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The Impact of the Coal Age on the German Environment: A Review of the Historical Literature

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The German landscape has been profoundly modified by human industry over the past two centuries. Densely populated and highly industrialised, Germany is integrally tied to the global trade network. Its historically important industries – coal, iron, steel, textiles, petro-chemicals, machinery, paper and pulp – are all major devourers of natural resources and significant polluters of Central Europe's air, land, and water.

Without doubt the transformative moment came in the mid-nineteenth century, when the various German states began shifting from wood to coal as a fuel source to feed the new steam engines coming from Great Britain. The fossil-fuel economy impacted Germany more than the rest of continental Europe, largely because Europe's most extensive coal reserves lay under Prussian-controlled soil, giving rise to an extraordinarily fast-paced industrial growth in regions such as the Rhineland, Westphalia, and Silesia. Coal mining caused ground depressions, altered the natural hydrology, and pockmarked the landscape. Coal dust, phenol (carbolic acid), and other coal pollutants washed into Germany's rivers and streams. Acid rain from coal burning became a major source of forest death. It was also coal-tar derivatives that produced the first artificial dyes, giving rise to Germany's mammoth chemical plants – Bayer, BASF, Hoechst, AGFA – companies which today are still among the greatest polluters of Germany's environment.

German scholarship in the field of environmental history still lags behind the Anglo-American literature in both quantity and scope, but an impressive amount of research has begun to emerge over the past decade. Quick access to the historiographic debates can be found in *Mensch und Umwelt in der Geschichte*, a collection of essays edited by Jörg Calließ, Jörn Rüsen, and Meinfried Striegnitz; and *Umweltgeschichte – Methoden, Themen, Potentiale*, edited by Günter Bayerl, Norman Fuchsloch, and Torsten Meyer.¹ In addition, a number of leading environmental historians – Arne Andersen, Franz-Josef Brüggemeier, Paul Leidinger, Joachim Radkau, Engelbert Schramm, Rolf Peter Sieferle – have attempted to define the term 'environmental history' and situate it within the socio-economic, scientific-technical, agrarian, medical, and political literature.²

Many of the questions raised by German scholars will sound familiar to English-language readers: What is meant by the term nature (or *Natur an sich*,

as the Germans prefer)? Is it possible to write a non-anthropocentric history? Does economic progress invariably entail environmental degradation? Scholarly opinion differs on a wide variety of theoretical issues. Andersen and Sieferle, for instance, argue for a non-anthropocentric approach to history, while Radkau and others doubt that 'nature' can be conceptualised separately from 'human' needs and notions. In practice, however, there is more agreement than discord regarding both the subject matter and the methods of environmental history, and most German scholars would probably accept Radkau's delineation of the field: 'Research in environmental history is part of an endeavour to uncover long-range developments in the conditions of human life and reproduction. It investigates how humans influence these conditions and how they respond to disruptions. Special attention is paid to the unintended long-term repercussions of human industry, to the synergistic effects and chain-reactions with natural processes thereby generated.'³ Even the widespread preference for the term *Umweltgeschichte* (environmental history) over *historische Ökologie* (historical ecology) mirrors a general recognition that environmental history is a human-centered enterprise, akin to *Sozialgeschichte* (social history), *Wirtschaftsgeschichte* (economic history), and *Frauengeschichte* (women's history), and not a radical departure from the well-established methodologies of historical research.

The impact of human activity over the past two millennia in Central Europe is so conspicuous that Germans have not been tempted by the 'wilderness debate' that animates so many scholars in the United States. Nonetheless, the changes in the European landscape wrought by the past two centuries of industrialisation are so striking that the Eden myth surfaces in more subtle disguise: modern history all too often gets transmogrified into 'pollution history' and the tale becomes one of decline. It is well worthwhile, therefore, for scholars of modern Germany to read their way into the general literature on Central Europe, if only as a reminder that environmental problems did not begin with the steam engine. Unfortunately, there is still no single book that can serve as a general introduction to the field, though Helmut Jäger's *Einführung in die Umweltgeschichte*, Gottfried Zirnstein's *Ökologie und Umwelt in der Geschichte*, and Ludwig Trepl's *Geschichte der Ökologie* collectively cover the terrain adequately.⁴ Jäger is primarily interested in the anthropogenic and non-anthropogenic transformations in Central Europe's vegetation, climate, land, air, and water over the past several thousand years. Despite the title, it is really a survey of historical geography, with an emphasis on early modern Europe, and it does not engage the recent debates among environmental historians. Zirnstein, by contrast, only cursorily handles the pre-modern period; most of his book is devoted to the industrial environment of modern Europe. Trepl traces the evolution of the ecology concept since the seventeenth century through the natural science literature. Taken together, these books paint a picture of Central Europe as a 'cultural' rather than 'natural' landscape.

There are also a number of excellent books that focus on medieval and early modern Europe. Bernd Herrmann's three edited collections provide a good starting point: *Mensch und Umwelt im Mittelalter*, *Umwelt in der Geschichte*, and (co-edited with Ernst Schubert) *Von der Angst zur Ausbeutung*.⁵ Equally useful are the essays edited by Albrecht Jockenhovel in *Bergbau, Verhüttung und Waldnutzung im Mittelalter* as well as those edited by Hermann Kellenbenz in *Wirtschaftsentwicklung und Umweltbeeinflussung (14.-20. Jahrhundert)*.⁶ On the transition from pre-industrial to industrial Europe, German historians of science and technology have made important contributions. One thinks here of two journals in particular, *Technikgeschichte* (sponsored by the Verein Deutscher Ingenieure) and *Environmental History Newsletter* (edited by the Landesmuseum für Technik und Arbeit in Mannheim), both of which publish articles on the interaction between technology and the environment. Also worth reading is the work of Ilja Mieck, one of the first to examine pollution problems in nineteenth-century Prussian industrialisation.⁷ More recently, Günter Bayerl has devoted considerable attention to the environmental consequences of paper production in pre-modern Germany in *Die Papiermühle*, and Joachim Radkau has traced the impact of technological innovation on the German landscape in his masterful *Technik in Deutschland*.⁸ Radkau is perhaps best known among environmental historians for his work refuting Werner Sombart's thesis of a 'timber crisis' (*Holznot*). He argues that there was no general wood shortage in Germany in the eighteenth century, and that the timber debate had more to do with protecting state-controlled resources (and the jobs of foresters) than with protecting the natural environment. The shift from wood to coal in Germany was driven by the need for a cheaper and efficient fuel to power the new steam engines, and it occurred during the mid-nineteenth century, long after the timber debate had ended.⁹

Nonetheless, the use of fossil fuels marked a shift from an economy based (at least potentially) on a sustainable yield (*Nachhaltigkeit*) to one based on the utilisation of a non-renewable resource (*Raubwirtschaft*) – and can therefore be viewed as the beginning point of modern environmental history.

Pollution from coal and coal-driven industries is the main subject matter of several general surveys. A good place to start is *Besiegte Natur*, co-edited by Franz-Josef Brüggemeier and Thomas Rommelspacher, which includes articles on energy, water, acid rain, land, autos, health, and nature protection issues. Also valuable is *Industrie-Nature*, co-edited by Brüggemeier and Michael Toyka-Seid, a compilation of primary documents covering forestry, smoke, rivers, effluence, public debates, and animal protection. Brüggemeier and Rommelspacher have also co-authored *Blauer Himmel über der Ruhr*, a brief survey of water, air, and ground pollution in Germany's chief coal-producing region over the past century and a half. Ulrike Gilhaus covers much the same ground in her study of Westphalia before the First World War, '*Schmerzskinder*

der Industrie', though she devotes far more attention to the social dimension and to popular protests than do the other authors. Klaus-Georg Wey's *Umweltpolitik in Deutschland* is the briefest and clearest introduction to twentieth-century German environmental politics available, though his bibliography is now outdated (his book appeared in 1982).¹⁰

Brüggemeier, Rommelspacher, Gilhaus, and Wey leave little doubt that the rapidity of early German industrialisation, its haphazard and unchecked growth, and the urban development that accompanied economic development, all had a negative impact on the land, air, and water of Central Europe. Hardest hit were regions such as Berlin, Silesia, Saxony, Rhineland, and Westphalia, where iron and coal mines, steel and chemical plants, and paper and pulp mills proliferated. Population growth transformed Cologne, Essen, Leverkusen, and other industrial cities into vast urban sprawls with noisy locomotives and power lines. Miners in Silesia and elsewhere suffered from 'Reichenstein disease' (liver, gastrointestinal, and nervous system disorders) caused by contaminated water from the mines. The textile industry, meanwhile, was polluting Germany's waterways. 'A National-Liberal who falls into the Wupper will resurface as black as a Catholic Centrist', quipped the Social Democratic Party leader Karl Liebknecht in 1912.¹¹

National, state, and local leaders of Wilhelmine Germany (1871-1918) were reluctant to intervene legislatively to protect Germany's environment, largely because it would mean placing restrictions on industries considered vital to the nation's economic growth, political stability, and military superiority. Industrial leaders were uniformly opposed to restrictions on their economic freedom, especially as regards environmental safeguards that might undermine their competitive edge and erode profit margins. The legislation that did pass generally only forced companies to bring their factories into conformity with the 'state of the technology' (*Stand der Technik*), an elastic phrase that lent itself to easy manipulation and misuse. In the absence of political pressures and economic incentives to create and improve environmentally friendly technologies, little environmental regulation passed the legislature in the nineteenth-century, and the few pieces of legislation that did become law placed few brakes on economic growth.

As Wey and others point out, political hindrances to environmental legislation persisted well into the twentieth century. Under the Bismarckian constitution, competence over water, forestry, mining, agriculture, and other environment-related matters belonged to the individual states and not to the national government. State governments cooperated with neighboring states only sporadically, resulting in a proliferation of conflicting laws and policies. The federal government finally gained constitutional control over the nation's water and forests during the Weimar era (1918-1933), largely because of the widespread recognition among political theorists that the states' rights of the Wilhelmine era had resulted in legal chaos. Yet matters did not improve after 1918. Weimar

parliamentarians were beset with a myriad of other pressing political and economic issues, and the Republic collapsed before any viable environmental legislation could be passed and implemented. The Nazi regime (1933-1945), despite its rhetoric of 'nature protection' and sponsorship of the Imperial Conservation Law of 1935, sided with industrialists over environmentalists in the interest of rebuilding Germany's economic and military strength. As a result, most national environmental legislation had to wait until after 1945.¹²

Nowhere was the legal and political chaos more clear than in the realm of nineteenth-century water policy, the subject matter of *Wassernöte* by Thomas Kluge and Engelbert Schramm, *Stadthygiene im 19. und 20. Jahrhundert* by Peter Münch, and articles by Gilhaus, Rommelspacher, and Johann Paul.¹³ The first victim was well water, which became increasingly poisoned by underground seepage from industrial and human settlements. As more and more communities and industries were forced to filter their groundwater, or draw their water resources from nearby lakes and rivers, water disputes inevitably arose. Cities, for example, that drew their water from the Rhine and Ruhr invariably poured their effluence back into these rivers without much thought to their downstream neighbors, all the while complaining vociferously about upstream polluters. A particularly nasty dispute raged from 1897 to 1901 when the city of Mannheim began using the Rhine as a city sewer dump eight miles upstream from the city of Worms, which used Rhine water to supplement its city drinking water supply. After a protracted legal battle, the 'perpetrator' (Mannheim) was allowed to continue dumping its feces virtually untreated into the Rhine, while the 'victim' (Worms) was forced to construct a costly filtration system or seek a different water supply.¹⁴

In inter-city battles over water resources, it clearly paid to live upstream. For industries, it paid to be large and concentrated. Textile, coal, iron, steel, chemical, sugar, paper, and other water-intensive industries grew into mega-corporations during the nineteenth century, usurping the forest and agricultural land along riverbanks as they expanded. Factories siphoned off the fresh water, turned it into polluted effluence, and returned it largely untreated into the streambeds. All of Germany's major rivers were affected but none more so than the Rhine and its tributary system, especially the Ruhr, Emscher, Lippe, Erft, Main, and Neckar. The seventy-mile-long Emscher river – which flowed directly through the middle of the Westphalian coal fields – was one of the first to be sacrificed. By 1903 it received effluence from one-and-a-half million humans, 150 coal mines, and 100 other factories. The coal mines and coking factories alone accounted for most of the chlorides and phenol that landed in the stream.¹⁵ By 1910, only half of the Emscher's annual flow came from natural runoff, the rest (about 96 million cubic metres) came from industrial (89%) and urban (11%) effluence.¹⁶ Unfortunately, the Emscher was ill-suited to its role as an industrial sewage dump: its flow was slow and its waters stagnated easily in

the marshes, making it a good host for typhus, cholera, malaria, and other water-borne diseases. After a typhoid outbreak struck 3000 persons (killing 300) near Gelsenkirchen in 1901, Rudolf Emmerich gave this report on the Emscher: 'Here we find a black, thick, swampy, rotten and fermenting manure, which hardly moves: during summer, gas bubbles burst, poisoning the surrounding area.' He added: 'The fermentation and putrefication of these enormous quantities of disgustingly dirty and muddy waste water is intensified to the highest degree by the hot water from innumerable steam engines; as a consequence, the waste water often reaches breeding temperatures.'¹⁷

The Emscher was, as one Prussian parliamentarian noted, 'the river of hell'.¹⁸ But the nearby Ruhr and Lippe rivers (south and north of the Emscher respectively) were hardly paradise. The Ruhr was the main source of fresh water for the entire Rheinland-Westphalia industrial region. Most of the water that was pumped out of the Ruhr (and to a much lesser extent the Lippe) was not returned to its original streambed; the water was pumped instead into the Emscher. The general idea was to protect industry's fresh water supplies through a simple hydraulic system: the Ruhr and Lippe functioned as suppliers of fresh water, the Emscher as recipient of polluted effluence. This system worked tolerably well at first, unless you happened to live on the Emscher. By the end of the nineteenth century, however, the Ruhr's annual water deficit (some 150 million cubic metres in 1900) was beginning to take its toll, especially in drought years. August Thienemann, commissioned to investigate the effects of the 1911 Ruhr drought, concluded that the 'liquid substance' flowing in the riverbed did not deserve to be called water. It resembled at different stretches a 'foamy yellow soup', 'milky gray mud', an 'oil slick'. At Mülheim, site of the giant firm Friedrich-Wilhelm-Hütte, Thienemann noted: 'Here the Ruhr is really nothing but sewage. Twenty-eight degrees celsius. A brown-black broth that reeks of prussic acid and is completely dead.'¹⁹

Such extreme conditions on the Lower Ruhr were the exception, but summer shortages in the Rhineland-Westphalian area were becoming the rule and by the end of the nineteenth century 'water wars' were beginning to clog the legal system. A way out of this impasse was found by the creation of the 'Ruhr Dam Association' (*Ruhrdalsperrenverein*) in 1899, a conglomerate of private and public waterworks, power companies, and industries. Headquartered in Essen, the Association set out to 'improve the quantity and quality of water levels on the Ruhr through the construction of dams in the Ruhr's watershed'.²⁰ The first dams were built in the Sauerland between 1901 and 1904 (collectively holding about 32 million cubic metres), then came a series of larger projects, including the mammoth Möhnetalsperre (134.5 million cubic metres), completed in 1913. As the Ruhr's water needs grew, so did the number of dams, until nearly every available drop of upstream water was captured. As of 1986, there were some seventy dams in North Rhine-Westphalia, mostly in private hands and almost all designed to feed the region's industrial and urban needs.²¹

The Ruhr Dam Association, to be sure, effectively handled Rhineland-Westphalia's most pressing industrial need – an abundant supply of fresh water – but it did so by thoroughly reworking the watershed ecosystems of Rhineland-Westphalia, a subject that needs more attention from researchers. The handling of wastewater was pioneered by another Ruhr association, the 'Emscher Cooperative' (*Emschergenossenschaft*), founded in 1904 in Essen. Separate cooperatives for the Ruhr, Lippe, Niers, and Wupper followed in subsequent years. The avowed goal of the Cooperatives was to coordinate policy between water suppliers and water users, and between cities and industries. But in practice the polluting industries held the majority and they made sure that the Cooperatives focused on getting effluence from the Emscher to the Rhine (and then to the North Sea) as quickly and cheaply as possible. Small wonder that opponents began to use the term 'Polluter Cooperative' (*Verschmutzer-Genossenschaft*) rather than 'Pollution Prevention Cooperative' (*Reinholdungs-Genossenschaft*) in their depictions of them.²²

The Emscher Cooperative's first priority was the installation of wastewater and sewage purification plants known as 'Emscher wells'. They first ones were quite primitive, consisting of two tanks for collecting and siphoning sludge mechanically; later ones combined mechanical and biological purification processes.²³ The Cooperative's second priority (which took nearly three decades to complete) was to turn the entire length of the Emscher and all of its tributaries into open-air sewers. Banks and beds were lined with cement. Pumps and drainage systems were installed in polder areas. 'The transformation of the Emscher into a sewer network meant, to be sure, that 2.5 million people have been deprived of clean-flowing brooks', one apologist admitted in 1936. 'But this regulatory system was necessary in order to save the mining industry. Anyway, all of the tributary streambeds had to be cut deeply into the earth in order to compensate for the ground sinkings, so deeply in fact that they were useful for nothing else; and in any case the water is overly laden with chloride from the mines. Under these conditions it made no economic sense to build a second sewage system at an additional cost of 100 million Marks alongside an already existing natural one.'²⁴

No other German river was damaged quite as much as the Emscher (though the Erft, which ran through the brown coal fields on the Rhine's left bank, and the Wupper, which flowed through a myriad of textile and chemical plants on the Rhine's right bank, suffered severely from similar ecological degradation). Nor did any other region of Germany feel the impact of coal and steel more than Rhineland-Westphalia. Yet nearly all German rivers – from the Isar in the south to the Oder in the east – were harnessed in one way or another to industrial and urban needs in the course of the nineteenth and early twentieth centuries. Some were dammed and used for hydroelectricity, others turned into shipping channels. Riverbeds were straightened, shortened, and linked to sanitation networks with little or no regard for aquatic life or riparian ecosystems. Since most German

rivers flow south to north, an east-west canal system was built to link the country together. By the time Wilhelmine Germany collapsed in 1918, Germany's major river system had become nothing but a vast network of canals and canalised rivers, a veritable autobahn of water transportation.

The scientific community, moreover, was slow to grasp the extent of ecological degradation wrought by industrial progress on the nation's streams, rivers, and lakes. Many of Germany's best-known water experts of the nineteenth century (chief among them Max von Pettenkofer) believed that rivers had virtually unlimited 'self-cleaning' capacities; it was only later established scientifically that industrial pollution was capable of killing off the microorganisms that kept the rivers clean. No doubt an overriding belief in economic progress helped blind scientists and researchers to the reality of water pollution, at least until the 1892 Hamburg cholera epidemic conclusively demonstrated the correctness of Robert Koch's germ theory of disease.²⁵ Yet even after these links were clear, many scientists continued to line up with industry in favor of the idea that certain stretches of rivers could be sacrificed to industry (the so-called *Opferstrecke*) without damage to the entire river's length. It was only when 'the sacrificed stretches kept getting longer' (to borrow Johann Paul's aptly titled article about the Sieg river)²⁶ that scientists began to realise that whole watersheds were being degraded through industrial activity. And it was only in the mid-twentieth century, when it became clear that Germany's largest river systems were becoming overwhelmed, that systematic cleanup efforts began, most notably on the Rhine in the 1970s.²⁷

Air pollution emerged side-by-side with water pollution as a major source of political tension in Germany, and it too has been the subject of numerous recent books and articles. Michael Stolberg's *Ein Recht auf saubere Luft* is a good place to start because it handles the earliest social conflicts from a comparative perspective (Britain, France, Belgium, Italy, Germany) and because it provides rich detail on the role of professionals in issues of health and medicine. Brüggemeier's fascinating new book, *Das unendliche Meer der Lüfte*, examines nineteenth-century German economic development through the prism of risk analysis; like Stolberg, Brüggemeier is particularly strong on the politics of health and hygiene. Anyone primarily interested in issues of 'acid rain' and forest damage in Central Europe will find Gerd Spelsberg's *Rauchplage* indispensable.²⁸

Both Stolberg and Brüggemeier use the Bamberg glassworks controversy of 1802-1803 to illustrate Germany's entry into the world of modern environmental conflict. The dispute revolved around the plan of Joseph Ernst Strüpf, a town councillor, to construct a coal-powered glasswork factory on the outskirts of Bamberg, next to the region's renowned Ludwigs Hospital. The councilor sought not only a concession from the city (a legal necessity before he could build) but also long-term exclusive rights to purchase the coal produced in the

Prince Bishop's mines and a monopoly over coal-fired glass production in Bamberg. He encountered resistance from a variety of people, most of whom stood to lose if he succeeded, including a rival glassmaker who sought a similar concession in the nearby town of Kronach. After much legal manoeuvring, the Bavarian government (which took control of Bamberg before the matter was resolved) granted a concession to Strüpf after he agreed to construct his factory on a site some distance from the hospital. The glassworks struggled for a few years, then Strüpf decided to move his factory to Kronach (the same town where his rival had originally proposed to build), where the necessary raw materials were readily available and cheap.

What made the controversy significant beyond its immediate results was that it entailed an attempt on the part of a German entrepreneur to justify the construction of a potentially hazardous industry next to a major town and hospital on the rationale that the factory needed to be close to its market and transportation network. Public opinion split on the matter. Some saw the new factory as a welcome first step in the resuscitation of Bamberg's commerce and trade, which had fallen on hard times since the beginning of the Napoleonic wars. Others viewed it, in the words of one complainant, 'as an offence to the rights of current inhabitants, which threatens property and endangers health and life'.²⁹ The medical community was swept up by the controversy, but scientific research on fossil fuels was still in its infancy, so there was little reliable data available. Local and state authorities found themselves forced to make fateful political and economic choices with little or no scientific understanding of the risks involved. The Bamberg controversy thus not only heralded the birth of the modern German industrial town but also signalled the beginning of the modern 'risk society' (to use the term Brüggeheimer borrowed from Ulrich Beck).

Implicit in nineteenth-century governmental and scientific policy on water issues was the notion that nothing should interfere with industrial development. As Spelsberg points out, this simplistic notion of progress was even more pronounced when it came to air pollution issues, for most Europeans already suspected at the outset of the industrial revolution that coal was a noxious fuel source and a potential hazard to human health. Pre-industrial enterprises preferred wood and charcoal over coal because of the perceived risks associated with coal burning; and in areas where coal was burned as a fuel (such as medieval England) laws and regulations tried to restrict its use to areas away from human settlements. As coal came into use more and more in the nineteenth century, its properties and effects came under close scientific scrutiny, and the research results confirmed that it was a toxic substance. In the 1840s, Adolph Stöckhardt and other forest scientists in the Saxon town of Tharandt made the link between sulphuric dioxide and forest damage (or *Waldsterben* as it later came to be called).³⁰ By 1872, Robert Angus Smith (Great Britain's first Alkali Inspector) had isolated 'acid rain' from smokestacks as the cause of vegetative damage around the industrial regions of England. Coal burning was also becoming

increasingly associated with a variety of lung and respiratory maladies. Scientific knowledge, however, did not translate into national environmental policy and regulation. Instead, pollution was often seen by scientists and politicians alike as the price of progress: 'The atmospheric pollution caused by industrial smoke is a cultural evil that technology will never fully eliminate', wrote Julius von Schroeder and Carl Reuß in 1883 in their famous exposé on forest death.³¹

As the nineteenth century progressed, German legal disputes and bureaucratic risk assessments increasingly became determined by the criterion of the 'district norm' (*ortsübliche Belastung*).³² A town or village that welcomed one industrial plant might find itself on a slippery legal slope: the existence of a single factory was sometimes sufficient for judges and bureaucrats to designate the surrounding area as an industrial region and to use that as grounds for licensing more factories in the area. Politics and economics often went hand-in-hand. Ottensen (near Hamburg), for instance, was transformed from an agrarian and artisan village into an industrial district of Altona in the short span of a few decades; decisive in this transformation was the construction of two glass factories in 1850, the German-Danish war of 1864, and Ottensen's proximity to Hamburg ports.³³ Other towns and villages throughout Germany experienced similar transformations.

Just as the 'sacrificed stretches' of rivers kept getting longer until they engulfed whole watersheds so too the 'industrial districts' kept getting larger until they began to encompass whole regions. This was particularly true in Prussian-controlled regions because the environmental safeguards built into the industrial codes of 1845 and 1869 were extraordinarily weak. In fin-de-siècle Westphalia, it was all but impossible to stop industrialisation through legal mechanisms because air and water pollution constituted the 'district norm' nearly everywhere on the Ruhr.³⁴ Class politics also played a large role. In 1861, Alfred Krupp and his family moved into a sleek new iron-and-glass 'Garden House' directly on the premises of his Essen factory. When the smoke and noise from his factory proved unbearable, he sought refuge a few years later on a hillside outside of Essen, which he turned into his own private park with a spectacular country villa and transplanted trees. The luxury of flight, of course, was not possible for his factory workers; they had to learn to cope with the air, water, and noise of Essen.³⁵

Once a region was designated 'industrial', legal and technical remedies were limited and largely ineffective. The most common recourse was to force a factory to construct higher smokestacks. This primitive techno-fix worked tolerably well in regions with only a few factories since it gave the soot and smoke a chance to drift and dissipate before falling back to the ground as diluted acid deposition. In regions with hundreds and hundreds of smokestacks, however, it only had the effect of scattering deadly gases over larger and larger stretches of territory, giving rise to the transboundary air pollution problems that still plague Europe today. Another common remedy was to seek compensation for damages, or to

sell one's property to the polluter and move to a more tranquil district. There were, however, limits to the amount that industries were willing to pay for property or for damages, and individuals who held out too long might discover that the 'district norm' rule applied. A judge, for instance, ruled in 1915 that a farmer did not deserve compensation for smoke damage because it was unreasonable for anyone to expect to grow fruit trees in the Ruhr region; it did not matter that the Ruhr nurtured fruit trees long before it nurtured industrial plants.³⁶ Such judgments were not unusual. Nor, incidentally, were the farmers' complaints against industry mere anti-modernist rhetoric or agrarian hyperbole. In 1923, when Ruhr industries shut down to protest French occupation and reparation policies, air quality in the Ruhr vastly improved and vegetation thrived beyond what any living Ruhr inhabitant could remember. This otherwise ruinous and fateful event brought with it a doubling of the potato yield and a bumper crop for grains, vegetables, and fruit – providing scientists with their first large-scale empirical confirmation of the deleterious effects of industrial smoke on vegetation.³⁷

All of Germany's key industries played a role in the fouling of the country's air and water, but none more so than the chemical industry, the subject matter of numerous recent monographs. An excellent starting point is *Das blaue Wunder*, co-edited by Arne Andersen and Gerd Spelsberg, which contains a variety of articles that handle technological, health, and political aspects of Germany's synthetic dye industry. Andersen has also written *Historische Technikfolgenabschätzung*, an examination of health and environmental problems in metallurgical and chemical production from 1850 to 1933; although it covers Europe in general, the focus on chemicals and metals ensures the prominence of German industry in his analysis. Ralf Henneking's *Chemische Industrie und Umwelt* focuses on the Prussian Rhineland, the heartland of the German chemical industry, during the nineteenth century. It provides concise descriptions of chemical processes and the environmental pollution they caused as well as detailed information on public controversies over the licensing of new chemical plants. Karl Otto Henseling's *Ein Planet wird vergiftet*, despite its polemical title, offers a good overview of the past two centuries of industrial chemistry in a very readable style. Also worthwhile is *Auch Umwelt hat Geschichte*, by Arne Dehn, Martin Desch, Lars Deckert, Jens Gallenbacher, and Rolf Hartmann, which focuses on a single chemical factory.³⁸

Nineteenth-century applied chemistry largely revolved around four synthetic products: acids, alkalis (bases), fertilisers, and dyes. Sulphuric acid and its derivatives (hydrochloric and nitric acids) were used in dye production, cloth bleaching, and by the gold and silver industries. Most sulphuric acid came from the town of Nordhausen (Saxony) until 1736, when a British entrepreneur discovered how to synthesise it inexpensively by burning sulphur and saltpetre in a laboratory. Natural alkalis (natron, potash, and barilla) were used for soap

production, textile dyeing, cloth bleaching, and glassmaking. In 1791, Nicholas Leblanc discovered how to synthesise soda with salt and calcium carbonate; Ernest Solvay subsequently found a more cost-effective salt-and-ammonia synthesis in 1873. Guano, bone meal, and wood ash were common natural fertilisers. After scientists began to ascertain their active ingredients in the 1830s, a wide variety of synthetic phosphate, nitrogen, and potash fertilisers became commercially available. The fourth (and for Germany most important) breakthrough came in the 1860s with the discovery that 'coal tar' (a byproduct of the coking industry) could be used to create synthetic 'aniline' and 'azo' dyes, including mauve, fuchsin, Hofmann's violet, *bleu de Lyon*, Bismarck brown, *cachou de Laval*, Congo red, and (after 1897) synthetic indigo.

Many of the advances in chemistry came from Germans, foremost among them Justus von Liebig, whose work in agro-chemistry led to synthetic fertilisers, and Wilhelm von Hofmann, who did the first theoretical research on coal-tar properties. Although the German states supported a chemical industry before the 1860s, the phenomenal rise began with the invention of synthetic dyes. As Henneking points out, the preferred site was the Rhine and its tributaries, headquarters of Bayer, Hoechst, BASF, and dozens of other firms. The Rhine offered an unsurpassed competitive advantage: water for production, heating and cooling, transportation, and dumping effluence; availability of inland harbours and bulky raw materials (sulphur, salt, chalk, limestone, phosphorus, etc.); nearness to Ruhr coal for energy and for coal-tar ingredients; and proximity to the textile markets on the Wupper and Ruhr.³⁹ These advantages proved so decisive that even today AGFA is the only large German chemical firm not headquartered on the Rhine.

Pre-industrial Europeans were, of course, already well-acquainted with the toxic properties of 'oil of vitriol' (sulphuric acid), 'aqua fortis' (nitric acid), 'aqua regia' (hydrochloric and nitric acids) as well as tannic acid and dye mordants. The most famous natural dye, 'Turkish red', made from madder-root, required a month of intense labour and a myriad of chemicals before it could be used on textiles.⁴⁰ Plant-dye agriculture was an industry in itself, one that took large tracts of land away from food production and entailed peasant and slave labour. Natural indigo and other dye-plants were cultivated on plantations in India; India's indigo plantations alone took up 1.6 million acres of cultivated land in 1896 (the year before synthetic indigo came into production and the natural indigo industry collapsed).⁴¹ What was new about the nineteenth-century was the phenomenal increase in production of known hazardous chemicals, and the quantum leap in the variety of new toxic chemicals under production. Pollutants, which had once affected only one locale or damaged only a small portion of a stream now spread across entire watersheds and ecosystems: acid factories produced nitrogen oxide as a wasteprodukt, soda plants produced calcium sulphide and hydrochloric acid as wastes, and the superphosphate plants produced hydrofluoric acid.

Without doubt, the synthetic dye industry had the greatest long-term impact on the German environment, beginning with the 'arsenic scare' of 1860 to 1880. Early aniline dyes required the use of arsenic acid for oxidation. It took, for example, 1000 kilograms of arsenic acid to produce 100 kilograms of pure crystal fuchsin; about 600 kilograms of the original arsenic acid went out with the resin and wastewater.⁴² The waste was discarded without much thought to its impact on human health, at least until neighbours began to complain. In 1864, a major industrial accident in the wastesteam exhaust system at the Bayer plant in Barmen resulted in a serious arsenic spill. When illnesses resulted from poisoned wells, Bayer founded himself on the losing end of a series of law suits. Admitting defeat in 1866, he built his new factory downstream in Elberfeld, along a stretch of the Wupper which (in the words of a company biographer) was 'already completely contaminated'.⁴³ Another Barmen manufacturer, Carl Jäger, also dumped arsenic directly into the Wupper until city residents and local authorities forced him to stop. Thwarted at home, Jäger began transporting arsenic-laden waste on Rhine barges to the North Sea and dumped it there. From 1861 to 1863, the Jäger firm alone dumped some 230 barrels containing 19,000 pounds of arsenic waste in the sea between Rotterdam and Liverpool.⁴⁴

The arsenic hazard was so serious that various local and national governments felt compelled to take draconian measures. First came an international treaty between the Netherlands and Prussia in 1868 that controlled the transport of hazardous chemicals on the Rhine and other waterways and the dumping of arsenic in the North Sea. Then came a new production process, developed by Hoechst, which utilised nitrobenzene instead of arsenic. These countermeasures were as successful as they were short-sighted: they handled the immediate problem of arsenic poisoning without addressing the larger problem of chemical waste disposal. Moreover, other toxic substances utilised in dye production (phenol, toluene, xylene, benzene, and the like) were left completely unregulated. While these substances did not pose the same immediate threat as arsenic, they could induce fatal damage to the liver, kidneys, and bone marrow of humans slowly over time, a fact that dye workers came to learn first-hand. The factory floor also remained inadequately ventilated, routinely exposing workers to hydrogen sulphide, sulphitic acid, arsine, aniline vapours, sulphuric acid, and other toxic fumes. Unavoidable emissions during the normal production process of such intermediaries as nitrotoluene and nitrobenzene (the much-touted arsenic substitute!) could also be toxic to workers over time.⁴⁵ As late as the 1880s, acids and other chemicals were poured by hand from open containers into dyeing vats and washtubs; neither vats nor tubs nor flasks had lids. Wasteproducts were stored in barrels around the plant or dumped (often clandestinely) into rivers and streams. Although matters improved greatly after 1945, there were still regions of Germany in the 1970s where local inhabitants could determine what dyes were being produced on any given day or week by simply looking at the colour of the nearby stream.

The emergence, growth, and spread of large chemical giants did not go uncontested, a point that Gilhaus and Henneking highlight in their books. Every new factory site, every new plant expansion, every new product line might unleash a storm of protests, provoke a citizens' movement, start a medical investigation, or otherwise make it exceedingly cumbersome for the firms to construct new plants or diversify their products on a predictable timetable. Yet in the end these proto-*Bürgerinitiativen* ('citizen initiatives') found themselves fighting rearguard actions, able to thwart construction here and there in Germany, but never able to halt or re-direct the march of chemical 'progress'. The reasons were elemental: chemistry was considered so vital to Germany's military might, and so central to its economic well-being, that the industry achieved a legendary status in the minds of most Germans and was therefore in a position to demand and receive more governmental leeway than was accorded to most other industries. ('The chemist', remarked Bismarck in 1894, 'decides war and peace with his discoveries.'⁴⁶) When faced with local pockets of resistance, moreover, industrialists could always invoke the unemployment scare, a sure-fire method of bringing authorities and the populace into line. 'We can only gladly welcome these colours, which the factories discharge into the river', the mayor of Elberfeld proclaimed in the 1920s, 'for only as long as the Wupper is dirty, is there still work to be found.'⁴⁷ With national and regional authorities on their side, it is small wonder that the chemical giants came to believe they enjoyed a sacred right to pollute the nation's water and air – an arrogance that has continued to persist despite the tight regulations that the German government imposes on all polluting industries today.

The chemical industry was not the only focal point of public discontent. Scholars have increasingly turned their attention to the whole gamut of environmental movements, nature protection societies, and ideologically based protests against industrialisation. Many researchers have been spurred by the success of the German Greens at the national and local levels, while others have been more interested in disentangling the right-wing and left-wing roots of the various movements. An excellent place to start is Raymond Dominick's masterful *The Environmental Movement in Germany*, which examines NIMBY groups, *Bürgerinitiativen*, and environmental agitation from the Bismarckian to the Brandt era. Anna Bramwell's two books, *Blood and Soil* and *Ecology in the 20th Century*, are also worth reading, despite her tendency to overplay the importance of the political right in the shaping of contemporary environmental movements. There is nothing comparable in scope in the German language to the works of Dominick and Bramwell, but several excellent books and articles handle similar themes from a different perspective. *Von der Bittschrift zur Platzbesetzung* by Ulrich Linse, Reinhard Falter, Dieter Rucht, and Winfried Kretschmer handles four *causes célèbres* of the past one hundred years (Laufenburg, Walchensee, Wyhl, Wackersdorf), all of which revolved around public protests against high-tech power generation projects. Rolf Peter Sieferle's *Fortschrittsfeinde?* weaves

some of the same material into a larger investigation of anti-technological sentiment in Europe (mostly Germany) from the Romantic era to the present. Jost Hermand's *Grüne Utopien in Deutschland* and Ulrich Linse's *Ökopax und Anarchie* both offer good surveys of ecological utopias and environmental movements. Articles by Arne Andersen and Michael Wettengel focus on the connections between industrial pollution and the *Heimatschutz* ('home preservation') and *Naturschutz* ('nature protection') movements of the late nineteenth and early twentieth centuries. Jost Hermand's edited collection, *Mit den Bäumen sterben die Menschen*, is particularly strong on efforts by the *Bund Heimatschutz* and other groups to mitigate the worst aspects of Wilhelmine-era industrialisation. *Die Liebe zur Landschaft* by Gert Gröning and Joachim Wolschke-Bulmahn takes a penetrating look at Nazi policies in the newly acquired eastern territories. Finally, Dietmar Klenke's '*Freier Stau für freie Bürger*' examines post-1945 environmental issues through the prism of West Germany's transportation politics.⁴⁸

No doubt German historians have concentrated their attention for the past decade on major industrial centres to the neglect of smaller industrial regions and rural settings. There is, for instance, now a plethora of information available on Rhineland-Westphalia, Berlin, and Hamburg, but still almost nothing on Baden, Schleswig, or Bavaria. Similarly, western German archives (especially those in the Rhine-Ruhr region) have been exploited far more extensively than eastern German ones, a situation that will no doubt change in the wake of unification. Industrial pollution has been at centre stage in most of the recent research, and for obvious reasons. But here too the record remains uneven. Far more has been written about coal and chemicals, for instance, than about paper mills and sugar beet factories. Even the iron and steel industries (and related industries such as machine-building) have received short-shrift as compared to the chemical industry. Likewise, more attention has been paid to air and water than to ground and noise pollution, and there has been more focus on rivers and streams than on mountains and coastlines.

Most German researchers, moreover, have preferred the nineteenth century – the heyday of *laissez-faire* pollution – over the post-1945 period, when systematic environmental cleanup efforts began. This sometimes creates the mistaken impression that German industrialists unleashed a never-ending war on the nation's air and water, and that all efforts to improve Germany's environment have been failures. One would be hard pressed to learn from *Wassernöte* (by Kluge and Schramm), for instance, that Germany's industrial and urban water systems rank today among the best in Europe, or that the nation's rivers flow far more pollutant-free now than they did twenty years ago. Similar complaints could be levied against other researchers as well. Still, if the past decade's monographs offer any hint of things to come, it is not too much to expect that these research gaps, and many others, will be rectified in upcoming years.

NOTES

¹ Jörg Calließ, Jörn Rüsen, Meinfried Striegnitz, eds. *Mensch und Umwelt in der Geschichte* (Pfaffenweiler: Centaurus-Verlagsgesellschaft, 1989); and Günter Bayerl, Norman Fuchsloch, and Torsten Meyer, eds. *Umweltgeschichte – Methoden, Themen, Potentiale. Tagung des Hamburger Arbeitskreises für Umweltgeschichte, Hamburg 1994* (Münster: Waxmann, 1996).

² Arne Andersen, 'Umweltgeschichte – Abschied vom Fortschritt', *Environmental History Newsletter*, no. 3 (1991), pp. 3-16; Franz-Josef Brüggemeier, 'Umweltgeschichte – warum, wozu und wie? Überlegungen zum Stellenwert einer neuen Disziplin', in *Historische Umweltforschung: Wissenschaftliche Neuorientierung – Aktuelle Fragestellungen* (Bergisch Gladbach: Thomas-Morus-Akademie, 1992), pp. 11-26; Paul Leidinger, 'Von der historischen Umweltforschung zur Historischen Ökologie. Ein Literaturbericht', *Westfälische Forschungen* 41 (1991), pp. 495-516; Joachim Radkau, 'Was ist Umweltgeschichte?', in Werner Abelshäuser, ed. *Umweltgeschichte. Umweltverträgliches Wirtschaften in historischer Perspektive. Acht Beiträge* (Göttingen: Vandenhoeck & Ruprecht, 1994), pp. 11-28; Engelbert Schramm, 'Historische Umweltforschung und Sozialgeschichte des 19. und 20. Jahrhundert', *Archiv für Sozialgeschichte* 37 (1987), pp. 439-455; and Rolf Peter Sieferle, 'Perspektiven einer historischen Umweltforschung', in Rolf Peter Sieferle, ed. *Fortschritte der Naturzerstörung* (Frankfurt: Suhrkamp, 1988), pp. 307-368. See also Ulrich Troitzsch, 'Historische Umweltforschung. Einleitende Bemerkungen über Forschungsstand und Forschungsaufgaben', *Technikgeschichte* 48 (1981), pp. 177-190. In addition, a special issue of *Environmental History Newsletter*, no. 1 (1993), edited by Christian Simon, is devoted to the theme of 'Umweltgeschichte heute: Neue Themen und Ansätze der Geschichtswissenschaft'.

³ Radkau, 'Was ist Umweltgeschichte?', in Abelshäuser, ed. *Umweltgeschichte*, p. 20.

⁴ Helmut Jäger, *Einführung in die Umweltgeschichte* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1994); Gottfried Zirnstein, *Ökologie und Umwelt in der Geschichte* (Marburg: Metropolis, 1994); and Ludwig Trepl, *Geschichte der Ökologie. Vom 17. Jahrhundert bis zur Gegenwart* (Frankfurt: Athenäum, 1987). Both Jäger and Zirnstein include useful German-language bibliographies.

⁵ Bernd Herrmann, ed. *Mensch und Umwelt im Mittelalter* (Stuttgart: Deutsche Verlags-Anstalt, 1986); Herrmann, ed. *Umwelt in der Geschichte* (Göttingen: Vandenhoeck & Ruprecht, 1989); and Ernst Schubert and Herrmann, eds. *Von der Angst zur Ausbeutung. Umwelterfahrung zwischen Mittelalter und Neuzeit* (Frankfurt: Fischer, 1994).

⁶ Albrecht Jockenhovel, ed. *Bergbau, Verhüttung und Waldnutzung im Mittelalter: Auswirkungen auf Mensch und Umwelt* (Stuttgart: Steiner, 1996); and Hermann Kellenbenz, ed. *Wirtschaftsentwicklung und Umweltbeeinflussung (14.-20. Jahrhundert). Berichte der 9. Arbeitstagung der Gesellschaft für Sozial- und Wirtschaftsgeschichte (30.3.-1.4.1981)* (Wiesbaden: Steiner, 1982). See also Joachim Allmann, *Der Wald in der frühen Neuzeit. Eine mentalitäts- und sozialgeschichtliche Untersuchung am Beispiel des Pfälzer Raumes 1500-1800* (Berlin: Duncker & Humblot, 1989).

⁷ Ilja Mieck, "'Aerem corrumpere non licet.'" Luftverunreinigung und Immissionsschutz in Preußen bis zur Gewerbeordnung 1869', *Technikgeschichte* 34 (1967), pp. 36-78. See also Mieck, 'Industrialisierung und Umweltschutz', in Calließ et. al. *Mensch und Umwelt*, pp. 205-228; Mieck, 'Umweltschutz zur Zeit der frühen Industrialisierung', in Kellenbenz, ed. *Wirtschaftsentwicklung und Umweltbeeinflussung*, pp. 231-245; and Mieck, 'Ber-

liner Umweltprobleme im 19. Jahrhundert', in Ingolf Lamprecht, ed. *Umweltprobleme einer Groß-Stadt. Das Beispiel Berlin* (Berlin: Colloquium, 1990).

⁸Günter Bayerl, *Die Papiermühle: Vorindustrielle Papiermacherei auf dem Gebiet des alten deutschen Reiches – Technologie, Arbeitsverhältnisse, Umwelt*, 2 Vols. (Frankfurt: Lang, 1987); and Joachim Radkau, *Technik in Deutschland. Vom 18. Jahrhundert bis zur Gegenwart* (Frankfurt: Suhrkamp, 1989).

⁹Radkau, 'Holzverknappung und Krisenbewusstsein im 18. Jahrhundert', in *Geschichte und Gesellschaft*, Vol. 9 (1983), pp. 513-543; and Radkau, 'Zur angeblichen Energiekrise des 18. Jahrhunderts. Revisionistische Betrachtungen über die "Holznot"', in *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte*, Vol. 73 (1986), pp. 1-37. See also Radkau, 'Wood and Forestry in German History: In Quest of an Environmental Approach', in *Environment and History*, Vol. 2 (February 1996), pp. 63-76; and Radkau, 'The Wordy Worship of Nature and the Tacit Feeling for Nature in the History of German Forestry', in Mikulás Teich, Roy Porter, and Bo Gustafsson, eds. *Nature and Society in Historical Context* (Cambridge: Cambridge University Press, 1997), pp. 228-239.

¹⁰Franz-Josef Brüggemeier and Thomas Rommelspacher, eds. *Besiegte Natur. Geschichte der Umwelt im 19. und 20. Jahrhundert* (Munich: Beck, 1989); Brüggemeier and Michael Toyka-Seid, eds. *Industrie-Natur. Lesebuch zur Geschichte der Umwelt im 19. Jahrhundert* (Frankfurt: Campus, 1995); Brüggemeier and Rommelspacher, *Blauer Himmel über der Ruhr. Geschichte der Umwelt im Ruhrgebiet 1840-1990* (Essen: Klartext, 1992); Ulrike Gilhaus, 'Schmerzskinder der Industrie'. *Umweltverschmutzung, Umweltpolitik und sozialer Protest im Industriezeitalter in Westfalen 1845-1914* (Paderborn: Schöningh, 1995); and Klaus-Georg Wey, *Umweltpolitik in Deutschland. Kurze Geschichte des Umweltschutzes in Deutschland seit 1900* (Opladen: Westdeutscher Verlag, 1982).

¹¹Cited in Brüggemeier and Toyka-Seid, eds. *Industrie-Natur*, p. 175.

¹²Wey, *Umweltpolitik*, pp. 33-151; Brüggemeier and Rommelspacher, *Blauer Himmel*, pp. 50-61; and Werner Wäble, 'Das Verhältnis von Industrie und Umwelt seit 1945', in Hans Pohl, ed. *Industrie und Umwelt. Referate und Diskussionsbeiträge der 16. Öffentlichen Vortragsveranstaltung der Gesellschaft für Unternehmensgeschichte am 15. 5. 1991 in Mannheim* (Stuttgart: Steiner, 1993), pp. 45-68.

¹³Thomas Kluge and Engelbert Schramm, *Wasssernöte. Zur Geschichte des Trinkwassers* (Aachen: Alano, 1988); Peter Münch, *Stadthygiene im 19. und 20. Jahrhundert. Die Wasserversorgung, Abwasser- und Abfallbeseitigung unter besonderer Berücksichtigung Münchens* (Göttingen: Vandenhoeck & Ruprecht, 1990); Ulrike Klein [Gilhaus], 'Die Gewässerverschmutzung durch den Steinkohlenbergbau im Emschergebiet', in Hans-Jürgen Teuteberg, ed. *Westfalens Wirtschaft am Beginn des 'Maschinenzeitalters'* (Dortmund: Gesellschaft für Westfälische Wirtschaftsgeschichte, 1988), pp. 337-355; Johann Paul, 'Die Opferstrecken wurden immer länger. Die Siegverschmutzung im 19. und 20. Jahrhundert', in *Historische Umweltforschung*, pp. 57-78; and Thomas Rommelspacher, 'Das natürliche Recht auf Wasserverschmutzung', in Brüggemeier and Rommelspacher, eds. *Besiegte Natur*, pp. 42-63.

¹⁴Kluge and Schramm, *Wassernöte*, pp. 119-121.

¹⁵Klein, 'Die Gewässerverschmutzung', p. 341-344.

¹⁶Rommelspacher, 'Das natürliche Recht', pp. 57-58.

¹⁷Cited in Franz-Josef Brüggemeier, 'The Ruhr Basin 1850-1900: A Case of Large-Scale Environmental Pollution', in Peter Brimblecombe and Christian Pfister, eds. *The Silent Countdown: Essays in Environmental History* (Berlin: Springer-Verlag, 1990), p. 212.

¹⁸Kluge and Schramm, *Wassernöte*, p. 102.

- ¹⁹ Thienemann's report is recounted in Kluge and Schramm, *Wassernöte*, pp. 174-176.
- ²⁰ Kluge and Schramm, *Wassernöte*, p. 160.
- ²¹ Statistics from Peter Franke and Wolfgang Frey, *Talsperren in der Bundesrepublik Deutschland* (Berlin: Nationales Komitee für Große Talsperren in der Bundesrepublik, 1987).
- ²² Wey, *Umweltpolitik*, p. 94.
- ²³ Wey, *Umweltpolitik*, pp. 77-86.
- ²⁴ Cited by Rommelspacher, 'Das natürliche Recht', in Brüggemeier and Rommelspacher, *Besiegte Natur*, p. 62.
- ²⁵ Kluge and Schramm, *Wassernöte*, pp. 105-131. See also Richard Evans, *Death in Hamburg: Society and Politics in the Cholera Years 1830-1910* (Oxford: Oxford University Press, 1987).
- ²⁶ Paul, 'Die Opferstrecken wurden immer länger', in *Historische Umweltforschung*, pp. 57-78.
- ²⁷ Hans Boldt, ed. *Der Rhein. Mythos und Realität eines europäischen Stromes* (Cologne: Rheinland-Verlag, 1988); Ragnar Kinzelbach and Günther Friedrich, ed. *Biologie des Rheins* (Stuttgart: Fischer, 1990); Günther Reichelt, *Laßt den Rhein leben! Strom im Spannungsfeld zwischen Ökologie und Ökonomie* (Berlin: Cornelsen-Velhagen & Klasing, 1986); and Thomas Tittizer and Falk Krebs, eds. *Ökosystemforschung: Der Rhein und seine Auen. Eine Bilanz* (Berlin: Springer, 1996).
- ²⁸ Michael Stolberg, *Ein Recht auf saubere Luft? Umweltkonflikte am Beginn des Industriezeitalters* (Erlangen: Fischer, 1994); Franz-Josef Brüggemeier, *Das unendliche Meer der Lüfte. Luftverschmutzung, Industrialisierung und Risikodebatten im 19. Jahrhundert* (Essen: Klartext, 1996); and Gerd Spelsberg, *Rauchplage. Zur Geschichte der Luftverschmutzung* (Aachen: Alano, 1984).
- ²⁹ Cited by Brüggemeier, *Das unendliche Meer der Lüfte*, p. 22.
- ³⁰ Hans Wislicenus, ed. *Waldsterben im 19. Jahrhundert. Sammlung von Abhandlungen über Abgase und Rauchschäden 1860-1916* (Düsseldorf: VDI-Verlag, 1985), a reprint of scientific articles published between 1908 and 1916 while Wislicenus was Director of the Tharandt Forest Academy.
- ³¹ Julius von Schroeder and Carl Reuß, *Die Beschädigung der Vegetation durch Rauch und die Oberharzer Hüttenrauchschäden* (Berlin: Parey, 1883), p. 12.
- ³² See especially Arne Andersen and Franz-Josef Brüggemeier, 'Gase, Rauch und Saurer Regen', in Brüggemeier and Rommelspacher, *Besiegter Natur*, pp. 64-84; also Andersen, 'Die Rauchplage im deutschen Kaiserreich als Beispiel einer versuchten Umweltbewältigung', in Gerhard Jaritz and Verena Winiwarter, eds. *Umweltbewältigung. Die historische Perspektive* (Bielefeld: Verlag für Regionalgeschichte, 1994), pp. 99-129.
- ³³ Elisabeth von Dücker, "'...in der Glashütte viel Staub und Rauch und Schmutz'" – Zu Gesundheitsrisiken und Umweltproblemen am Beispiel der Ottenser Glashütte 1850-1939', in Arne Andersen, ed. *Umweltgeschichte. Das Beispiel Hamburg* (Hamburg: Ergebnisse, 1990), pp. 42-69.
- ³⁴ Brüggemeier and Rommelspacher, *Blauer Himmel über der Ruhr*, pp. 35-37.
- ³⁵ Spelsberg, *Rauchplage*, pp. 46-47.
- ³⁶ Brüggemeier and Rommelspacher, *Blauer Himmel über der Ruhr*, p. 36.
- ³⁷ This phenomenon was first explored in a dissertation by Heinz Bergerhoff, *Untersuchungen über die Berg- und Rauchschädenfrage mit besonderer Berücksichtigung des Ruhrbezirks* (Bonn-Poppelsdorf: Landwirtschaftliche Hochschule, 1928).

³⁸ Arne Andersen and Gerd Spelsberg, eds. *Das blaue Wunder. Zur Geschichte der synthetischen Farben* (Cologne: Volksblatt, 1990); Andersen, *Historische Technikfolgenabschätzung am Beispiel des Metallhüttenwesens und der Chemieindustrie 1850-1933* (Stuttgart: Steiner, 1996); Ralf Henneking, *Chemische Industrie und Umwelt. Konflikte um Umweltbelastungen durch die chemische Industrie am Beispiel der schwerchemischen, Farben- und Düngemittelindustrie der Rheinprovinz (ca. 1800-1914)* (Stuttgart: Steiner, 1994); Karl Otto Henseling, *Ein Planet wird vergiftet. Der Siegeszug der Chemie: Geschichte einer Fehlentwicklung* (Reinbeck: Rowohlt, 1992); Arne Dehn, Martin Desch, Lars Deckert, Jens Gallenbacher, and Rolf Hartmann, *Auch Umwelt hat Geschichte. Eine Fabrik von 1873 bis heute* (Bad Homburg: Verlag Ausbildung und Wissen, 1987).

³⁹ Henneking, *Chemische Industrie und Umwelt*, pp. 35-37.

⁴⁰ Sylvia Reckel, 'Von 'Teufelsfarbe', 'Scharlachtüchern', 'Waidjunkern' und 'Schönfärben': Aufstieg und Fall der natürlichen Farben', in Andersen and Spelsberg, eds. *Das blaue Wunder*, pp. 57-81.

⁴¹ Karl Otto Henseling and Anselm Salinger, 'Eine Welt voll märchenhaften Reizes...', Teerfarben: Keimzelle der modernen Chemieindustrie', in Andersen and Spelsberg, eds. *Das blaue Wunder*, p. 83.

⁴² *Ibid.*, pp. 89-90; and Henneking, *Chemische Industrie und Umwelt*, pp. 63-65.

⁴³ Cited by Spelsberg, 'Im Fieber des Farbenrausches': Eine Siegesgeschichte', in Andersen and Spelsberg, eds. *Das blaue Wunder*, p. 46.

⁴⁴ Tim Arnold, 'Ein leichter Geruch nach Fäulnis und Säure...': Wasserverschmutzung durch Färberei und frühe Farbenindustrie am Beispiel der Wupper', in Andersen and Spelsberg, eds. *Das blaue Wunder*, p. 154. For a similar situation in Basel, see Anthony S. Travis, 'Poisoned Groundwater and Contaminated Soil: The Tribulations and Trial of the First Major Manufacturer of Aniline Dyes in Basel', *Environmental History* 2 (July 1997), pp. 343-365.

⁴⁵ Henneking, *Chemische Industrie und Umwelt*, p. 61-62.

⁴⁶ Cited by Joachim Radkau, *Technik in Deutschland*, p. 132.

⁴⁷ Cited by Brüggemeier, 'The Ruhr Basin', in Brimblecombe and Pfister, eds. *The Silent Countdown*, p. 224.

⁴⁸ Raymond Dominick, *The Environmental Movement in Germany: Prophets and Pioneers, 1871-1971* (Bloomington: Indiana University Press, 1992); Anna Bramwell, *Ecology in the 20th Century: A History* (New Haven: Yale University Press, 1989); Bramwell, *Blood and Soil: Walter Darré and Hitler's 'Green Party'* (Abbotsbrook: Kensal House, 1985); Ulrich Linse, Reinhard Falter, Dieter Rucht, and Winfried Kretschmer, *Von der Bittschrift zur Platzbesetzung. Konflikte um technische Großprojekte* (Berlin: J.H.W. Dietz, 1988); Rolf Peter Sieferle, *Fortschrittsfeinde? Opposition gegen Technik und Industrie von der Romantik bis zur Gegenwart* (Munich: C.H. Beck, 1984); Jost Hermand, *Grüne Utopien in Deutschland. Zur Geschichte des ökologischen Bewußtseins* (Frankfurt: Fischer, 1991); Hermand, ed. *Mit dem Bäumen sterben die Menschen. Zur Kulturgeschichte der Ökologie* (Cologne: Böhlau, 1993); Ulrich Linse, *Ökopax und Anarchie* (Munich: Deutscher Taschenbuch, 1986); Arne Andersen, 'Heimatschutz. Die bürgerliche Naturschutzbewegung', in Brüggemeier and Rommelspacher, *Besiegte Natur*, pp. 143-157; Michael Wettengel, 'Staat und Naturschutz, 1906-1945: Zur Geschichte der Staatlichen Stelle für Naturdenkmalpflege in Preussen unter der Reichsstelle für Naturschutz', *Historische Zeitschrift*, Vol. 257 (October 1993), pp. 355-399; Gert Gröning and Joachim Wolschke-Bulmahn, *Die Liebe zur Landschaft*,

Teil 3. Der Drang nach Osten: Zur Entwicklung der Landespflege im Nationalsozialismus und während des Zweiten Weltkrieges in den 'eingegliederten Ostgebieten' (Munich: Minerva, 1987); and Dietmar Klenke, *'Freier Stau für freie Bürger'. Die Geschichte der bundesdeutschen Verkehrspolitik 1949-1994* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1995).

CONFERENCE ON AFRICAN ENVIRONMENTS, PAST AND PRESENT

Journal of Southern African Studies/St. Antony's College

Convenors: William Beinart, St. Antony's College, Oxford and Richard Grove, Australian National University

The *Journal of Southern African Studies* is organising a conference on African environments, past and present, 5-8 July 1999 in Oxford. The geographic focus is not restricted to southern Africa and we would welcome contributions on other parts of the continent as well as papers which explore comparative contexts and wider international linkages. A rich body of research which examines the interaction between social and environmental change is accumulating. The conference is designed to stimulate dialogue between different approaches and disciplines, following some productive recent encounters.

Historians and social scientists of Africa are increasingly focusing their attention on environmental change and regulation; one purpose of the conference will be to draw together some of this work. But we hope also to engage with natural scientists both in discussions of the history of their disciplines, which have been so important in building an understanding of environmental change in Africa, and in an effort to keep pace with rapid scientific developments and their impact on policy. Natural scientists in turn might find value in approaches which seek to be sensitive to African practice and the political implications of environmental controls. With reference to specific issues and areas there is often a good deal of common ground. It is important to explore this, not only in order to understand environmental change, but because access to and conservation of natural resources remain critical questions for African people and governments.

This is an open conference for which we invite papers and proposals for panels by the end of January 1998. Topics covered could include: African ideas and local knowledge; the history of natural sciences; colonisation and conflict over natural resources markets, commoditisation and environmental change; climate and desertification; the impact of introduced species; hunting and wildlife conservation; parks and people; vegetation change and rangeland management; the impact of property regimes; water and its control; fire; timber, forestry and fuelwood; disease and environmental change; urban environments and pollution; literature, film and conceptions of landscape; biodiversity, degradation and sustainability. Panels on the history of Commonwealth forestry will be convened by Prof. J. Burley, Oxford Forestry Institute.

Proposals for papers should be about 300 words; panels should consist of two or three papers and a discussant. We plan to precirculate papers so that the bulk of time can be devoted to discussion. We cannot undertake to accept all proposals. Participants should plan to raise their own fares, but let us know if this will be impossible. All correspondence and proposals to JoAnn McGregor, St. Antony's College, Oxford OX2 2JF, fax 01865 554465; email joann.mcgregor@sant.ox.ac.uk