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Cautionary Perspectives of Environmental History

Zusammenfassung

Große einschneidende umwelthistorische Ereignisse wie z.B. Naturkatastrophen wurden in der Umweltgeschichte sehr oft zu einem zentralen Forschungsgegenstand. Neben diesen natürlichen Ereignissen ist es der Mensch, der entscheidend die heutige Umwelt prägt und verändert und direkt oder indirekt Umweltprobleme aber auch Umweltkatastrophen verursacht oder zumindest verstärkt. Am Beispiel des Gorongosa Nationalparks in Mozambique wird das Wechselspiel zwischen Phasen der Degradierung und Maßnahmen zur Renaturierung aus umwelthistorischer Sicht analysiert. Besondere Berücksichtigung fand die Geschichte der ortsansässigen Bevölkerung genauso wie die Einflüsse aus der Kolonialzeit und die aktuellen Rahmenbedingungen.

Eine kurze Darstellung der Geschichte international bedeutsamer Umweltkongresse zeigt die Entwicklung von Wegen zum Schutz und der Erhaltung der Umwelt genauso auf, wie Möglichkeiten der Regeneration und Renaturierung. Völlig neue Herausforderungen gehen mit dem Klimawandel einher. Für den Umgang mit diesem Problem kann man aus der Umweltgeschichte lernen. Die Umweltgeschichte zielt bei der Analyse von Prozessen in sehr frühen Phasen der Entwicklung der menschlichen Gesellschaft wie auch von Ereignissen aus der jüngsten Vergangenheit auf das Vorsorgeprinzip, d.h. was kann man aus der Geschichte für die Lösung heutiger Umweltprobleme lernen. Entscheidend ist aber, wie werden dieses Wissen und die Erkenntnisse heute bei der Lösung unserer Umweltprobleme berücksichtigt („To heed or not to heed that is the question.“).

“Nature to be commanded must be obeyed.”
Francis BACON

The Cassandra Problem

A dramatic painting hangs in the Princeton University Art Museum, portraying a famous natural disaster – the eruption of Mount Vesuvius in 79 CE (ROLANDI et al. 2008)¹. Through an arched doorway in a wall, the volcano can be seen spewing ash into the sky while a tsunami wave sweeps in from across the Bay of Naples. Two agitated women are fleeing down the stairs. In the foreground are three figures,

¹ The date given in the manuscripts is August 24, but archaeological evidence, including wind direction and the fruits and other vegetable remains found in Pompeii, suggests a date in autumn.

Pliny the Younger in the center, his mother on the left, and on the right a friend from Spain warning him to flee immediately or face death. Pliny looks up from his assiduous reading of a scroll containing the historian Livy's writings and the notes he is taking on a waxen tablet. (Fig. 1)



Fig. 1: “The Younger Pliny Reproved,” by artist Angelica Kauffman (1785).
Courtesy of Princeton University Art Museum.

From Pliny's own letters describing the event, we know that he rejected the warning and continued his study until earthquakes threatened to bring the house down around him. Then he and his mother left the villa, only to be engulfed in total darkness. The image is an epitome of the refusal to deal with a disaster even when there are unmistakable signs of its advent. It was painted in 1785 by the Swiss-born English artist Angelica Kauffman (1741–1807), who has been criticized for her overly romantic style, and who must be forgiven for giving Pliny two left feet, possibly a metaphor for his ineptness in the emergency.

When environmental historians find that their data indicate possible disasters, they encounter the problem faced by the friend from Spain. They are heard but not believed, or they are believed but not heeded. Audiences avoid environmental lectures because they have the impression that they will be harangued by pessimism and impending disasters of such a scale that they despair of doing anything effective against them. Environmental historians with a cautionary perspective may

feel kinship with the man from Spain – and with Cassandra, the Trojan prophet who had received Apollo’s blessing that she could anticipate the future along with the curse that no one would accept her prophecies. This Cassandra problem can be illustrated by the subsequent history of Vesuvius.

An image of Mount Vesuvius painted in the quiescent years of the early first century CE represents a mountain robed in the green of vineyards and presided over by a benevolent Bacchus who is at the same time a bunch of ripe grapes, appropriate for the god of wine.² The artist, and the people who lived in the towns and farms overshadowed by the mountain, had forgotten that it was a volcano. It was not that Romans were ignorant of volcanoes. Mount Etna on Sicily smoked almost all the time and coughed up lava fairly often, and islands in the Tyrrhenian Sea such as Vulcano and Stromboli put on a good show as well. Silius Italicus writes of a flare-up of Vesuvius in 217 BCE “with flames worthy of Etna” (PUNICA 8.653–655, 12.140–157³), which is confirmed by stratigraphy in the local area (STOTHERS 2002). An earlier explosion detected by modern volcanologists is the Avellino eruption of Vesuvius around 1640 BCE, which covered the area that is Naples today (SULPIZIO et al. 2010). Diodorus Siculus, Vitruvius, and Strabo, all writing before 79 CE (BIBLIOTHECA HISTORICA 4.21.5⁴; DE ARCHITECTURA 2.6.2⁵; GEOGRAPHY 4.5.8⁶), thought that the rocks and activity on Vesuvius indicated past eruptions. Strabo believed they had ceased, saying, “One might infer that in earlier times this district was on fire and had craters of fire and then because the fuel gave out, was quenched” (GEOGRAPHY 4.5.8⁷). Seneca leaves Vesuvius off his list of well-known volcanoes (SENECA, QUAESTIONES NATURALES 6.1, 6.27⁸). Pliny the Elder lists all the volcanoes he has heard of, and other places where fire comes out of the ground, including some near the Bay of Naples, but does not include Vesuvius (HISTORIA NATURALIS 2.110⁹). He must not have recognized its volcanic character, or perhaps thought it was extinct and not worth mentioning. It is therefore not surprising that when he saw what his nephew, Pliny the Younger, described as an awesome cloud shaped like a pine tree, with a trunk rising up in the air to a high elevation where it spread out, what we might call a “mushroom cloud,” he had to guess which place it was coming from. Soon afterwards, he learned it was Vesuvius. Modern volcanological investigations south and east of the mountain have found a series of shallow deposits indicating that minor eruptive incidents occurred over the years before 79 CE. A small explosion that may have alarmed some of those closest to the caldera may have occurred the night before the awesome event (SIGURDSSON 2002). The Plinies were not aware of it, although noises like distant thunder had been heard for a few days.

² This painting of Vesuvius was discovered in 1879 on a wall in the Casa del Centenario, one of the largest houses in Pompeii. It is now in the National Archaeological Museum, Naples.

³ SILIUS ITALICUS 1934.

⁴ DIODORUS SICULUS 1933.

⁵ VITRUVIUS 1931.

⁶ STRABO 1923.

⁷ Ibid.

⁸ SENECA 1972.

⁹ PLINY 1938.

The ancients might be excused for not heeding such warnings, since earthquakes are common around the Bay of Naples, but the same has not been true of those living in the centuries after the Plinian explosion. Vesuvius was not finished. It erupted again in 172 while Marcus Aurelius was emperor, and at least eight more times up to 1139, when there was a spectacular eruption with fountains of molten lava. Then there was a long period of almost non-interrupted quiet until 1631, when a major eruption killed more than 3,000 villagers and rained ash as far away as Istanbul (DOBTRAN 2006). After that, there followed a series of over twenty important eruptions, averaging 13 to 14 years apart, the last of which occurred on March 1944 during the allied campaign in Italy in the Second World War. That eruption damaged much of an airbase near Pompeii, destroyed at least 80 airplanes on the ground, wiped out several villages, and killed 28 people (CHESTER et al. 2007). The quiescent period since then has lasted 68 years at this writing (2012). In the crater and nearby, there are hot vents of steam and gases that have a sulfurous smell. Sulfur deposits, which are often noted by mountain climbers but seldom seen from afar, confirm that the volcano is still active. Eruptions occurring in the past after long inactive periods have usually been the most destructive ones, and another eruption is inevitable.

In a sense, the volcano has created a trap; the lushness of the vineyards and other vegetation was the result of prior eruptions. Volcanic deposits can become some of the richest agricultural lands on Earth because they contain a wide variety of elements needed for plant growth. They attract farmers to the very places that may be in danger of further eruptions. The only effective plan to avoid damage and loss of life from eruptions is to avoid settlement on volcanic soils near an active volcano. Because the length of time between eruptions can be many years, generations, or even millennia, the short-term economic needs of people lead them to bet against a new eruption in their own lifetimes or those of their children. This virtually assures future disaster.

About 3,000,000 people live in the possible danger zone around the mountain, going about their daily lives without being preoccupied by the thought of an eruption, except for the few who have the responsibility of preparing disaster plans (LANCASTER 2005). Humans are powerless against volcanoes, so the plans have to involve relocation outside the danger area or evacuation before or during an eruption. The Italian government has endorsed both approaches. Relocation is unpopular; the amount offered as a subsidy is small, and only 5,697 families applied in the first two years, a number smaller than those who have moved to the slopes of Vesuvius, many illegally, and occupy homes that may not meet building standards. In 1995 the Italian Civil Protection Agency approved a Vesuvius Evacuation Plan that assumes a warning of about two weeks before an eruption on the basis of seismicity, ground deformation, geochemistry of gas, and gravimetry. The evacuation plan defines a Red Zone containing a number of villages around the volcano, with a total population of almost 700,000, to be evacuated by bus, train, and boat to other parts of Italy in advance of an eruption. The plan has been attacked and its implementation stymied by bitter political controversy. A counter-plan called Vesuvius 2000 was prepared at a conference of scientists and experts, and described the government plan as inadequate, which of course it could well

prove to be in an actual event (DOBTRAN 2006). Meanwhile, real estate promoters and others with development interests tell people that Vesuvius is extinct. Scientists, gathering information from benchmarks, gravity stations, seismic stations, tidal gauges, and leveling lines for surveillance of changes, and having detected a huge pool of magma under the mountain, disagree.

The ancient response to disaster was for the most part uninformed, chaotic, and inadequate. Knowledge of the true causes of volcanic eruptions did not exist back then. During the actual event, social cohesion broke down, and most individuals tried to save themselves and perhaps also those closest to them without concern for the larger community and also without knowing what was the best course of action. One wonders whether the plans for dealing with a future eruption in Naples and its suburbs would be carried out in an orderly fashion, or whether a mass of hundreds of thousands of people (perhaps including official rescuers) trying to save their lives would produce chaos. Pliny reports that those around him when he fled from his uncle's house were disoriented, panicked, and willing to follow anyone who looked as if he knew what he was doing, whether this was true or not. The ancient case study is worthy of careful scrutiny in the modern world. Imagining the people of modern Naples trying to cope with a new Plinian eruption offers a horrifying prospect, in which one wonders whether or not our increase of knowledge has improved our social wisdom and ability to cope. As the Roman poet Statius warned, "This summit does not cease its mortal threat" (SILVAE 4.4¹⁰).

Declension and Restoration

Critics of environmental history allege that it consists in large part of "declensionist" narratives (HUGHES 2006), that is, describing processes by which environmental situations become progressively worse due to human actions. Environmental historians can reply that in many cases, deterioration of the environment is a fact revealed by careful research. While our accounts may be used by environmentalist groups to gain support for their projects, our self-assumed task is simply to give an account of what actually happened, using historical and scientific methods, and to give reasonable conclusions. Some of these conclusions indeed turn out to be cautionary, but they are not exclusively declensionist. They can also be linked to narratives of hope, but when they are, critics including some of the same ones who cried "declension" will cry "modernism", "progressivism," and "presentism." In the US, they label positive accounts of improvement in history "Whiggish." We must therefore be must be critical and realistic as we steer between Scylla and Charybdis.

As an example, there is the environmental history of the Gorongosa district in Sofala Province of Mozambique, a former Portuguese colony in southeastern Africa. For centuries before the Portuguese occupation, traditional farmers with iron tools thinly populated the land at the southern end of the Great Rift Valley and on the lower slopes of Mount Gorongosa. Europeans regarded the wildlife in the area as among the most diverse and numerous remaining in all of Africa. As the

¹⁰ STATIUS 2003.

Mozambican Hunting Commission noted, it is as rich in the variety of species as it is in the sheer numbers of each one. "The numbers of animals that I saw just on a drive of just a few dozen kilometers," said one visitor who frequented hunting parks, "are NOT easily found just anywhere!" (ROSINHO 1981, 9)

In 1921 the Mozambique Company, the Portuguese corporation that controlled the colony, set aside an area of more than 100 km² (enlarged to 3,200 km² in 1935) as a hunting preserve for its employees and visitors (LECANIDES 1948). It expelled the farmers living there, prohibited their hunting, and burned their houses and other buildings. These people moved to other parts of the district, mostly to the west around and near Mount Gorongosa, which is an inselberg, an isolated zone of forested ridges and peaks, the highest being Gogogo at 1,853 m (6,112 ft). Here orogenic rainfall provides the sources of several rivers that bring moisture to lower, dryer areas and fill Lake Urema, the largest body of water in the district. Denser farming on the mountain intensified a process of forest removal that continues. Hunting by local people, regarded as poaching by the Portuguese, continued in the reserve.

The Portuguese colonial government displaced the Mozambique Company in the area in 1942, and in 1960 established the Gorongosa National Park in place of the hunting reserve. By then more than 6,000 tourists were visiting annually. More tourist facilities were constructed and the park became a popular destination to see what was regarded as the old, unspoiled Africa. New regulations prohibited hunting and fishing, and the park's purpose was defined to include scientific research as well as tourism. An ecologist, Kenneth L. Tinley, was hired in 1968 as a consultant to make a survey of the park and its environs. He recommended enlarging the park, and in particular to include Mount Gorongosa within the borders and to exclude farming there (TINLEY 1977). Nothing was done at the time, because the war for independence intervened.

The park escaped severe damage during the war for independence, although soldiers stationed there poached animals. The government of the Republic of Mozambique, newly independent, selected Gorongosa National Park as the site for the first National Conference on Wildlife in 1981. But this hopeful event was almost immediately followed by the invasion of the park by soldiers of an insurgency sponsored by the apartheid government of South Africa. A horrendous civil war raged until 1992, destroying infrastructure and bringing untold suffering and terror to local people (FINNEGAN 1993). Both the opposed armies slaughtered elephants by the hundreds for ivory and rhinos for horns, which they sold to buy weapons and ammunition. Soldiers and dispossessed people, desperate for food, killed buffaloes, zebras, and other hoofed mammals. Lions died as their prey were decimated. Park staff departed, and when they returned in 1994 surveys found that the populations of most large mammals had been reduced to extremely small remnants. The loss is estimated at 90 percent; some species had disappeared. With grazers removed, grass grew much higher and fires started by lightning or poachers were more intense and spread further. This was more than mere declension - it was catastrophe.

The African Development Bank (ADB) initiated a five-year rehabilitation plan – with assistance from the European Union and International Union for the

Conservation of Nature (IUCN) – to rebuild Gorongosa National Park’s infrastructure and restore its wildlife. Fifty new staff were hired, most of them former soldiers. Over a five-year period the project reopened about 100 km of roads and trails and trained guards to slow illegal hunting. The time frame was far too short for effective restoration, however, and the agenda was set by outside agencies, both problems that afflicted many aid programs throughout sub-Saharan Africa (ADAMS u. MCSHANE 1996)¹¹.

A long-term program sensitive to local needs was required, and just such an idea was embraced by Gregory C. Carr, a philanthropist based in the U.S. After careful investigation and negotiation, the government of Mozambique and the Carr Foundation agreed upon in a compact in 2004, later expanded to envision a 30-year effort to expand infrastructure, restore wildlife, and work with local communities for health, education, and economic improvement. The plan is wise because no attempt to restore ecosystems in the national park could be successful without the support of the people who live in and around it (ADAMS u. MCSHANE 1996). Local men became ranger-guards, including many who had soldiered on both sides in the civil war – as one of them said, “We knew where the land mines were buried” (CHARLES 2012, 1). Improvements in the nearby town of Vinho included a school, a health center, and a water pump so that villagers would not have to go to the crocodile-infested Pungue River. Park and foundation staff consulted with elders and *regulos* (chiefs), seeking mutual understanding. To augment the remnants of wildlife, park staff created a fenced sanctuary of 6,200 hectares (23 m²) to hold introduced animals temporarily until their release in the open park. They transported these from other parts of Mozambique and from South Africa, and chose them to improve the ecology but also to provide charismatic animals for tourist viewing. To reduce overgrown grass and understory vegetation, they augmented the numbers of large grazers such as cape buffaloes, zebras, and wildebeest. They brought in hippos to clear out the water plants including invasive water hyacinths in lakes and rivers.

Elephants would help to keep the forest open, so more were moved in. During the civil war tuskers had been killed preferentially for their ivory, leaving tuskless survivors to make up much of the population, therefore males with large tusks were chosen for introduction to improve the genetic pool. Elephants that had been in the park during the war had learned to fear humans and their vehicles, fleeing or attacking any that came too close, overturning trucks and sometimes killing their occupants. Other animals also flee when humans approach, but it is hoped that they will be accustomed to human presence much as they are, for example, in parks in Kenya, and experiments have been launched to attempt that result¹². The effect of reintroductions, and the increase of the small surviving numbers in the park, must be carefully surveyed. Natural processes will inevitably have greater effects than human interventions. Numbers of warthogs, antelope, and baboons are notable today, but lion numbers have increased little until recently, possibly due to less availability of larger prey.

¹¹ Other projects in Africa have taken the warnings of this book seriously.

¹² An effort to accustom Gorongosa elephants to human presence is presented theatrically in the National Geographic Society film, “War Elephants” (2012).

In 2011, the government of Mozambique set aside the land on Mount Gorongosa above 700 m (2,300 ft) elevation as a separate part of Gorongosa National Park, fulfilling the vision of ecologist Kenneth Tinley. At the same time, it created a buffer zone of 3,300 km² (1,274 m²) surrounding the park. Infrastructure including tourist facilities is improving, and animals are seen in greater numbers than at the end of the war. (Fig. 2) Continuing problems include poaching and hundreds of fires, many of them incendiary and uncontrolled. But there is promise in the fact that those working for restoration include Mozambicans and Portuguese, members of both parties in the civil war, local people from nearby villages and government people from Maputo, and scientists and others from around the world.

Thus far the environmental history of Gorongosa could be interpreted as a story of ecological disaster followed by the beginnings of restoration. Questions remain. To what extent does restoration depend on human effort, and on the input of major external resources such as those provided by the Carr Foundation? Will the ecosystem recover to a great degree on its own? Will local communities improve their conservation efforts? Can the restoration to something like the prior ecological state be expected? However these questions may be answered (or not), the narrative is not simple declension; it is also the role of human creativity and effort based on history and science.

To Heed or Not to Heed?

The history of international conferences and agreements on environmental issues offers another cautionary narrative. Delegates to these meetings represent the interests of nations, governmental agencies, and regions. Successive United Nations environmental conferences have increasingly emphasized development at the expense of conservation. This is reflected almost blatantly in the themes selected for the meetings. The first, held in Stockholm in 1972, was titled “The United Nations Conference on the Human Environment”. The Rio summit, 1992, was called “The United Nations Conference on Environment *and Development*”. Then Rio + 20 in 2012, completely eliminated the word “environment,” under the headline, “The United Nations Conference on *Sustainable Development*”. This eclipse of environment in the themes is notable to some extent in the agendas as well, as economic issues rose to the top. Their agreements for the most part contain few stipulations for enforcement, and seem to have had lessening practical effects, with some encouraging exceptions. This may well have resulted from two attitudes at the opposite ends of the world economic structure.

The leaders of so-called Third World nations announced, and no doubt believed, that environmental measures proposed at these conferences would impose costs and restrictions on them that had not limited industrialized nations during their earlier period of development, when their growth had squandered natural resources at home and abroad, and produced prodigious emissions of pollution. They asked for economic measures before environmental ones, and demanded that developed countries provide them aid for any environmental measures. Thus they “thought locally” before they “acted globally”¹³. As Indira Gandhi, the only head of state to

¹³ The converse of the oft-used phrase, of unknown origin, “Think globally, act locally.”

travel to Stockholm 1972, pointedly remarked, “Are not poverty and need the greatest polluters?” (TOLBA 1988, 15).

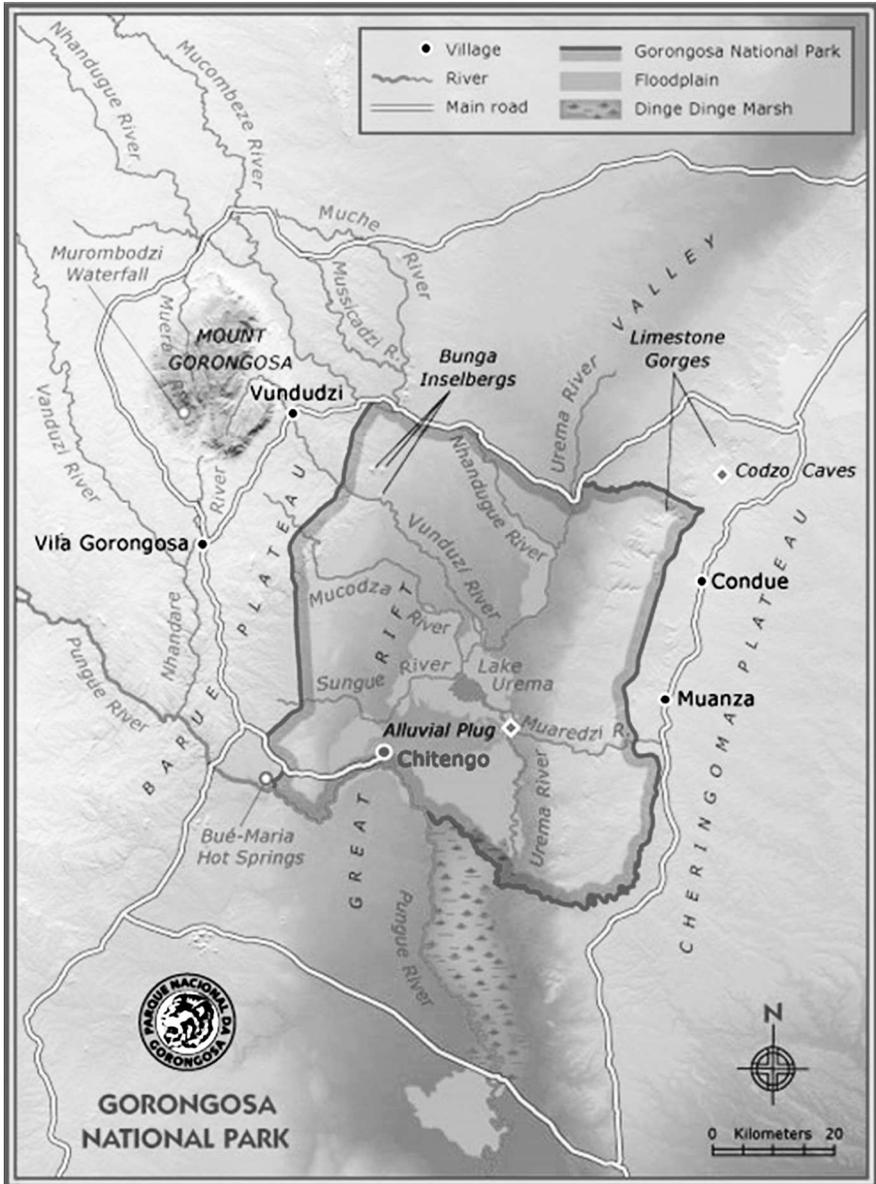


Fig. 2. Map of Gorongosa National Park, with the disjunct Mount Gorongosa addition to the northwest. The sanctuary is near the road west of Chitengo. Courtesy of Public Relations, Gorongosa National Park.

At the same time, industrial leaders deemed that international agreements to protect the environment threatened to curb development (and to limit their profits), and therefore used their considerable influence to center the agenda on economic issues. They were faced with statements such as this one by A.S. Bhalla: “The world has experienced unprecedented and spectacular economic growth since 1945, largely based on technological advances. However, the environmental impact of such development – reflected in increasing pollution, environmental deterioration, and the exhaustion of natural resources – has been a source of major concern, ... and this has led to increasing agreement that growth at such costs cannot be sustained for long, except at the risk of our survival” (BHALLA 1992, 11).

In response, they seized upon the words, “sustainable development,” first promulgated in the Brundtland Report (1987), the result of a four-year study sponsored by the United Nations World Commission on Environment and Development. It defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT 1987, 43). Here the emphasis is on development, and the moral concern is for future generations (though how many of them is left unclear). This definition says nothing about sustaining the environment, the Earth, or its ecosystems, although the report as a whole does address these issues. Subsequent discussions have taken development, rather than balance with available resources, as the desideratum. Statements by business and political entities have rarely acknowledged the importance of sustaining anything beyond economic growth.

Stockholm 1972 laid the foundation for the United Nations Environment Programme, which forwards environmental programs within the structure of the United Nations. It was hampered by the facts that it was a program, not an agency; that it had an inadequate budget and small staff; and that its headquarters were established in Nairobi, Kenya, symbolic in that it was the first UN unit to be located in a “Third World” country, but isolated from UN headquarters in New York and Geneva. As a result, it had to depend on long-distance communication and its subsidiary New York office. Nonetheless, it had many accomplishments, including the maintenance of an information-gathering program, provision of diplomatic support for the evolution of a body of international environmental law including service as a secretariat to several important treaties, the negotiation of regional agreements such as the Mediterranean Action Plan, and a worldwide environmental education program for nations and people, including publications.

Perhaps the most impressive achievement of UNEP’s labors was the drafting and negotiating of the Vienna Convention for the Protection of the Ozone Layer and the 1987 Montreal Protocol, aimed at reducing the production of chlorofluorocarbons (CFCs) and other chemicals that weaken the Earth’s atmospheric shield against harmful ultraviolet radiation (TOLBA u. RUMMEL-BULSKA 1998). This is one of the most successful international environmental agreements, with excellent compliance around the world (Ibid., 57). Scientists took an active part in the negotiations, and even though there were uncertainties, important political leaders involved decided to take the side of caution. There was strong support from NGOs and public opinion, especially in the US, reflected in declining sales of spray cans. The US

banned spray cans with CFCs in 1978. The US provided leadership in the negotiations (including, surprisingly, President Ronald Reagan though not the ideologues in his administration), while Canada and some European nations gave support. The European Community, a major producer, was opposed but eventually Germany and the UK brought it around. The Montreal meeting was small enough to reach consensus, and was mercifully short. Throughout, the United Nations Environment Programme and its head, Mustafa Tolba, actively worked for the agreement. The agreement took account of the special problems in North/South inequalities, and included reasonable positive and negative market incentives. Although industry producers fought against regulation almost every step of the way, they finally decided to phase out CFCs and seek substitutes. All major nations supported the Montreal Protocol, and CFC production was sharply reduced as a result (TOLBA u. RUMMEL-BULSKA 1998). This and other successful agreements are encouraging historical examples demonstrating that humans can be creative enough to find ways to reverse damaging trends. A celebration held for the 20th anniversary of the protocol in 2007 has been somewhat dampened by the discovery that HFCs, the chemicals often used to replace CFCs, are potent greenhouse gases and also need to be phased out.

A document emerging from the Rio 1992 UNCED conference was the Framework Convention on Climate Change (FCCC), a proposed international agreement that sought to limit or reduce emissions of gases, mainly carbon dioxide and methane, possessing the potential to exacerbate global warming. The discussions preparing for this convention took place with the positive background of the Montreal Protocol. The negotiation of the FCCC was a much more difficult process. Its objective was “to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”. (UNITED NATIONS 1992, Article 2).

Observation by atmospheric scientists had shown that a rapid increase in the concentration of these gases was occurring, and that it was associated with a rise in the average temperature of the Earth. Computer models suggest that the effects of these changes, should they continue, will vary in different regions of the Earth’s surface, but could include rising temperatures, changing patterns of precipitation, an elevation of sea level, disruption of freshwater flows by removal of ice, and stresses on agricultural crops, forests, and wildlife, including coral reefs and fish because of changes in ocean temperatures and acidity. Many world leaders agreed that these dangers called for an effort to reduce the level of greenhouse gas emissions, but to do this for carbon dioxide and methane, the most important heat-trapping gases, is more difficult than it was for CFCs. Disagreement over the actions recommended to counter global warming figuratively raised the temperature of the meeting rooms. The US and other nations managed to keep any emission reduction goals or timetables out of the agreement.

A conference to set arrangements for meeting the goals of the FCCC, including specific reductions in emissions of “greenhouse” gases and timetables for achieving them, was held in Kyoto in 1997. Goals were accepted by Japan, the US, and the European Union, but developing countries, including such increasingly important emitters as China, India, and Brazil, were not required to agree to any specific reductions. The US successfully pushed for the inclusion of the principle of trading emission rights, that is, that nations that continue to pollute could continue to do so by paying for that right to other nations that have reduced their pollution below the targets. As an economically powerful nation, the US could trade for such rights and not have to reduce emissions to as great an extent.

Observers noted that it would take reductions several times those envisioned in the Kyoto Protocol to bring emissions down to a level that might be effective in reducing the rate of global warming. The cost of measures to achieve those reductions would be high; whether it would be greater than the costs incurred by global warming is unlikely, but unknown. Kyoto was one step of many that would have to be taken as the magnitude of the effects of global warming on human health, the economy, and the natural world becomes clearer, and when most nations come to see international cooperation to initiate effective measures as being in their national interest. However, that has not yet occurred. President George W. Bush rejected the Kyoto Protocol in 2001. By 2005, enough other nations had agreed so that the protocol could enter into force, and this was done formally at the UN Climate Change Convention in Montreal, Canada. At the same meeting, participating nations agreed to extend the Kyoto Protocol beyond its December 2012 expiration date and to conduct negotiations on deeper emissions cuts. Unfortunately there was little indication that the original target reductions would be achieved by 2012.

The eighth Meeting of the Parties to the Kyoto Protocol was held in 2012 in Doha, Qatar. That round of climate change negotiations agreed to extend the Kyoto Protocol to 2020, and recognized that developing countries had been harmed by the failure of developed countries to make meaningful reductions in greenhouse gas emissions. However, no agreement emerged on new goals in emissions reductions or on specific amounts of aid to developing countries. Those who hoped for effective movement toward action were disappointed.

Historians and geographers are aware of climate changes in the past – the Medieval Warm Period and the Little Ice Age are prominent examples – and the effects they have had on human societies. They know that the careful work of the Intergovernmental Panel on Climate Change (IPCC) indicates that the present warming has no precedent in human history. They, the participants in the meeting, and major polluters such as China, the US, India, and Brazil, have not made significant progress in reductions of emissions. Success similar to that of the Montreal Protocol has until now eluded negotiations on countering global warming.

Vesuvius still looms over Naples, and authorities in Rome and Campania could indeed cooperate on a plan to save people from the inevitable eruption. Gorongosa is healing, while its future as an ecosystem and park is linked to the political stability and economic revival of Mozambique. The worst aspects of the unmistakable environmental effects of global warming now under way could be

moderated if the process of international negotiation moves toward the model of the Montreal Protocol, and if local entities take effective action to meet goals. It is not enough to say that history shows humans will always find ways of ameliorating dangerous processes. Environmental history also reveals the cautionary perspective that knowledge has not always entailed accomplishment. From ancient times until today, to heed or not to heed, that is the question.

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