## Contents

Publisher's Note ........................................ vii
List of Contributors ................................... ix
Introduction ........................................... xiii
List of Articles by Category ............................ xvii

Abbey, Edward ........................................ 1
Accounting for nature .................................. 2
Acid deposition and acid rain .......................... 3
Acid mine drainage ..................................... 7
Adams, Ansel ............................................ 8
Aerosols .................................................. 9
Agent Orange .......................................... 10
Agricultural chemicals ................................ 12
Agricultural revolution ................................ 15
Air pollution ............................................ 17
Air pollution policy .................................... 22
Alar ...................................................... 27
Alaska Highway ........................................ 28
Alaska National Interest Lands Conservation Act ........................................ 29
Alternative energy sources ............................ 30
Alternative fuels ....................................... 34
Alternative grains ....................................... 38
Alternatively fueled vehicles .......................... 39
American alligator ...................................... 41
Amoco Cadiz oil spill .................................. 42
Amory, Cleveland ........................................ 43
Animal rights ........................................... 45
Animal rights movement .............................. 48
Antarctic Treaty ....................................... 52
Antarctica Project ...................................... 53
Anti-environmentalism ................................ 53
Antinuclear movement ................................ 57
Aquifers and aquifer restoration ...................... 61
Aral Sea destruction ..................................... 64
Arctic National Wildlife Refuge ....................... 65
Argo Merchant oil spill ................................ 66
Asbestos ................................................ 67
Asbestosis ............................................... 69
Ashio, Japan, copper mine ............................ 70
Aswan High Dam ........................................ 71
Audubon, John James ................................ 72
Automobile emissions ................................ 74

*Bacillus thuringiensis* ........................................ 77
Bacterial resistance and super bacteria ............. 77
Balance of nature ...................................... 82
Berry, Wendell .......................................... 85
Bhopal disaster ......................................... 86
Bikini Atoll bombing .................................. 88
Bioassays ............................................... 89
Biodiversity ............................................ 89
Biofertilizers ........................................... 93
Biomagnification ....................................... 94
Biomass conversion .................................... 96
Bioremediation ........................................ 97
Biopesticides .......................................... 97
Biotechnology and genetic engineering ............ 107
Birth defects, environmental ........................ 111
Black lung .............................................. 113
Black Wednesday ...................................... 115
Bookchin, Murray ...................................... 116
Borlaug, Norman ....................................... 117
Boulder Dam ............................................ 118
Braer oil spill .......................................... 120
Brazilian radioactive powder release ............... 121
Brent Spar occupation ................................ 122
Brower, David .......................................... 122
Brown, Lester .......................................... 124
Brundtland, Gro Harlem .............................. 125
Bureau of Land Management, U.S. ................. 126
Burroughs, John ........................................ 127

Captive breeding ....................................... 129
Carson, Rachel Louise ................................ 130
Carter, Jimmy .......................................... 131
Catalytic converters ................................... 132
Chalk River nuclear reactor explosion ............. 133
Chelyabinsk nuclear waste explosion ............... 134
Chernobyl nuclear accident .......................... 135
Chipko Andolan movement ............................ 137
Chloramine ............................................. 138
Chloramphenicol ...................................... 139
Chlorination ........................................... 140
Chlorofluorocarbons ................................ 142
Audubon’s unique paintings demonstrated ecological relationships among organisms by illustrating their food plants, nesting sites, competition, and predators. In his writings, Audubon set new standards for field observation and foresaw the threat of species extinction. Above all, by illustrating the beauty of birds and animals, he promoted the popular study of natural history, laying foundations for a national environmental consciousness in the United States.

Robert W. Kingsolver

SEE ALSO: Conservation; Endangered species.

Automobile emissions

CATEGORY: Atmosphere and air pollution

Fossil fuel emissions from transportation vehicles contain carbon monoxide and other compounds that undergo secondary reactions under certain environmental conditions. Such emissions negatively impact the environment and human health.

Automobile emissions create ongoing and potentially dangerous environmental problems when gases and particulates are released into the atmosphere at a rate that exceeds the capacity of the atmosphere to dissipate or dispose of them. Smog, a term coined in 1905 in England to describe the combination of smoke and fog, comes from exhaust fumes from transportation vehicles and other sources of air pollution that contain carbon monoxide and a variety of complex hydrocarbons, nitrogen oxides, and other compounds.

This collection of chemicals changes in composition when exposed to the heat of sunlight, thus producing the brown smog seen in urban areas of the United States, such as Los Angeles, California, and Denver, Colorado. Carbon monoxide levels peak twice during the day, corresponding to morning and evening rush-hour traffic, with Los Angeles urban areas averaging 37 parts per million in general and 54 parts per million in heavy traffic, and peaking at 120 parts per million near stop signals. This elevated level extends up to 20 meters (65 feet) from the roadway. Policemen in Tokyo, Japan, often wear supplemental oxygen units when directing traffic at busy intersections. Temperature inversions cause a greenhouse effect, which reverses the ecosystem’s normal atmospheric temperature gradient, heats the harmful chemicals, and enhances their negative effects via delayed photochemical reactions. Secondary pollutants formed by photochemical reactions under certain atmospheric conditions include ozone, formaldehyde, and peroxycyaninitrate, with ozone being the most highly reactive and dangerous to the environment and human health.

Researchers have discovered that nitrogen dioxide from exhaust fumes will create ozone one hundred times more rapidly when combined with hydrocarbons that are naturally produced by trees than with hydrocarbons that are produced by human sources. The Environmental Protection Agency (EPA) originally estimated that Atlanta, Georgia, could meet federal air quality ozone standards by reducing exhaust levels by 30 percent, but more later data that took into account the contribution by trees indicated that a 70 to 100 percent reduction would be necessary to meet current standards.

Automobile emissions have been shown to exert their negative effects a considerable distance from the source depending upon atmospheric changes in wind and temperature. Suburbs surrounding rural areas often exhibit higher levels of pollution than the downtown areas where the emissions were originally produced. Fallout of tetraethyl lead from urban automobile exhausts has been observed in oceans and on the Greenland ice sheet.

Studies in cities such as London, England, have shown that major improvements in air quality can be achieved in fewer than ten years in urban areas with favorable climatic conditions by requiring cleaner-burning fuels and more combustion-efficient engines. In an attempt to reduce automobile emissions, the U.S. Congress passed legislation requiring that the exhaust gases of new vehicles pass through catalytic converters, which transform more of the carbon monoxide and hydrocarbons into carbon dioxide and water. However, these converters only
minimally reduce carbon dioxide or nitrogen oxide levels. Automobiles with catalytic converters can meet emissions standards if they are appropriately tuned and burn only unleaded gasoline.

Environmental problems associated with automobile emissions include deleterious effects on many forms of agriculture and natural forests, as well as damage to metal, building materials such as stone and concrete, rubber, paint, textiles, and plastics. Automobile emissions can reduce visibility and cause lung and eye irritation and coughing, chest pain, shallow breathing, and headaches. Automobile-produced air pollution is also a contributing factor to allergies, asthma, emphysema, bronchitis, lung cancer, heart disease, and negative psychological states. Carbon monoxide quickly combines with blood hemoglobin and impairs oxygen delivery to the tissues, particularly in children and senior citizens, causing heart and lung problems to such an extent that some large urban areas regularly broadcast air-quality reports over television and radio.

The increased rate and depth of breathing during physical exertion exposes more polluted air to delicate lung tissues. Research indicates that exercise near a busy freeway may be more harmful than beneficial to the body. The evening rush-hour start of the 1984 Los Angeles Olympic men's marathon during a stage 2 California Health Advisory alert drew criticism that organizers were more interested in commercial revenues than the safety of the athletes and spectators. Later events were postponed during heavy air-pollution episodes.
Professional organizations such as the American Lung Association conservatively estimate that air pollution costs Americans nearly $100 billion each year in health care and related costs. The 1970, 1977, and 1990 amendments to the Clean Air Act set emissions standards for automobiles and ambient air-quality standards for urban areas for six pollutants—carbon monoxide, sulfur oxides, nitrogen oxides, particulates, ozone, and hydrocarbons—to better protect human health and the environment.

Daniel G. Graetzer


SEE ALSO: Air pollution; Air pollution policy; Catalytic converters; Clean Air Act and amendments; Smog.