

On Frontiers of Natural Environments

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Carson [1] sounded the alarm, people took notice, and a movement was born. In the half-century since Silent Spring, societies have become much more acutely aware of a chronic problem; there are so many of us, approximately 7.2 billion [2], and our numbers will continue to grow to an estimated 9.6 billion by 2050 [3]. In order to survive, we push relentlessly against the boundaries between consumption (or, depending on who you are, overconsumption) and conservation; clearly, one of the biggest challenges humanity faces, one that may mean the difference between our species survival and extinction, is how to best manage the remaining resources available to us. We face challenges concerning ecosystem services, biodiversity, and the production and consumption of energy. It is simple hedonistic calculus, action and reaction with a philosopher's twist: As demand for ecosystem services grows, something has to be taken to satisfy those demands. Curbing demand would seem the most logical choice, but so far, that has proven easier said than done. The pleasure of utilizing those resources often masks the pain of the harvest, in many cases, because the consumer is so far removed from the source – what happens in one place can affect another, far-removed place [4]. Yet as Garrett Hardin [5] opined, and many have echoed, we are often blind to the ultimate destruction we are bringing upon ourselves by what at first appears to be the optimal solution given a set of circumstances. Through the continued destruction of wetlands, tropical and temperate rainforests, deciduous forests, as well as gross mismanagement of farmland and its life-giving skin of the Earth, arable soil [6], we lose much more than geographic area classified as a particular biome, we lose biodiversity, the necessary richness of species spread across the planet. It then stands to reason that destroying those areas, thus reducing biodiversity, is a monumentally important consideration as well [7]. Yet, we do not possess adequate measures to even understand how much we are affecting the diversity of life on Earth [8], and as argued by Ferrer-Paris et al. [9], even knowing where groups of organisms are and in what concentration – the distribution of species – can prove challenging! We must strive to better understand the natural world, its infinite complexity, and our place in that scheme. Many summits, conferences, and symposiums have convened in order to identify the grandest challenges before humankind today. While the results may vary in their carefully detailed and purposefully chosen words, common themes emerge; one of the most important today is the concept of sustainability. We may be able to agree that “sustainability” means the ability of a given system to continue ad infinitum, but in the context of environmental management, as Brown et al. [10] point out, neither global nor operational definitions present themselves with quite as much simplicity. Temporal and spatial considerations and context become vital as the problem shifts from global to regional to local, and back again (the modifiable aerial unit problem, or MAUP, as described by geographers [11]). Within the framework of sustainability science, we will continue to be challenged to better incorporate renewable energy sources and natural resources into viable and realistic solutions at all scales. We must find ways to live within the means the planet can realistically continue to provide, so that humanity may continue to exist. According to the United Nations Millennium Ecosystem Assessment, our current technologies may be well-suited to assist us in addressing the host of environmental problems we face, but we have yet to address, in earnest, a problem of perception. The flawed hope (and for decades,

continuing even today, the flawed practice) of simply assuming there is no price tag on the ecosystem services we are consuming will be an enormous barrier to real and permanent change. True, we have come a long way from the days of men like William Gilpin (the first territorial governor of Colorado and a staunch advocate of “conquering” nature and Western Frontier), but as though we have a long way to go. We must find the strength to abandon the notion that natural resources are unlimited. We are also seeing the emerging BRIC countries (Brazil, Russia, India, and China, and to an extent, South Africa) ramping up their hunger for cheap energy and durable goods without looking to the lessons already available from the emergence of past giants on the global stage; the result: steadily increasing Carbon dioxide emissions [12,13]. While the notion of perception may be the purview of the intangible, the results of our actions within the world around us cut very visible scars into the Earth through the thoughtless large-scale removal of materials. It is this mass exodus of the planet's tangible offerings that carries a price tag far greater than we may realize, and it is this price tag which we must discover [4,14]. How much of the physical Earth can be mined before we gush past the threshold at which we can extract no more ceiling fans, running shoes, and ski trips to Vail? Where does the boundary between sustainability and continued (and comfortable) existence, lie? Managing the triple bottom line, the intersection of environment, economic, and social concerns is highly sought after and inherently difficult [15]. In fact, this consideration is central to the key findings of the MAE, where it is stated, “Better protection of natural assets will require coordinated efforts across all sections of governments, businesses, and international institutions”. As more of us appear, more stresses on our already strained resources tell us it has become more important than ever to understand this complex threefold dynamic, as any major perturbation in one area inevitably will lead to disruption in another. Human and natural systems are inextricably linked and fantastically difficult to unravel or in many cases, even understand [16]. But we desperately need to strive to do so, for it is the extent of the human influence on natural systems that provides us with our most formidable challenges.

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