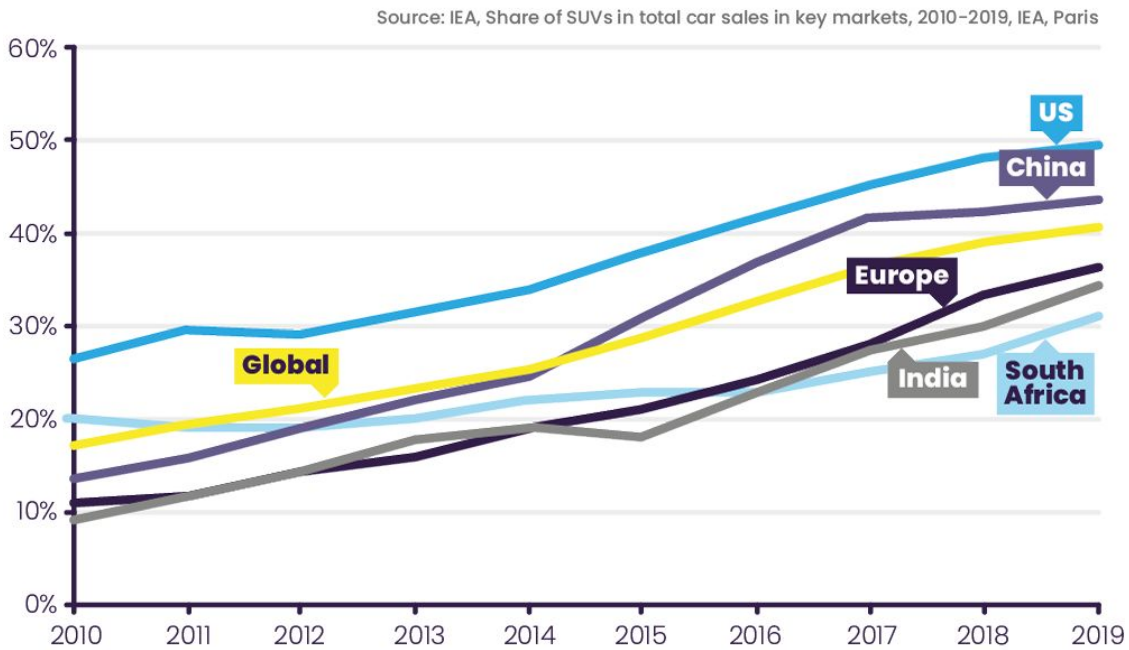
Fig. 3: Changes in Number of Kilometers flown by Paying Passengers from 2016-2020. (Source: IATA)

Source: IATA Economics, IATA Monthly Statistics
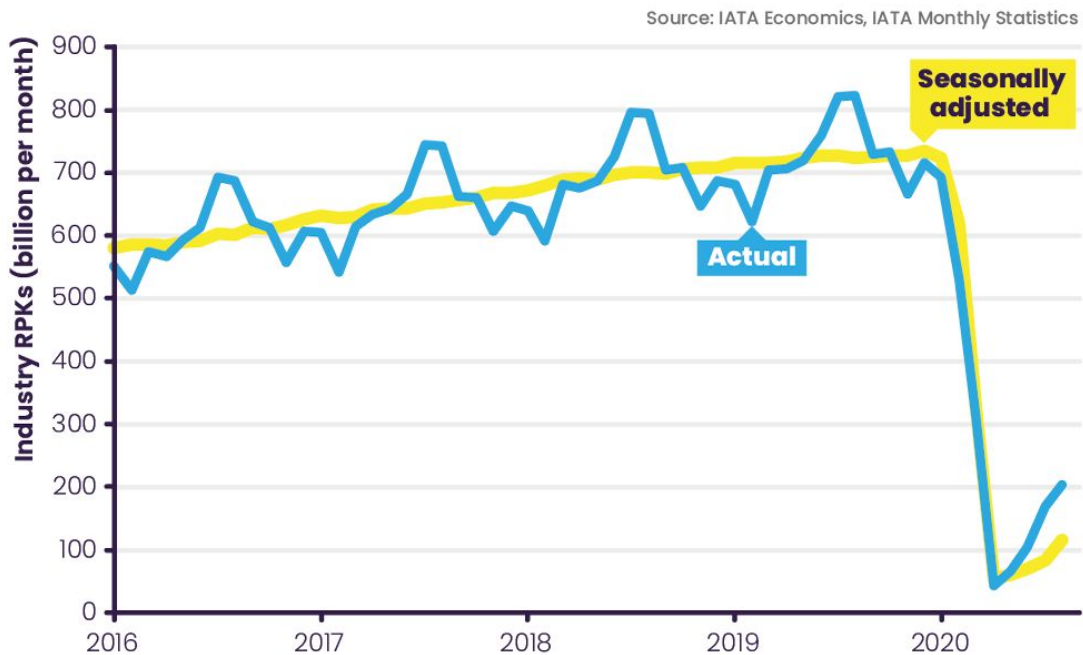
Note: 'RPK' is revenue passenger kilometers, which is the number of paying passengers multiplied by the distance flown.

First, advertising researchers recently calculated the carbon cost of an award-winning campaign from 2015-2017 by auto-maker Audi. They did so by combining information on the increase in Audi sales attributed to the new campaign (almost 133,000 autos) with life cycle assessments of the emissions of the autos that were sold. Their best estimate is that the ad campaign contributed to over 5 million tons of carbon emitted.[15]

Second, in a survey of ~1000 German adults, participants self-reported how much they had seen online advertisements and social media posts encouraging consumption of leisure airline flights, their own aspirations to fly, and how much they had actually flown in the previous year. Analyses supported a mediational model in which advertising exposure predicted the desire to fly, which, in turn, predicted how much participants reported actually having flown for leisure in the previous year.[16]

Clearly these studies are preliminary, and much more work remains to be done to test whether the relationships of advertising with the consumption of SUVs and airline flights yields findings similar to the more extensive body of research on the relationship of advertising with the consumption of beef and tobacco. We cautiously predict that future studies will indeed find similar relationships, and we hope that researchers will take up these questions.

In the meantime, given the reasonably large body of scientific evidence reviewed in this report consistent with the argument that advertising has indirect effects on climate and ecological degradation, and given the scale of climate and ecological degradation that Earth's inhabitants currently face, we suggest that the most reasonable conclusion is that advertising also leads to increased consumption of SUVs, airline flights, and other products, services, and experiences that are damaging Earth's climate and ecology. Of course, some in the advertising industry may disagree with this conclusion, and we are curious to see the scientific evidence they might proffer to support their viewpoint.

[15] Davison & Essen (2020)

[16] Frick et al. (2020)

Closing

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"If humanity hopes to make progress in addressing and reversing climate and ecological degradation, it would be prudent to rein in and change the practices of the advertising industry."

This report has reviewed scientific research consistent with the claim that that if humanity hopes to make progress in addressing and reversing climate and ecological degradation, it would be prudent to rein in and change the practices of the advertising industry. This report, however, is not the place to review the wide variety of ways to do so.

Some specific actions available to different levels of government and that build upon past precedents for applying checks and balances to the advertising industry are explored at **www.badverts.org/toolkit**. Future reports from the New Weather Institute and Possible will also provide additional strategies for activist organizations, businesses, and individual people in their roles as consumers and as citizens.

Glossary of Statistical and Methodological Terms

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Control Variable

A control variable is a variable that a researcher enters into statistical equations even though it is not one of the primary variables about which the researcher has hypotheses. Typically, control variables are additional variables that the researcher suspects may be associated with the primary variables under investigation, and so the researcher wants to investigate whether the primary variables relate to each other as hypothesized even after "controlling for" (or holding constant) the potential effects of the control variable(s). For example, a researcher might want to examine the association between households' work hours and energy use, but would do so after controlling for the number of people in the household, as, of course, households with more people are likely to use more energy and to have a larger total number of hours worked than would households that have fewer people.

Correlation

Correlations describe the association between two variables. If a correlation is positive, as Variable X increases, Variable Y also increases (e.g., height and weight). If a correlation is negative, as Variable X increases, Variable Y decreases (e.g., math anxiety levels and scores on a math exam). The specific statistic used to test the significance of a correlation depends on the nature of the data and whether control variables are also in the statistical equation. Although it is useful to know when two variables are correlated with each other, correlational data cannot allow a researcher to reach causal conclusions.

Experiment

In lay use, the word "experiment" is often used for any study that a researcher conducts. In fact, however, an experiment is a certain kind of study, and it is the only kind that can

establish causality. In the simplest case, participants are randomly assigned to one or another group. If they are assigned to the "control group," they typically have a relatively neutral experience; participants in drug studies who receive a placebo are a standard example. If they are assigned to the "experimental group," they typically have some experience that the researcher expects to cause some effect on them; participants who receive an actual active drug are a standard example. After their experience in the control or experimental group, all participants are then measured on some other variable, known as the "outcome" or "dependent" variable (e.g., depression level). If the experimental group has a score on the outcome variable that is statistically significantly different from the control group's score, the researcher can conclude (in a well-designed experiment) that the experimental manipulation caused that difference.

Life Cycle Assessment (LCA)

LCA is a systems-level approach for quantifying the known (and potential) environmental impacts of a product or activity throughout its life cycle, i.e., from cradle to grave. To this end, LCA researchers collect information regarding the product's or activity's impact(s) from raw material acquisition through production, transportation, distribution, use, re-use, recycling, and disposal.

Longitudinal study

In this type of study, the participants are assessed multiple times. This design allows the researcher to examine changes in variables over time and how a variable assessed at an earlier point in time predicts a variable assessed later in time. Longitudinal studies contrast with cross-sectional studies, in which all variables are assessed at a single point in time.

Meta-analysis

The gold standard in scientific research concerns the extent to which any particular finding is replicated, or found again, in other samples of participants or with other ways of measuring the variables of interest. Meta-analysis is a statistical procedure that allows researchers to test how consistently replicated a particular finding is across many studies. Meta-analytic researchers begin by finding all of the existing studies (published and unpublished) that have tested the relationship between a certain set of variables. The researchers then convert each of the reported findings

(or what are known as "effects") into a standard statistical format. Finally, in the simplest case, they combine all of the effects together to determine whether, across all of the studies that have tested a particular idea, the results replicate consistently. If the meta-analysis yields a significant result, one can become more confident that the effect is real rather than due to random fluctuations in the data or to specific sample characteristics.

Mediational Model

In the simplest mediational model, there are three variables. The "predictor" variable is the one that the researcher believes causes the "outcome" variable. So, for example, one might believe that childhood abuse (the predictor) causes adult depression (the outcome). The question remains, however, what the mechanism is through which the predictor causes the outcome. For example, perhaps childhood abuse causes low self-esteem, which, in turn, causes depression. In this case, low self-esteem is the "mediator" variable, or the variable that explains the relationship between the predictor and the outcome. Said in a different way, the effect of child abuse on depression is an "indirect" one that occurs through low self-esteem. To test for such indirect effects, the researcher collects data on all three variables and then runs a series of statistical tests to see if all, some, or none of the relationship between the predictor and the outcome is explained by the mediator.

Significance

When researchers compute statistics, they check if the results are statistically significant by comparing their observed results to standardized tables. In most cases, for a researcher to conclude that the result is statistically significant, there must be less than a 5% chance that the observed result occurred due to random fluctuations in the data. Sometimes researchers set even more stringent requirements for establishing significance (e.g., 1%).

Tables

Table 1: Some Studies Showing that Advertising Exposure is Associated with Materialism.

Key Studies	Methodological Summary	Key Results
Moldes & Ku (2020)	The researchers conducted a meta-analysis of 10 experiments in which consumeristic ideas had been "primed" or "activated" in participants' minds. Priming occurred by various means, including unscrambling phrases with consumeristic content (e.g., "stuff want I") vs. neutral content or viewing consumeristic vs. neutral images. In each study included in the meta-analysis, a measure of materialism was administered to participants soon after their exposure to these primes.	Consumeristic primes (such as those common in advertising) caused significantly larger increases in materialism than did neutral primes. Notably, this effect was somewhat stronger in samples from Eastern countries (China & Singapore) than from Western countries (US, UK, and Germany).
Opree et al. (2014).	Dutch children participated in a longitudinal study. At first contact, they reported their exposure to advertisements. One year later, they reported their desire for advertised products and their materialism.	Exposure to advertisements was significantly positively correlated with materialism one year later. Mediational analyses showed that this relationship was explained fully by desire for advertised products, such that advertising exposure led to higher desire for advertised products, which, in turn, led to higher materialism.
Twenge & Kasser (2013)	For the years 1976-2007, the researchers obtained measures of the materialism levels of >350,000 USA high school seniors and of the percentage of the USA Gross Domestic Product that was due to marketing and advertising expenditures.	The percentage of the USA economy that was due to marketing and advertising expenditures in a given year was significantly positively correlated with how materialistic teenagers were both that year and five years later.

Additional Studies	Methodological Summary	Key Results
Benmoyal-Bouzaglo & Moschis (2010)	French young adults self-reported their materialism and viewing of television.	TV viewing was significantly positively correlated with materialism.
Brand & Greenberg (1994)	USA high school students were recruited from two types of school districts: those with Channel One (a company that broadcasts news and advertisements into classrooms a few times per week) and those without Channel One; school districts were matched on other important variables (e.g., socio-economic status). Students self-reported their consumer-oriented attitudes (i.e., materialism).	Children in Channel One school districts had significantly higher consumeristic orientations than did those in non-Channel One school districts.
Chia (2010)	Singaporean adolescents self-reported their materialism and exposure to advertising.	Advertising exposure was significantly positively correlated with materialism.
Jiang & Chia (2009)	Chinese undergraduate students self-reported their materialism and exposure to advertising.	Advertising exposure was significantly positively correlated with materialism.
Nairn, Ormrod, & Bottomley (2007)	UK children self-reported their materialism and level of television viewing.	TV viewing was significantly positively correlated with materialism.
Schor (2004)	USA children self-reported their consumer involvement (i.e., materialism) and level of television viewing.	TV viewing was significantly positively correlated with consumer involvement.
Shrum et al. (2011)	USA adults self-reported their materialism and level of television viewing.	TV viewing was significantly positively correlated with materialism.
Sirgy et al. (2012)	Adults in Australia, Bosnia and Herzegovina, Germany, Egypt, Turkey, Korea, and the USA self-reported their materialism, level of television viewing, and perception of the presence of materialism in advertisements.	Materialism was significantly positively correlated with perceptions that advertisements are materialistic, but uncorrelated with level of television viewing.

Table 2 – Some Studies showing that Materialism is Associated with Climate and Ecological Degradation.

Key Studies	Methodological Summary	Key Results
Chen (2015, Study 2)	Canadian college students participated in an experiment in which they looked at, described, and rated several images. In the control condition, images were of non-materialistic, non-luxury items whereas in the experimental condition, images were of materialistic, luxury items. Participants then entered a virtual "micro-world" where they managed a fishery along with 3 other participants (who were actually computer programs). Participants were told that they would be paid 10 cents for every fish they caught (see Fish 4.0 at **https://www.youtube.com/watch?v=9PGam-zTKcY**). Participants then managed the fishery.	Compared to participants who had been exposed to non-materialistic images, participants who had been exposed to materialistic images depleted the virtual fishery significantly more quickly, as they showed less restraint in their fishing behaviour in their efforts to earn more money.
Gu et al. (2020, Study 3)	Using regions of China (rather than individual people), the researchers obtained measures of regional materialism (e.g., number of Baidu searches for luxury goods in 2015) and regional energy consumption (e.g., gas and electric consumption in 2015).	Regional materialism was significantly positively correlated with regional energy usage.
Hurst et al. (2013)	The researchers conducted a meta-analysis of 15 samples from past research studies. Participants included people from the USA, UK, and Chile who completed self-reports of materialism, pro-environmental attitudes (PEAs), and/or pro-environmental behaviours (PEBs).	The relationships of materialism with both PEAs and PEBs were negative, consistent, and significant.
Unanue et al. (2016)	UK and Chilean adults participated in a longitudinal study in which they self-reported their materialism and PEBs over a 2-year period.	Not only was materialism significantly negatively correlated with people's pro-environmental behaviours two years later, it was also a stronger predictor than environmental attitudes were.

Additional Studies	Methodological Summary	Key Results
Andersson & Nassen (2016)	Swedish adults self-reported their materialism and PEAs. In addition, assessments of the adults' Greenhouse Gas Emissions were obtained from self-report and objective sources.	Materialism was significantly negatively correlated with PEAs and significantly positively correlated with Greenhouse Gas Emissions, particularly emissions from leisure airline flights.
Bakirtas et al. (2014)	Turkish adults self-reported their materialism, PEAs, and PEBs.	Materialism was significantly negatively correlated with PEBs but was unrelated to PEAs.
Bauer et al. (2012, Study 4),	U.S. adults participated in an experiment in which they read about four people who shared a well during a water crisis. In the control condition, study participants were referred to as "individuals," whereas in the experimental condition, participants were referred to as "consumers." All participants then self-reported their feelings about various aspects of the water crisis.	Those participants referred to as "consumers" reported feeling significantly less personal responsibility for dealing with the water crisis than did those participants referred to as "individuals."
Diaz-Ruiz et al. (2018)	Spanish adults self-reported their materialism and food-waste behaviours.	Materialism was significantly positively correlated with generation of food waste.
Gatersleben et al. (2018)	Chinese, UK, and Spanish adolescents self-reported their materialism, PEAs, and PEBs.	Materialism was significantly negatively correlated with PEAs and PEBs.
Gu et al. (2020, Studies 1 & 2)	Chinese adults self-reported their materialism, PEAs, and PEBs.	Materialism was significantly negatively correlated with PEAs and PEBs.
Ku & Zaroff (2014, Studies 1 & 2)	Ethnic Chinese undergraduate students and adults from Hong Kong self-reported their materialism, willingness to pay to protect the environment, and PEBs.	Materialism was significantly negatively correlated with willingness to pay to protect the environment and with PEBs.

Additional Studies	Methodological Summary	Key Results
Ku & Zaroff (2014, Study 3)	Ethnic Chinese undergraduates from Macao participated in an experiment in which they read magazines with neutral content (control group) or magazines glorifying image and possessions (experimental group). Participants were then asked to imagine that they could donate some of the pay they had just earned in a video game to a conservation fund or use it for other purposes.	Participants who read magazines with materialistic messages said that they would donate significantly less of their hypothetical pay to environmental causes (12.7%) than did those who read neutral magazines (19.3%).
Lundberg et al. (2019)	Finnish adults self-reported their materialism and environmental philanthropic behaviours.	Materialism was significantly negatively correlated with belonging to, donating to, and volunteering for environmental charities.
Raggiotto et al. (2018)	Italian adults self-reported their materialism and PEBs.	Materialism was significantly negatively correlated with PEBs.
Segev et al. (2015)	USA adults self-reported their materialism and PEAs.	Materialism was significantly negatively correlated with PEAs.

Note: A few studies (e.g., Dermody et al., 2015) have not replicated the meta-analytic results of Hurst et al. (2013); further, a couple of studies (e.g., Ali et al., 2019) have shown that under certain circumstances (e.g., when status concerns are prominent), materialistic individuals can be encouraged to engage in certain pro-ecological consumption behaviours, like buying green luxury cars.

Table 3: Some Studies showing that Advertising is Associated with Long Work Hours.

Study	Methodological Summary	Key Results
Brack & Cowling (1983)	For the years 1919–1976, the researchers obtained data on USA average weekly hours of work per production worker in manufacturing and the annual USA real expenditure on advertising. Data on control variables (e.g., wages) were also collected.	Holding control variables constant, the annual amount of real expenditure on advertising was significantly positively correlated with production workers' average weekly work hours.
Cowling et al. (2011)	For the years 1947–2001, the researchers obtained data on USA male and female workers' average weekly work hours and all workers' average annual work hours. They also obtained the USA's annual aggregate advertising expenditure per capita. Data on control variables (e.g., tax rates, wages) were also collected.	Holding control variables constant, the amount of advertising per capita was significantly positively correlated with both males' and females' average weekly work hours and with all workers' average annual work hours.
Fraser & Paton (2003)	For the years 1952–1997, the researchers obtained data on UK male and female workers' average weekly and annual work hours. They also obtained data on the UK's annual aggregate advertising expenditure per capita. Data on control variables (e.g., wages) were also collected.	Holding control variables constant, advertising was significantly, positively correlated with males' weekly and annual work hours and with females' weekly work hours.
Molinari & Turino (2018)	For each economic quarter from 1976–2006, the researchers obtained data regarding USA workers' average weekly work hours and per capita aggregate advertising expenditures in the USA by domestic and international firms in all media. Data on control variables (e.g., GDP) were also collected.	Holding control variables constant, increases in advertising expenditures over time were significantly and positively associated with increases in hours worked over time.

Note: One study yielded "scant support" for a correlation between hours worked and advertising levels (Reekie & Allen, 1983); unlike the other studies summarized above, which conducted analyses over time, it examined if there was a correlation between different nations' work hours and their levels of advertising.

Table 4 – Some Studies showing that Long Work Hours are Associated with Climate and Ecological Degradation.

Key Studies	Methodological Summary	Key Results
Fitzgerald et al. (2015)	For the years 1990-2008, the researchers obtained data from 52 nations (23 economically developing, 29 economically developed) on annual number of hours worked per worker and total energy consumption. Data on numerous control variables (e.g., urbanization) were also collected.	Holding control variables constant, annual number of hours worked per worker was significantly positively correlated with total energy consumption; this effect was most notable in economically developed nations. Over the years of the study, annual work hours and energy consumption became more strongly positively correlated with each other in both economically developed and developing nations.
Fremstad et al. (2019)	Four times throughout a single year, USA households self-reported their expenditures in the previous quarter. Household carbon emissions were calculated by combining annual expenditure on each type of good purchased with existing information about the carbon intensity of each type of good. At the end of the year, household members reported their work hours that year. Data on numerous control variables (e.g., number of workers in the household) were also collected.	Holding control variables constant, annual number of hours worked per household was significantly positively correlated with household carbon emissions.
Rosnick & Weisbrot (2006)	For the year 2003, the researchers obtained data from 48 nations on annual hours of work per employee and energy consumption per capita. Data on numerous control variables (e.g., average year-round temperature of the nation's capital) were also collected.	Holding control variables constant, nations' work hours was significantly positively correlated with their energy consumption per capita.

Additional Studies	Methodological Summary	Key Results
Devetter & Rousseau (2011)	In 2001, French households self-reported their consumption behaviour (e.g., transport, food, electricity) and their weekly work hours. Data on various control variables (e.g., household income) were also obtained.	Holding control variables constant, households with longer weekly working hours engaged in significantly more ecologically-damaging consumption patterns than did those with shorter weekly working hours.
Fitzgerald et al. (2018)	For the years 2007–2013, the researchers obtained data from each of the 50 USA states on CO_2 emissions and weekly working hours per worker. Data on numerous control variables (e.g., state population) were also collected.	Holding control variables constant, average work hours in a state was significantly positively correlated with the state's CO_2 emissions.
Hayden & Shandra (2009)	For the year 2000, the researchers obtained data from 50 nations (35 high-income, 15 mid- and low-income) on the annual hours of work per employee and the ecological footprint of each nation. Data on numerous control variables (e.g., national GDP) were also collected.	Holding control variables constant, national annual hours of work per employee was significantly positively associated with national ecological footprint.
Kasser & Brown (2003)	USA adults self-reported their average weekly work hours, pro-environmental behaviours (PEBs), and ecological footprints.	Average weekly work hours was significantly positively correlated with ecological footprints and significantly negatively correlated with PEBs.
Knight et al. (2013)	For the years 1970–2007, the researchers obtained data from 29 high-income nations on annual hours of work per employee, ecological footprint, carbon footprint, and carbon emissions. Data on numerous control variables (e.g., national urbanization) were also collected.	Holding control variables other than GDP constant, annual hours of work per employee was significantly positively correlated with ecological footprint, carbon footprint, and carbon emissions. When GDP was also controlled for, annual hours of work per employee was significantly positively associated with ecological footprint, but unrelated to carbon footprint and carbon emissions.

Additional Studies	Methodological Summary	Key Results
Nassen & Larsson (2015)	In 2000/2001, Swedish households reported their time use, which was used to both obtain the households' working hours and to estimate the households' energy use and greenhouse gas emissions. Data on numerous control variables (e.g., household income) were also collected.	Holding control variables constant, number of hours worked per household was significantly positively correlated with household energy use and greenhouse gas emissions.
Schor (2005)	For 18 OECD nations, the researcher obtained data on average working hours and ecological footprint.	National average working hours was significantly positively correlated with national ecological footprint.

Note: Two studies (Shao et al., 2016, 2017) yield results that contradict those reviewed above. In these papers, the researchers found that work hours may not relate to ecological degradation in economically developing nations and that, in some types of economically developed nations, reductions in work hours might cause higher levels of ecological degradation because of the "rebound effect," wherein people spend their increased leisure time in activities that are carbon and energy intensive (e.g., flying to far-away locales).

Table 5 – Some Studies showing that Advertising is Associated with Beef Consumption.

Study	Methodological Summary	Key Results
Brester & Schroeder (1995)	For the years 1970-1993, the researchers obtained data on quarterly per capita beef consumption in the USA. Quarterly advertising expenditures on generic and branded beef were also obtained. Data on relevant control variables (e.g., price of products) were also collected.	Holding control variables constant, branded (but not generic) beef advertising was associated with increases in beef consumption.
Cho et al. (2009)	For January 2004 to November 2008, the researchers obtained data on monthly beef consumption in South Korea. Parallel information on generic beef advertising expenditures was also collected, as were data on relevant control variables (e.g., price, broadcasts about food safety).	Holding control variables constant, generic beef advertising was significantly positively correlated with demand for beef.
Cranfield & Goddard (1999)	For the years 1971-1991, the researchers obtained data on Canadian and USA consumption of beef. They also obtained data on generic and branded beef advertising expenditures by Canadian cattle producers. Data on control variables (e.g., price) were also collected.	Holding control variables constant, both Canadian and USA beef demand were significantly, positively associated with both branded and generic advertising by Canadian cattle producers.
Fousekis & Revell (2004)	For the years 1989-2000, the researchers obtained data from UK households concerning their monthly expenditures on meat from different species (e.g., cow, lamb). Information was also collected on monthly UK advertising expenditures for beef, pork, and lamb, as well as generic advertising for red meat. Data on relevant control variables (e.g., the occurrence of meat scares due to Bovine Spongiform Encephalopathy) were also collected.	Holding control variables constant, generic advertising of beef was significantly, positively associated with expenditures on beef. Associations between species-specific advertising and expenditures for pork and lamb were not significant.
Jeong et al. (2012)	For the period August, 2005 to June, 2011, the researchers obtained monthly data on Koreans' consumption of Honwoo beef, as well as advertising expenditures on this product. They also collected data on control variables (e.g., price).	Holding control variables constant, advertising of Honwoo beef was significantly, positively associated with consumption of Honwoo beef.

Study	Methodological Summary	Key Results
Piggott et al. (1996)	For the years 1978-1988, the researchers obtained data on Australians' quarterly expenditures on beef, lamb, pork, and chicken. They also obtained quarterly advertising expenditures by the Australian Meat and Livestock Corporation (AMLC) for beef and lamb and by the Australian Pork Corporation (APC) for pork. Data on control variables (e.g., price) were also collected.	Holding control variables constant, AMLC advertising expenditures were significantly positively associated with beef consumption, significantly negatively associated with chicken consumption, and unrelated to lamb consumption. APC advertising expenditures were not consistently related to consumption of any products.

Note: Cho et al. (2009) was published in the Korean language, but a personal communication from the first author supplemented the information found in the article's English-language abstract. Jeong et al. (2012) was also published in Korean, but its English-language abstract provided sufficient information for this summary. Also, it should be noted that one experimental study (Jensen & Schroeter, 1992) failed to find effects of advertising on demand for beef.

Table 6 - Some Studies showing that Beef Consumption is Associated with Climate and Ecological Degradation.

Study	Methodological Summary	Key Results
Eshel et al. (2014)	For the years 2000-2010, and based upon data collected from USA federal agencies, the researchers estimated the land, irrigation water, Greenhouse gas (GHG) emissions, and nitrogen requirements of each of the five main animal-based categories in the US diet: dairy, beef, poultry, pork, and eggs.	Results show that beef is by far the least efficient of the five animal categories across the environmental metrics examined. Compared to other animal sources of food, to produce 1 megacalorie of beef requires, on average, ~28 times more land, ~11 times more irrigation water, ~5 times more GHG emissions, and ~6 times more nitrogen.
Fiala (2008)	For the years 2010, 2020, and 2030, the researcher forecasted meat production patterns based upon Confined Animal Feeding Operations (CAFO) systems. The study used data from 61 countries (based on UN, World Bank, and FAO sources), and meat production was divided into beef, chicken, and pig products.	With expected consumption trends, the production of meat under CAFO systems will add 1.9 biotonnes of GHGs by 2030, accounting for up to 6.3% of current GHG emissions. In all three scenarios studied, beef had the largest CO_2 equivalent emissions.
Gerber et al. (2013)	The researchers developed a global livestock environmental assessment model (GLEAM) that estimates the global GHG emissions and emission intensities for the main livestock commodities, farming systems, and world regions. The analysis used the life cycle assessment (LCA) method to identify the main emission sources along global livestock chains, incorporating geo-referenced data from databases, literature sources, expert opinion, and life cycle inventory packages published mainly by a variety of international organizations (e.g., the UNFCCC) and peer-reviewed journals between the years 2007-2010.	Total annual emissions from animal agriculture (i.e., production emissions plus land-use change) account for about 14.5% of all human GHG emissions. Beef cattle is the commodity with the highest total emissions and emissions intensities, as it is responsible for ~41% of the agriculture sector's total GHG emissions (or ~2.9 gigatonnes CO_2 equivalent).

Study	Methodological Summary	Key Results
Henders et al. (2015)	For the years 2000-2011, the researchers used a bottom-up material-flow approach to estimate the land-use change area associated with CO_2 emissions embodied in their seven case countries' domestic consumption of and export of beef, soybeans, palm oil, and wood products.	In 2011, among all four commodities examined, beef was the main driver of forest loss across the case countries, accounting for nearly 60 % of embodied deforestation (2.1 million hectares (Mha) and 1.6 Mha in Brazil alone). It also was responsible for just over half of all embodied CO_2 emissions (860 ± 203 Million tons of CO_2).
Poore & Necemek (2018)	For the reference year 2010, the researchers built a comprehensive meta-analysis reviewing the environmental impacts of food. Data were collected from 570 studies, covering 40 products made on 38,700 farms from 119 countries. These products were assessed on five environmental impact indicators: land use, freshwater withdrawals, GHG emissions, acidifying emissions, and eutrophying emissions (i.e., emissions of phosphorus, nitrogen, and other plant nutrients that can cause excessive growth of algae in bodies of water).	Per 100g of protein, beef has the greatest GHG emissions among all products studied. The production of beef for meat consumption has substantially higher impacts than for any other form of protein. For example, the average GHG emissions of beef cattle are 2.9x that of dairy cattle, 25x that of tofu, and 125x that of peas. Similarly, the average land use associated with beef cattle is 7.4x that of dairy cattle, 74.5x that of tofu, and 48.2 that of peas.
Searchinger et al. (2018)	The researchers developed GlobalAgri-WRR, a global accounting and biophysical model that quantifies food production and consumption from national diets, populations, and land-use demands. The model also estimates GHG emissions from agriculture and incorporates other biophysical sub-models that estimate GHG emissions or land-use demands in specific agricultural sectors. The model attempts to quantify three "gaps": food production, agricultural land area, and GHG mitigation; each gap is an estimation of the difference between present and future demand. Three scenarios were modeled based upon FAO and FAOSTAT data for the 2010 base year and 2050 baseline. Countries and regions included were India, Asia, Sub-Saharan Africa, China, the Middle East, North Africa, the European Union, OECD nations, USA, Canada, Latin America, the former Soviet Union, and Brazil.	Results forecast that the consumption of animal-based foods will rise by 68% between 2010 and 2050, with an 88% increase in consumption of meat from cattle, sheep, and goats. While beef provides only about 3% of the calories in the diets of people from the USA, it accounts for roughly half of land use and half of GHG emissions in US diets due to food production. A 30% shift of people's expected consumption of ruminant meat (e.g., beef) in 2050 to plant-based proteins would close half the GHG mitigation gap and nearly all of the land gap.

Table 7 - Some Studies showing that Advertising is Associated with Tobacco Consumption.

Study	Methodological Summary	Key Results
Cho et al. (2020)	Grade 10 & 11 high school students in Myanmar were surveyed about their use of any type of tobacco product in the previous 30 days. They were also asked about their exposure to various types of tobacco advertisements. Data on control variables (e.g., smoking of parents, peers, and siblings) were also collected.	Holding control variables constant, students who reported exposure to tobacco advertising were ~6x more likely to report tobacco use in the previous 30 days than were students who reported no exposure to tobacco advertising.
Cruz et al. (2019)	U.S.A. 11th and 12th graders participated in a longitudinal study. At first contact, they self-reported their tobacco use and the frequency with which they saw advertisements for tobacco products. 2 years later, they again reported their tobacco use.	Compared to adolescents who continued to avoid using tobacco products, those who began using tobacco products in young adulthood were significantly more likely to have reported frequent exposure to advertising for tobacco products two years earlier.
Goodchild & Zheng (2019)	The researchers combined information from Levy et al. (2018) with the extent to which China has implemented WHO's MPOWER program package of tobacco control in order to predict decreases in smoking rates that would occur if control measures were fully implemented.	By 2030, the rate of smoking in China was predicted to reduce by 2% if bans on advertising were fully implemented.
Levy et al. (2018)	The US Public Health Service Community Prevention Services Task Force updated its 2004 "Scorecard," which had summarized the effectiveness of various means of trying to affect tobacco initiation, cessation, and prevalence. The Task Force reviewed scientific articles published from 2000-2016 on ways to control the use of tobacco, including marketing bans on tobacco.	On the basis of the reviewed scientific literature, the Task Force concluded that banning advertising of tobacco was among the "highly effective strategies for reducing smoking prevalence." They estimate that, compared to no bans, a complete tobacco advertising ban would reduce the prevalence of smoking by 2%-6% over a 5-year period and 3%-9% over a 40-year period.

Study	Methodological Summary	Key Results
Papaleontiou et al. (2020)	Over 17,000 U.S.A. middle and high school students completed a survey packet. They self-reported their use of tobacco products in the last 30 days and how frequently they were exposed to tobacco advertisements. Data on control variables (e.g., number of smokers in the household) were also collected.	Holding control variables constant, students who reported frequent exposure to tobacco advertising were significantly more likely to have used tobacco products in the last 30 days than were students who were not exposed to such advertising.
Shadel et al. (2016)	U.S.A. adolescents participated in an experiment at the RAND StoreLab, a life-size replica of a convenience store. Adolescents began by completing a survey designed to assess how likely they were to smoke a cigarette in the future, as well as a number of control variables (e.g., smoking history). Next, they shopped in the StoreLab with $10 provided by the researchers. Participants were randomly assigned to one of three store layouts: tobacco ads were either visible behind the cashier's counter (i.e., the "tobacco power wall"), visible on a side wall, or hidden behind an opaque wall. After shopping, participants once again completed the measure of their likelihood of smoking a cigarette.	Holding relevant control variables constant, adolescents reported an increased likelihood of smoking cigarettes in the future if they saw advertisements behind the cashier compared to if the advertisements were hidden. Rated likelihood of smoking was equivalent whether the advertisements were visible on the side wall or behind the cashier.

Table 8: Three Reviews of the Literature on Life Cycle Assessments of Tobacco's Role in Climate and Ecological Degradation.

Study	Methodological Summary	Key Results
Lecours et al. (2012)	The researchers conducted a standard literature search of the peer-reviewed scientific literature on the ecological costs of tobacco farming. Their review is based on 45 studies they found.	The scientific literature suggested two main ways that growing tobacco is ecologically damaging. First, agrochemical application to tobacco plants harms workers' physical and mental health and pollutes water and soil. Second, deforestation occurs when farmers clear land for tobacco cultivation and cut wood to provide fuel for flue curing of the tobacco.
Novotny et al. (2015)	The researchers reviewed the literature on the environmental problems associated with each of four stages in the life cycle of tobacco: its growth and curing, manufacture and distribution, consumption, and post-consumption waste.	Environmental problems primarily associated with the growth and curing of tobacco include deforestation, pesticides that pollute water, and soil depletion. Tobacco manufacturing results in millions of tons each year of solid, nicotine, and chemical waste. Regarding consumption, the matches used to light cigarettes each year require about nine million trees. Finally, concerning waste, cigarette butts are the most common type of waste in the world, and cigarette packaging leads to ~3.8 million tons of waste per year.
World Health Organization (2017)	The WHO assembled a team of scientists and public health professionals to review the scientific evidence concerning the environmental costs of tobacco cultivation, production, distribution, consumption, and waste generation.	The report reinforces and expands upon the two earlier reviews regarding the chemical pollution and deforestation associated with tobacco farming and the waste associated with cigarette butts and packaging. Regarding manufacturing, the authors note that, in addition to the other wastes associated with this stage, an estimated 8.7 million tons of CO_2 equivalent are emitted annually; millions of liters of water are also used annually to manufacture cigarettes. Regarding the actual lighting and smoking of a cigarette, the authors estimate that side-stream smoke annually releases 2.8 –4.7 million metric tons of CO_2, as well as substantial amounts of formaldeyhyde, methane, and other noxious pollutants.

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