The “Earth Transformed” Program

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ABSTRACT: The authors summarize the results of the international symposium “The Earth as Transformed by Human Action” held at Clark University, USA, in October 1987 with the purpose of inventorying human impact and environmental changes over the last three centuries. There are suggestions on the comparison of driving forces and environmental changes on the regional and global scales, and on the conceptualization of the human dimensions of global change. Some perspectives of the further development of the international and interdisciplinary “Earth Transformed” project are also discussed.

In 1987 a group of more than 80 scholars representing a wide range of nations and disciplines met at Clark University in Worcester, Massachusetts for a week-long symposium devoted to the subject of “The Earth as Transformed by Human Action”. The product of several years of planning, the symposium examined, through the presentation and discussion of some forty papers, the major changes wrought in the biosphere by human activity over the past three centuries, and itself represented a major step on the route towards a volume of the same title (now in press) and a subsequent expanded program of study.1

The project drew upon a tradition of concern with the historical breadth of humanity’s modification of its terrestrial habitat that had previously found expression in two wide-ranging studies: George Perkins Marsh’s Man and Nature; or, Physical Geography as Modified by Human Action (first published in 1864), and Man’s Role in Changing the Face of the Earth (1956), edited by William L. Thomas, Jr. from the proceedings of a symposium held in Princeton, New Jersey in 1955. The rationales for a new assessment were several. The rapid increase in specialized knowledge since the 1950s, the product of vastly improved conceptual and research tools, had outstripped the tasks of synthesis and historical interpretation. The ever-more apparent visibility of human impacts generated by the demands of rising populations and standards of living called urgent attention to environmental issues. Beyond such quantitative changes lay the hint of a qualitative one. Whereas Marsh spoke of an earth modified and the Princeton symposium of the human role in changing the earth, the topic could now accurately be described as the earth transformed, because of both the changes that had taken place since the 1950s and the less visible changes, particularly in biogeochemical cycles, that were already underway at that time but of which we have only become aware since then.

Yet the “Earth Transformed” (“ET”) symposium and volumes from the outset took a path somewhat different from those of its two predecessors. The qualities of idiosyncratic insight, literary skill, and imaginative personal synthesis so evident in their pages were not to be the central goals (though certainly not to be rebuffed when offered); an empirical and science-based approach was chosen, its objective a more orchestrated, comprehensive, and rigorous inventory of the major transformations of the biosphere. For besides its place in such a historical progression, the “ET” project was also designed to fill several gaps in the current profusion of scientific studies of “global change.” Predictive assessments of our environmental plight already abound, while even scholarly studies tend to focus on current processes to the exclusion of any significant historical
dimension; and much research, exemplified most recently by the International Geosphere-Biosphere Program, focuses on the physical transformations with little attempt to understand the social processes that created them.

The “ET” effort was planned around these gaps as an assessment of historical magnitudes and trends in environmental alteration that would also, while not making it the prime focus, constantly keep the social dimension of transformation in view and seek paths towards its further exploration. A time span of three centuries, from the late seventeenth century to the present, was chosen in order to capture the changes wrought by the great human revolutions of industrialization and global interconnection. The principal goals of the symposium and volume were to undertake a systematic inventory of the components of the biosphere as they have been affected over this span of time, in order to provide a reliable assessment of the state of our current knowledge and current ignorance, and to move towards an examination of the human actions responsible for those changes that have occurred.

Towards this end, topics were identified, the papers commissioned from leading experts, many from teams of experts, and preliminary drafts of most papers were circulated prior to the 1987 meeting. Discussions following brief presentations at the meeting, and editorial review and criticism, formed the basis for revised versions incorporated into a volume (“The Earth as Transformed by Human Action.”) The symposium results have formed the basis for several new projects now being undertaken within the expanded “ET” Program.

The original division of global topics rested on a commonsense distinction between “faces” and “flows” of the biosphere, or between the components or compartments that exist or can be studied at rest as landscape-like features, and those that exist in motion through these compartments. The original faces were population, land use, water management, atmosphere, the marine environment, forests, soils, and terrestrial and marine animals; papers on coasts and plant biota were commissioned after the symposium, while population was treated instead as a social variable. The flows examined were carbon, sulfur, nitrogen and phosphorus, sediment, trace pollutants, climate, the ionizing radiations, and water quality and flows.

This scheme required some modification; it became evident that the general distinction between faces and flows did not adequately parallel the major distinctions in transformation across time or space. Nor was it clear how some topics, such as climate, were best classified in this framework, while the two papers on water, though clearly divergent in approach and focus, likewise both cut across the boundary. During the editing of the papers and the syntheses of their findings undertaken for the introductory material in the volume, it seemed more useful to group the components in sets according to common physical characteristics or frequent historical association. This also made it possible to characterize the broad trends in global and regional transformation in terms of the sets most affected.

Many of the figures of the magnitudes, chronology, and geography of transformations provided in the global papers should be treated as estimates, based on current knowledge, rather than be repeated as established or proven fact. They are offered in the hope of establishing either starting points or new way stations for further progress that may draw upon both improved theoretical assumptions and more dependable and abundant data. But the results obtained do make possible at least a preliminary description of trends in change over the three centuries.

In the earlier phases of the three-hundred-year period, the most significant human induced changes at a global scale involved land use, the forests, the terrestrial animal biota, and sediments and soils, and stemmed from the largely agricultural and colonial expansion of human activity. New clusters of transformations were introduced with the advent of industrialization while the agrarian-based alterations already under way accelerated and spread under the pressures of clearance and resource extraction promoted by increasing population, and economic growth and integration. In more recent times, most of the components have shown still further accelerated alteration. But the picture is not one of ever-more rapid change in all areas. In some major components – the sulfur cycle and the forests, for instance – net global human-induced change may have either slowed down or levelled off in the past decade or two, although estimates of forest area show wide discrepancies among one another. In both of these, however, change has still reached an imposing plateau: the annual human contribution to the world sulfur budget now matches the natural, while a net area almost the size of Europe has been cleared of forest during the Holocene. A rough world regional division between the developed and the developing countries, moreover, has become necessary in the discussion of global trends; current patterns in sulfur emissions and deforestation follow this pattern, with improvement in the “North” balancing continued rapid transformation in the “South.” Regulation has likewise had more tangible effects in the wealthier nations in other modest areas of success – in improving the quality of air and water and in controlling the release of some trace pollutants and the depletion of some animal species.

While the principal focus of the project was on the global inventory of three centuries of change, several additional sets of papers were included to maintain perspective on other significant questions. Fourteen regional case studies, of which twelve will appear in the published volume, explored the ways in which faces and flows changes were manifested, singly and in interaction, within particular social and physical environments differing widely from global composite conditions. Here, more