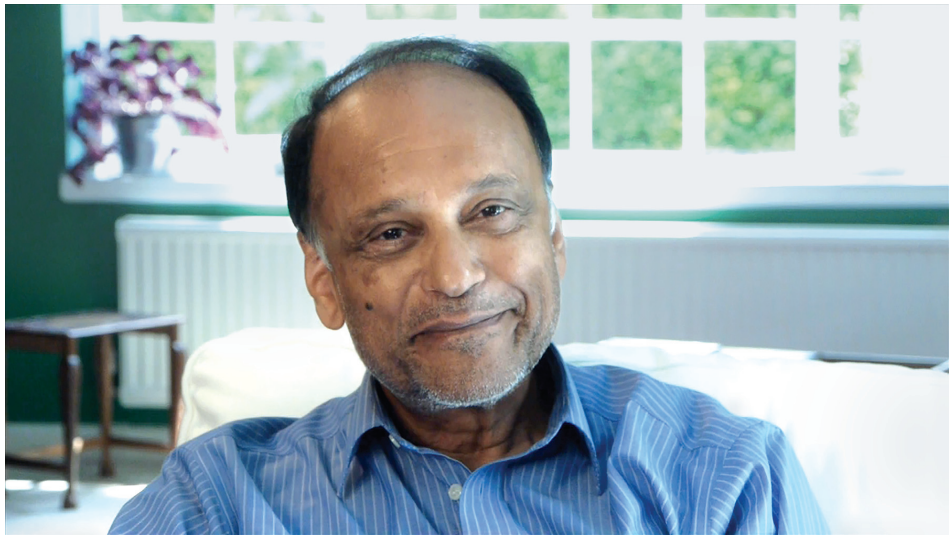

Partha Dasgupta

ANNUAL REVIEWS

Annual Review of Resource Economics

Sir Partha Dasgupta: Meeting the Challenges of Environmental and Development Economics

Partha Dasgupta,[1] Gordon C. Rausser,[2] and David Zilberman[2]

[1]Faculty of Economics, University of Cambridge, Cambridge, United Kingdom; email: pd10000@cam.ac.uk

[2]Department of Agricultural and Resource Economics, University of California, Berkeley, California, USA; email: rausser@berkeley.edu, zilber11@berkeley.edu

Annu. Rev. Resour. Econ. 2023. 15:1–18

First published as a Review in Advance on June 12, 2023

The *Annual Review of Resource Economics* is online at resource.annualreviews.org

https://doi.org/10.1146/annurev-resource-102422-092155

Keywords

autobiography, environmental economics, development economics, sustainability

Abstract

The *Annual Review of Resource Economics* presents Professor Sir Partha Dasgupta in conversation with economist Dr. David Zilberman. In the conversation, we follow Sir Partha's life from his childhood in Bangladesh, where his father was a distinguished economist, to his childhood and undergraduate studies in India, his graduate studies in England, and his fascinating academic career, mostly in Cambridge, UK. We discuss Sir Partha's seminal contributions to multiple fields. He was among the founders of modern resource economics and the emerging multidisciplinary field of ecological economics. He also played a fundamental role in establishing the venues and agenda for research on the environment and development, led initiatives to incorporate nature into national accounting, and pioneered analysis of the economics of population growth and the foundation of a just society. We also learn about Sir Partha's family and life, his collaboration and perspective on leading scholars, and his vision for economics, science, and humanity.

INTRODUCTION

Sir Partha Dasgupta is one of our time's most creative and significant economists. As a researcher, he has combined technical savvy with a social conscience and rich imagination to break new ground in different fields: He launched the field of environment and development economics; he pioneered a dynamic model incorporating population, natural capital, social capital, and produced and human capital for studying economic growth, which led to the development of aggregate measures of sustainability that should augment standard national accounts in assessing economic well-being; he introduced natural resources to the study of industrial organizations and the notion of a backstop technology in an uncertain future for designing resource policy; and his multidisciplinary inclinations led him to develop a better understanding of the economics of science and technology.

Even more importantly, perhaps, he has in a steady stream of articles and books over the past four decades reconstructed growth and development economics and the economics of poverty in a way that sees the human economy as embedded in nature, not as external to it. That body of work culminated in the launch at the Royal Society in February 2021 of his widely acclaimed treatise, *The Economics of Biodiversity: The Dasgupta Review* (Dasgupta 2021). As an independent, global review, the publication was commissioned by the UK government in the spring of 2019 and is due to be published, with additional technical material for graduate students, by Cambridge University Press in 2023.

Sir Partha is an institutional builder. With the late Karl-Göran Mäler, he founded the journal *Environment and Development Economics* (*EDE*) and the South Asian Network for Development and Environmental Economics (SANDEE) and has been active in both. He received the 2002 Volvo Environmental Prize (joint with Mäler), the 2007 John Kenneth Galbraith Award, the 2011 Zayed International Prize for the Environment, the 2015 Blue Planet Prize, the 2016 Tyler Prize, and the 2021 Kew International Medal of the Royal Botanic Gardens, Kew. He is the 2022 Laureate of the United Nations' annual Champion of the Earth Award in the Science and Innovation category, the first economist to receive this award. In the 2023 New Year's Honors List of His Majesty King Charles III, Dasgupta was named Knight Grand Cross of the British Empire for service to economics and the natural environment. Sir Partha is a fellow of the Econometric Society, the British Academy, and the Royal Society; an honorary member of the American Economic Association; a foreign member of the American Academy of Arts and Sciences, the American Philosophical Society, and the US National Academy of Sciences; and past president of the Royal Economic Society, European Economic Association, and European Association of Environmental and Resource Economists.

A CONVERSATION WITH SIR PARTHA DASGUPTA

This conversation took place on June 20, 2022, in Rimini, Italy.

Zilberman: You are the son of an important economist. Tell us about your family background and how your father's research affected your work. Also, tell us about the intellectual richness of the Bengali community that led to so many important contributions to economics.

Tell us about your childhood and the trauma of moving from East Bengal to India (I was touched when you told me how your father was affected by the move but adapted to it, and how you were sent to a boarding school and your experience there). Throughout your career, you migrated and were part of multiple communities, and it seems that you were able to fit in and prosper. Can you tell us about some of the transitions?

Dasgupta: I was born in November 1942 in Dacca, East Bengal, then in united India and now the capital city of Bangladesh and known as Dhaka. My maternal grandfather was manager of

a jute mill in Dacca, which is where my mother was born. The family lived comfortably until the Great Depression when the market for jute collapsed. My paternal grandfather was an employee in provincial government, residing in Bhanga, the district capital of Faridpur, in the Ganges-Brahmaputra Delta of East Bengal. My father was born there. On retirement, my grandfather and his family moved to their ancestral home in Goila, a village in the neighboring district of Barisal. My father's childhood was spent there. My father's mother was also from East Bengal.

Barisal is an especially poor region. When my father was born, the family was financially impoverished but had a long scholastic history. As I understand it, my paternal line was a dynasty of scribes, dating back to the seventeenth century. Three of my grandparents died before I was born, but I knew my maternal grandmother well. She was a woman of great independence of mind. One of my mother's sisters, quite a bit older than she, was married at age 13 and widowed at 15. My grandmother insisted that fate should not befall her youngest daughter. My mother graduated from Dacca University and married my father at the age of 22. She had a deep interest in both Bengali and English poetry, but I didn't realize that until she was old. When I was growing up, she was wholly engaged in raising a family, managing our home, and looking after my father. I have an older sister, Alaknanda, who became a distinguished singer of north Indian classical music and subsequently a social historian with a remarkable publication, in Bengali, on life among Bengali middle-class women in the first half of the twentieth century. My sister conducted archival research, discovering scores of letters written by women in my mother's extended family of relatives and friends, detailing their daily lives—what they cooked, what they purchased, at what price, what their concerns were, and on occasion their aspirations—in the decades that included the Great Depression, the Second World War, and India's partition. The book is a homage to our mother. In 2009 she compiled and edited the complete works of our father in three volumes for Oxford University Press. And it is hard to imagine how she had to persevere to track down his publications in the war years.

My father's eldest brother, the head of the family once my grandfather had died, left his studies incomplete to support the extended family. He both encouraged and supported my father to study economics in college and subsequently at Dacca University. It is one of the underappreciated nuances in the colonial relationship between India and England that at the suggestion of the University's Vice Chancellor, Philip Hartog, my father was appointed Lecturer in the Department of Economics even as he sat for the MA examination, in 1926. That, though, was the only break he enjoyed from the university. He borrowed funds in 1934 to work toward a PhD (1934–1936) at the London School of Economics (LSE) under the supervision of Lionel Robbins and returned as unarguably the leading economic theorist on the Indian subcontinent. Through his teaching and writings, he established modern resource allocation theory there. Nevertheless, he remained a lecturer at Dacca University until 1946, which is when he accepted a senior lectureship at Delhi College (an affiliated college of the University of Delhi). It was a wise decision, most especially because India's partition in 1947 was accompanied by extreme violence in Bengal. There were of course communal tensions, including riots, even before 1947, but in Dacca we had remained safe, in part because of the support and protection afforded to us by both Hindu and Muslim students.

I was too young to feel our dislocation to Delhi, but I do remember we left Dacca hurriedly, with only our luggage and a few of my father's books. In fact, that was pretty much all we possessed, as my father was still paying off his debt and continuing to provide financial support to his oldest brother and his large family. I still cannot imagine how my mother kept us fed and dressed all those years with the meager funds available to her.

I don't believe the post at Delhi College suited my father, because in a few months we moved to Ravenshaw College, in Cuttack, Orissa (Odisha). And it was only when we moved, in autumn

1947 to Banaras (now Varanasi), where my father was appointed Professor of Economics at Banaras Hindu University, that I began to live a settled life. Both of my parents had assumed they would spend their life together in Dacca—they had a deep affection for the city, the university, and the culture of Bengal—but I can't recall ever hearing either of them complain, even lament, that circumstances had dislocated them to what at that time must have felt an alien language and culture that was Banaras. I believe it was because of a fear that my very precocious sister, who was at that time 10 years old, would lose her proficiency in Bengali that she was sent to live and study in Santiniketan, a renowned school in West Bengal, founded by the poet Rabindranath Tagore. I still remember my mother crying as she composed her weekly letter to my sister.

Although ours was an academic household, my parents let me spend my days in the manner I chose (playing in the university fields). I received tutorials on Hindi and arithmetic one hour a week from a teacher well known on campus for coaching academics' children, but that was all the formal education I received. It was only when we moved from Banaras to Washington, DC in December 1950, when I had just turned eight, that I entered school properly, perhaps because school attendance was compulsory in the United States. I once asked my parents why my sister had been encouraged in her studies from a very early age while I had not. My father replied that she had shown a deep interest in studies, whereas my mind was always in the playground. On recalling those days, I can't help thinking I was at risk of being spoilt silly by my parents and my sister. Although a very great scholar, my father was never too busy for us. In many ways my mother set the ethos. There were always guests at meals—students, friends, colleagues—and there was much laughter in our home.

We moved to Washington, DC in December 1950 because my father had been asked by India's Finance Minister to serve as Chief of the International Monetary Fund's (IMF's) South Asian Division. We were there for three years, the shortest tenure my father could have if he wanted to draw an IMF pension. As it happened, that provided my parents with a comfortable, if austere, retirement in Santiniketan. My memory of Washington is that we missed India for a brief while, but then grew to love the place. My mother, for the first time, enjoyed freedom from the financial stringency she had had to exercise in India. We all enjoyed the city enormously; the contrast between what Banaras and Washington had on offer in those days is unimaginable today. But my father missed teaching. He compensated for a lack of formal students by inviting young economists at the IMF to dine with us regularly. I believe my sister made up her mind at age 14 to marry I.G. Patel, a young economist at the IMF and my father's favorite there. In fact, they were married when she had completed her university studies in India in 1958. Over the years my brother-in-law became Chief Economist and then Principal Secretary at the Ministry of Finance of the Government of India and Governor of the Reserve Bank of India; he later retired as Director of the LSE. He had a great influence on my social and political sensibilities. Leaving Washington in late 1953 was wrenching for me. My fondness for the United States goes back to those years. Even now, whenever I arrive at the immigration counter of a US airport, I feel I am returning home.

Although the field of classical political economy attracted some of my father's most profound writings, for example, his book titled *Epochs of Economic Theory* (Dasgupta 1985), he was a Marshallian at heart in his analytical thinking. George Stigler once told me he and my father were the last Marshallians. In his obituary of my father, Amartya Sen (Sen 1994) wrote what drove my father's economics can best be called astute compassion. Sen was exactly right. The astuteness displayed itself in the many instances where the policies he commended for Indian development plans were at odds with the ones in current vogue. That independence of mind, the insistence that policy should be built where rigorous analysis leads one to be irrespective of one's prior convictions or current fashion, lay behind his belief that there should be a distance between theory and policy; that if theory is too close to policy, it is at risk of being shallow.

Religious practices were not routine in our home. My mother followed a few of Hinduism's basic rituals, but even during the brief prayers she offered to the household goddess each day, her mind would be in the kitchen. My father in contrast had a distaste for organized religion. He was drawn to a strand of Brahminic thought that had dispensed with rituals and made religion an entirely private meditation. The briefest way to get a sense of his approach to life is to say it was a distilled form of Vedantic philosophy. In this he may have been influenced by his father, who in his retirement meditated daily on the banks of the village pond in Goila, our ancestral home, with his back to the village temple.

Scholarship was hugely prized among the middle class in Bengal. In the nineteenth century, Bengal enjoyed a Renaissance, blending the English Renaissance of the previous centuries with a strand of Brahminic thought that did away with the need for rituals (the Tagore family did not come out of nowhere). I don't believe my father had any difficulty accommodating his sense of the sacred with his commitment to empirically driven rational discourse; for as I understand it, Vedanta sees the two at harmony with each other. On social thought my father had been much influenced by John Stuart Mill. As he found urgency in applying economics to study the widespread poverty in India, my father was drawn more to liberal socialism than Mill would have countenanced, but he fielded the tussle between liberalism and socialism with equanimity. A social thinker he admired enormously was Bertrand Russell, so of course in my teens I read Russell's social essays avidly. The one criticism I heard my father level against Russell was over what he called Russell's waywardness; he had in mind that Russell had been married three times and had reported many affairs.

On return to Banaras in late 1953—I had just turned 11—I went to study at La Martinière College, a well-known school in Lucknow, some 200 miles from Banaras. My parents' reasoning was that as I had become proficient in English, there was a risk that I would lose it were I to be enrolled in Banaras, where schools had Hindi as the medium of instruction. I would not know when I went to boarding school in Lucknow that, excepting for holidays, that was the last time I would reside in our family home.

La Martinière was a famous school, but I hated my time there. Teaching was almost always by rote, life was regimented, and corporal punishment was routine. On the other hand, to complain to my parents would have meant them having to find an alternative school for me. It was more than two years later, when in the summer break I told my sister of my experiences there that she informed my parents and insisted I should be moved. On the advice and encouragement of a friend of my father, the renowned social thinker and activist Achyut Patwardhan, I was enrolled in what is today known as Rajghat Besant School, in the vicinity of Banaras, at the confluence of the rivers Ganges and Jamuna. I was 13 then.

The school was founded in 1934 by J. Krishnamurti, a philosopher and public speaker with a global following. Krishnamurti had been adopted by Annie Besant, a theosophist, educationist, and social activist who had settled in India, which is why the school bears her name. In due course Krishnamurti broke away from theosophy and developed a conception of the liberation of the human person that comes close to Buddhist thought. As Hindi was the medium of instruction at Rajghat in those years and I was still weak in the language, my teachers would write in Hindi on one half of the blackboard and translate what they had written into English on the other half until I insisted that I could take notes in English directly from what they spoke and wrote.

Aside from my family, the two years I spent at Rajghat have been the most powerful influence on my life and work. Krishnamurti's teachings informed the educational practice of the school. The school buildings were in clearings in 400 acres of forest, on a plateau overlooking the confluence of the two rivers. Girls and boys lived in separate buildings on campus, but the entire school community met twice daily at assembly, where Vedic hymns would be sung by our music teacher

and his students. The prayers were meditations on nature—dawn, dusk, creation—and I sensed what I can only identify as the transcendent when engulfed in those hymns. Today I get a similar sense at Evensong in the chapel of my college in Cambridge (St. John's), listening to the student organist playing Bach.

As I was fluent in English, I would be asked by Krishnamurti—or Krishna-ji as we knew him—to accompany him on his evening walks when he was visiting the campus. Even then I recognized they were privileged experiences. The quality of teaching was exceptional. Most of my teachers joined the school at Krishna-ji's behest, which meant they were of an intellectual caliber you would, sadly, not find among schoolteachers in India in those days. I cannot recall a class I did not find intellectually stimulating, but the person who in the long run influenced me most was my geography teacher, Mr. Vishwanathan. He taught geography as an analytical subject and brought the physical landscape alive. The ethos at Rajghat was the same as the one in my home. That congruence may be why I have experienced no difficulty accommodating my life in the many different social milieus I have lived in over the years.

Given my academic interests, it would have been natural for me to specialize in geography in college. But in those days the prize subject among successful school students was physics, so I sleepwalked into the subject for my undergraduate studies. As my parents would be moving to Delhi shortly, I enrolled in Hans Raj College, University of Delhi, as an Honors student in physics. The university was far from where my parents lived, so I boarded in college.

The four years in Delhi were fallow; I didn't develop intellectually. I read widely, novels and plays, developed a love of both English and Hindi cinema, and did well in examinations, but I didn't experience the elation I had felt on understanding new things while at Rajghat. My father had hoped that should I perform well in college, I would go to Cambridge to complete my pregraduate education. In the event, I went there on a loan scholarship from the Tata Education Trust.

Zilberman: What about your early experiences in England?

You received your PhD from Cambridge, where James Mirrlees was your dissertation advisor and early mentor, and where you met some outstanding young scholars, including Geoffrey Heal and Tony Atkinson. Can you tell us about this period and your colleagues?

Your dissertation was about population growth and economic growth, and you were unique in your interests in population and economic growth. What were some of the insights and challenges associated with this research?

Dasgupta: Theoretical physicists at Cambridge are drawn from mathematics, so I was enrolled in the mathematics department. Russell's and Keynes's essays on their life and friendships as Cambridge undergraduates told me that the place was full of utterly clever people, engaged constantly in deep conversations with friends. I also had experienced many encounters with my brother-in-law and Amartya Sen, both of whom had been Cambridge undergraduates, and they were as clever as I knew anyone to be. On arriving in Cambridge in mid-September 1962, I feared I wouldn't measure up to my fellow students and they would dismiss me. For several days I avoided going into Hall in Trinity, which was my college. I couldn't go on doing that, of course, so I eventually went to lunch there, petrified. I chose an isolated corner but was soon joined by a young man who introduced himself to me. He was Francis Cripps, as clever an undergraduate as I have ever met. Within a week I met three other enormously gifted and original thinkers, Simon Blackburn (philosopher), Stephen Blomfield (mathematician/physiologist/psychologist), and Christopher Garrett (mathematician/oceanographer). Contrary to what I had imagined such minds to be, they were not solemn; they were playful, occasionally even boisterous, and most interestingly for me, dismissive of intellectualism. The four became my closest friends in college, all in due course becoming College Fellows, the highest achievement for young academics at Cambridge. We have remained close

ever since. Soon after, I met Martin Rees (cosmologist and now Astronomer Royal) with whom, many years later, I helped to establish a center in Cambridge for studying the risks humanity now faces from technological overreach and ecological destruction. My suspicion that Cambridge was full of extremely clever students proved to have been well founded, but cleverness was not what mattered to them. I experienced no difficulty settling into undergraduate life in Cambridge.

In my third year at Cambridge (I was studying for Part III of the Mathematics Tripos, something like a pre-PhD program), I was elected to the Apostles, an undergraduate discussion society in Cambridge. It had a formidable reputation. Only a select few were members at any one time, and although it was widely known to exist (Russell and Keynes had written affectionately of the society in their memoirs), current membership was a secret among members, probably because that way they wouldn't be lobbied for election.

James Mirrlees was a member. As many of my remarks at our meetings were directed at societal problems, he suggested I move to economics for postgraduate work. He was at the time an Assistant Lecturer, the lowliest position in the teaching hierarchy of the university but had a formidable reputation. He always hesitated before speaking and spoke only tentatively, but the way he formulated social problems made them come alive for me because there was precision in what he said. Mirrlees recommended me for funds at Trinity, and that enabled me to switch to economics and work toward a PhD on the subject.

I spent the year 1965–1966 studying under Mirrlees' supervision for the required papers of the Economics Tripos and began work on my dissertation in October 1966. For a reason I shall come to presently, I was in a rush to obtain my PhD. Because I worked in college to avoid distraction, I didn't get to know my fellow graduate students in the economics department. There was an outstanding batch among us, drawn from the Economics Tripos, including Tony Atkinson and Geoffrey Heal, but I got to know them only in later years. In the event, I submitted my thesis in April 1968.

At that time one of the most exciting topics in economic theory was optimum economic development, a subject Frank Ramsey (another Apostle) had initiated in his famous 1928 paper but had lain dormant until the early 1960s. Mirrlees was an expert on the subject. The common tactic in formulating the problem was to focus on consumption and various forms of investment under the assumption that population is exogenous (at that time exponential growth in population was the favored assumption). It was James Meade, my future father-in-law, who asked me in a letter what Ramsey's theory would look like if population was endogenous. In my reply I sketched a model that followed Henry Sidgwick's version of utilitarianism (Sidgwick 1907), which is the (discounted) sum of utilities of all who are ever born. I found that a crucial determinant of optimum policy is the consumption level at which utility is zero. That meant utility is measurable uniquely up to positive linear transformations, a stronger requirement than in classical decision theory, which requires that utility be unique only up to positive affine transformations. Zero-utility (the neutral life, as Sidgwick—yet another Apostle!—read it) had no operational significance in prevailing theories of optimum economic development.

As it was clear to me why zero-utility plays a role in any theory where population can be affected by policy, I didn't belabor its interpretation (for example, I didn't insist that the neutral life could not be the point of indifference between dying and continuing to live). Instead, I studied alternative formulations of production possibilities. I first considered the familiar model in which output is a function of (produced) capital and labor under constant returns to scale. I showed that the optimum program was one of unbounded growth in both capital and people. As that world was being discussed relentlessly in the literature (and has prevailed in growth and development economics), I wasn't too impressed. So, out of curiosity I then added a third factor of production, fixed in size (land), to what is otherwise a constant returns to scale production function. I found

that the optimum was a bounded economy, and that the larger is the standard of living at which utility is zero, the smaller is the long run optimum population size. That the limiting population was finite once you introduce a fixed factor in production was itself a break from the prevailing view of economic possibilities in the literature, but I did not regard the finding to be radical (this was before the limits to growth criticisms of mainstream economic thinking were aired).

Although I imagined the fixed factor to be land and took it to be indestructible, the model was directly adaptable to a setting where the asset in question is the biosphere, which is a destructible entity. In effect, that model in my thesis (Dasgupta 1969) served as the template for the global economic possibilities envisaged 52 years later in *The Economics of Biodiversity* that I had been asked by the UK's Chancellor of the Exchequer to prepare for the Treasury (Dasgupta 2021).

It was also years later, on reading the philosopher Derek Parfit's work on population ethics and the adulatory literature that was being built on it, that I realized population ethicists had got the meaning of zero-utility entirely wrong. In his famous Repugnant Conclusion, Parfit (1984, p. 388) claimed utilitarianism to be saying that, "...for any possible population, say 10 billion, all with a very high quality of life, there must be some much larger imaginable population whose existence, if other things are equal, would be better, even though its members have lives that are barely worth living."

The play on words in the passage baffled me. We were being asked to consider a figure for world population that will in all probability be reached by the end of this century and a figure that is unlikely to be sustainable at reasonable material comfort. We were then made to imagine an Earth where, because of population pressure, people scramble for resources to eke out an existence, having lives that are barely worth living. But someone whose life is barely worth living doesn't enjoy a life of positive quality; she suffers from a life that is not only not good (as experienced by her) but is positively bad. In the contemporary world over a half billion people are malnourished and regularly prone to illness and disease, many of whom are also debt ridden, but who survive and tenaciously display that their lives are worth living by the fact that they persist in wishing to live. If you were to say that you would not wish those circumstances on anyone, no one would take you to mean their lives aren't worth living; people would take you to be saying that their circumstances are so bad that you wouldn't wish them on even your worst enemy, that something ought to be done to improve their lives.

It was only years later, when preparing for the publication of my Kenneth Arrow Lectures at Columbia University and the Institute of Advanced Study, Jerusalem (Dasgupta 2019), that I began to suspect that Parfit's misreading of zero-utility was built on an arithmetic error of Sidgwick. In his monumental treatise, Sidgwick (1907, pp. 414–15) concluded that for human beings generally, life on average yields a positive balance of pleasure over pain on grounds that "...the great majority of men, in the great majority of conditions under which human life is lived, certainly act as if death were one of the worst of evils, for themselves and for those whom they love."

It is hard to know how so profound and careful a thinker could have made such an elementary arithmetic mistake. That death is a horror to most people doesn't imply that life is on balance pleasurable. On the contrary, the greater is the horror that taking one's own life is felt by someone (betrayal of one's family and friends, revelation of one's misery to others when one wants it to remain undisclosed even after death, and the horror of death that is wired in us through selection pressure), the more a person would be willing to carry on in a state of misery. To illustrate Sidgwick's error, imagine that in the units chosen to measure utility (or well-being), the horror of suicide for someone is -300. The person would choose to continue to live so long as life offered her a value exceeding -300, and that could be as low as -299.99. That means Parfit's Repugnant Conclusion isn't repugnant at all. You may question the trade-off utilitarianism commends between population size and the average level of well-being when the latter is low but positive (the

isobars of the product of population number and average well-being are rectangular hyperbolae), but that's a different concern altogether.

Robert Solow, commenting on the manuscript of my Arrow Lectures, suggested to me that life in the gap between death and the neutral life could be thought of as being bearable: not good, but not necessarily ghastly either. But at the time I submitted my dissertation, I didn't foresee its many ramifications; I looked at the chapter on optimum population as an economics exercise, hoping that my dissertation would be awarded a PhD, not much more. The severe and taciturn Mirrlees said it was not unsatisfactory, which to me meant he thought it was good.

In time my way of doing economics grew away from Mirrlees's and we became distant even at the personal level. Years later I learnt indirectly that he had recommended me for the professorship at Cambridge that had just been vacated by Robert Neild, successor to Joan Robinson. I wasn't an applicant for the post, he was not writing as my referee. The gesture meant a great deal to me once I learnt of it. As I was keen to return to Cambridge, I accepted the offer. I assumed the post in January 1985, and Carol and our three children moved from London that summer. Since then, with but a period of two years (1989–1991) when I assumed joint professorships in the economics and philosophy departments at Stanford University, Cambridge has been our residence.

Mirrlees and I had seen little of each other since his move to Oxford in 1968 where he was at the time of my move to Cambridge the Francis Edgeworth Professor of Economics. It was only when I was able to persuade him to return to Cambridge, and Trinity, as Professor of Political Economy, in 1994, that I realized we had grown close at the personal level. I even served as best man at his wedding to Patricia Wilson in 2001.

Zilberman: Another important area of research was resource economics, such as the work with Heal on technology and the environment emphasizing the importance of randomness and timing. What triggered this work?

Dasgupta: It took me three years following my PhD to find a tenure track teaching position, Lecturer in the Department of Economics at the LSE. Geoffrey Heal, with whom I had become acquainted, was teaching in Cambridge then. Meadows et al.'s (1972) book on the limits to growth had just been published but was dismissed by economists on grounds that price signals of resource scarcity played no role in their analysis. Heal and I agreed with the criticism but felt equally that economists were studying economic growth in a world with no natural resources. At that time, we were unaware of the publication by Hotelling (1931), which was fortunate for us, because otherwise we probably would have modeled intertemporal commodity allocations with exhaustible resources in a Marshallian, partial equilibrium framework. Instead, we constructed a complete capital model in which the factors of production were produced capital and the flow of an exhaustible resource (Dasgupta & Heal 1974, 1979). That enabled us to study the joint problems of the optimum accumulation of produced capital and the optimum depletion of exhaustible resources.

As the resource in question was depletable, its usage perforce would have to tend to zero in the long run. If the human economy was to survive, technological knowledge had to advance so that, over time, produced capital and the flow of the resource in production would be sufficiently substitutable between one another. We didn't know until both our manuscripts had been prepared that Solow was working on a similar model (Solow 1974a,b). Although none of us spoke about sustainable development (the term hadn't been invented), that is what our analysis was about.

At that time (I am speaking of 1972–1973) there was much speculation of nuclear fusion as a source of unlimited energy. So, Heal and I included a section in which an innovation that released the economy from dependence on critical exhaustible resources was forecast to arrive at an uncertain date. That's of course what came to be called a backstop technology, but as we hadn't

christened it so, attribution went elsewhere. The point of our paper was to prove a certainty equivalence theorem. We showed that the optimization problem under uncertainty was equivalent to a deterministic problem in which there is no chance of a backstop technology ever arriving, but in which the rate at which the future is discounted is raised appropriately.

Zilberman: You worked with Paul David on the economics of research. What started this collaboration, and what are some of the lessons you got from it?

Dasgupta: It was in 1983–1984, when my family and I were once again visiting Stanford, that Paul David asked me why publications on market structure and innovative activity spoke only of technology, never science. He noted that the science/technology distinction is usually conducted in much the way commodities are classified. For example, it is not uncommon to draw a distinction between them in terms of episteme and techne, or theoretical and practical knowledge, or ideas and instruments. We agreed this was unsatisfactory and that the distinction should rather be traced to differences between the institutions (even cultures), science and technology, that produce knowledge. In Dasgupta & David (1987, 1994) we argued that whereas science regards its output to be a public good (users are not charged), technology takes its output to be a private good (users pay for the product). To sustain itself, the former has created a system of incentives that encourages disclosure, in contrast to the latter, which encourages secrecy. We showed that these features are knitted to the reward systems in the two institutions (prizes and social esteem versus financial rents) and that both are reliant on a winner-takes-all system of rewards (priority and disclosure versus patents and secrecy). We noted as well that winner-takes-all gives rise to a race among rival researchers in both institutions. As education is in large measure funded by the public and discoveries are disclosed in science, technology enjoys a free ride. Today there is increasing traffic between science and technology, somewhat blurring the distinction we were drawing. But the sharp distinction we drew explained the tension sociologists have observed between the two cultures.

David, who wanted to place the emergence of the two institutions historically, argued to my surprise that while technology is ancient (prior to patent laws, maintaining secrecy of production techniques was a means by which inventors could earn rents from their work), science, with its elaborate system of norms of conduct, is new. David thought it originated in the early modern era, in the courts of princes, dukes, and clerical eminences. The work of scientists (more generally any creative talent, such as poets, artists, and architects) was displayed to the world at large because patrons wanted to display their eminence. Scientists were ornaments in their courts.

Our analysis concluded in a pessimistic note that science is increasingly under threat from technology as dwindling public funds compete against the lure of private profits. The growing presence of Silicon Valley technology in Bay Area science was, to us, indicative of this. Collaboration with David was my first experience of interdisciplinary work. It has since become routine to me.

Zilberman: You have had a special relationship with Kenneth Arrow and a partnership with Karl-Göran Mäler. Can you tell us about those? What about some of your students, especially Scott Barrett?

You launched the field of environment and development. What is unique about your approach to environmental economics?

Dasgupta: I first met Karl-Göran Mäler in 1979 at a meeting in the Nairobi office of the United Nations (UN) Environment Programme (UNEP). I had known of him from his magisterial book on environmental economics (Mäler 1974) but came only subsequently to experience his generosity, personal warmth, and fun and conviviality he injected into academic work. At that time, I

was puzzled that nature was absent from mainstream development thinking, that environmental and resource economics took resources to be inputs in production but regarded the environment mostly as an amenity, and that demography was disappearing from developmental concerns. But I didn't know how to put those wrongs right. Moreover, my expression of concern to development economists and friends in the Indian government was mostly met with polite silence.

Mäler, in contrast, encouraged me to pursue my ideas of studying the human economy from an overarching population-consumption-environment (PCE) nexus to create an ecological economics that would inform both mainstream economics and development thinking. In Dasgupta (1982) I tried to do that, but I constructed it as a series of short chapters, identifying the dynamics that characterize key ecosystems (fisheries, forests, water bodies, the atmosphere as sinks for pollutants, and so on). Although the monograph served as a template for the unification I was after, there was still a need to reconstruct growth and development economics and the economics of poverty in a way that sees we humans as being embedded in nature, rather than being external to it. Attempts at a unification were more successful in Dasgupta & Mäler (1990) and Dasgupta (1990), but neither publication had population as a policy variable.

It was when my family and I moved to Stanford in 1989 that I began to get a better sense of the PCE nexus. On meeting Paul Ehrlich at a dinner at the university's Faculty Club, I expressed admiration for his book on ecology (Ehrlich et al. 1977). He said I was the first economist ever to have paid him a compliment. It is hard today to appreciate the distance between the two disciplines in the past. Ehrlich had had no academic contact with Kenneth Arrow, even though the two had been colleagues since the late 1950s.[1] I invited them to lunch at the Faculty Club and proposed a joint fortnightly seminar among ecologists and economists at Stanford.

Both Arrow's and Ehrlich's involvement with ecological economics developed further when the Beijer Institute of Ecological Economics was reestablished in Stockholm in 1991 and Mäler was appointed Director. Mäler asked me to serve as Chairman of the Institute's Scientific Advisory Board, which included Ehrlich. One of his first decisions was to establish a weekend workshop at a marine field station on the island of Askö in the Trosa archipelago following each year's board meeting. Arrow attended 16 Askö meetings between 1993 and 2016, on one occasion missing it only because he was informed at the airport that his passport had expired. By my count Ehrlich attended more than 20 meetings in that same period. The first publication of significance to grow out of an Askö meeting was probably also the first paper in which economists spoke of Earth's carrying capacity and its implications for sustainable development (Arrow et al. 1995).

Zilberman: You walked the talk. Tell us about the creation of *EDE* and SANDEE and your role in the Beijer Institute. What led you to this social entrepreneurship?

Dasgupta: Over the years Mäler and I had often spoken to each other of our hopes of helping to introduce environmental concerns in economics curricula of universities in the developing world. His and my involvement in establishing SANDEE and less directly the Resource Accounting Network for Eastern and Southern Africa (RANESA) and the Latin American and Caribbean Environmental Economics Program (LACEEP) came about in an unexpected way.

Soon after I moved to Cambridge in 1985, my wife and I met the physicist Murray Gell-Mann at lunch at the home of Martin Rees and his wife Caroline Humphrey. Over the following years Gell-Mann kept in touch with me. He was on the board of the MacArthur Foundation, and it was sometime in 1994 that I was invited to the Foundation's Chicago headquarters by Dan Martin, who was Program Director there. He and his colleagues asked me whether the Foundation

[1] Arrow had moved to Harvard in 1968 but had returned in 1979, so my surprise was entirely justified.

could help me financially with my work in ecological economics. I said that, being an economic theorist, I personally did not need financial support but thought the Foundation could help create networks of environmental and resource economists in the developing world. I also suggested that the Foundation's support could be channeled through the Beijer Institute. In any event, the financial package was so substantial that Mäler and I were able to help establish an ambitious program in SANDEE (now based in Kathmandu) and collaborate with Cambridge University Press to create the journal *EDE*. Our idea of establishing *EDE* was to create a journal in the West that welcomed submissions from developing countries. In its initial years, editors of *EDE* worked closely with authors to meet rigorous refereeing standards; today, as would be expected, no such help is needed.

The work SANDEE has produced through its teaching and research program has been exceptional. Mäler and I in effect abducted Priya Shyamsundar, who was managing the grant at the MacArthur Foundation, to become SANDEE's Director. She was able to attract an exceptionally able group of environmental and resource economists to be mentors in the program. The empirical findings in two volumes of essays, Ghate et al. (2008) and Haque et al. (2011), mostly by SANDEE grantees, were to me a revelation. I relied on them greatly when preparing the chapters on poverty and the local environmental resource base in my review of the economics of biodiversity (Dasgupta 2021).[2]

Zilberman: You emphasize the importance of measuring the environment. You led an effort to quantify sustainability through analysis of the dynamics of genuine capital. Can you explain the basic ideas and what some of the implications and impacts have been?

Dasgupta: Mäler, like myself, had been interested in economic measurement from his student days. He spoke against the use of GDP for measuring economic well-being over the long run, but other than noting that depreciation of capital ought to be recorded, neither of us had much to say.

Economists of our generation were accustomed to conducting intertemporal optimization problems in the language of Lev Pontryagin, where the analysis proceeds from the relevant Hamiltonian function, which is a flow variable. On one occasion, however, Mäler and I, when constructing a model of an imperfect economy, began instead with Bellman's value function, which has the dimensions of a stock and is, moreover, a function of the economic system's state variables, which are also stocks. On differentiating the value function with respect to the state variables, we realized that intergenerational well-being corresponds to the accounting value of the totality of an economy's capital stocks: If one increases over a period, so does the other, and if one declines, so does the other (Dasgupta & Mäler 2000). We also showed that the equivalence between wealth and well-being holds even in imperfect economies. Movements in wealth reveal whether an economy is on a sustainable path.

That national accounts should include natural capital was the motivation of our paper (Dasgupta & Mäler 2000), meaning that the notion of wealth we advanced consists not only of produced capital and human capital, but also of natural capital. Today the measure is called alternatively inclusive wealth (e.g., IHDP-UNU/UNEP 2012, 2014; Managi & Kumar 2018; Dasgupta 2021) and comprehensive wealth (e.g., Arrow et al. 2012, 2013; Dasgupta 2014). But as our paper contained only raw basics, Arrow encouraged us to explore the relationship between wealth and well-being further and study the connections, if any, between sustainable and optimum development (Arrow et al. 2003a,b). That was followed by an Askö meeting on wealth accounting,

[2] SANDEE's teaching and research program has retained its excellence under Shyamsundar's successor, Mani Nepal. Their most recent publication, Haque et al. (2022), is a masterly collection of empirical studies on the ways local communities have demonstrated resilience by adapting to climate change.

on which occasion I placed crude numbers to judge whether the world economy in the previous years had been on a sustainable path (Arrow et al. 2004).

My numbers were overly crude, as they involved putting together ad hoc assumptions about income–wealth ratios. The papers by Arrow et al. (2012, 2013) were, to the best of my knowledge, the first detailed attempts at estimating national wealth movements, including the atmosphere as one of the assets comprising natural capital. We selected five countries (Brazil, China, India, United States, and Venezuela) for their distinctiveness and estimated, as well as we could, movements in per capita inclusive wealth over the period 1995–2000. Since then, three publications have advanced the tracking of wealth movements in over 120 countries: IHDP-UNU/UNEP (2012, 2014) and Managi & Kumar (2018). As we should have expected, inclusive wealth per capita in recent years has grown in some countries but declined in others. Natural capital accounts are very likely to become part of national income accounts. The UK, Canada, New Zealand, and Costa Rica, among others, are developing them as satellites to their traditional accounts.

Our work on national accounts was done during breaks at Askö meetings. We could do that because until recently there was no preannounced theme at Askö. Mäler preferred streams of consciousness to lead participants to a theme. The discussions would be converted into a paper by a small group (usually two people), which of course meant that the published version sometimes bore little resemblance to what had been discussed. Nevertheless, I know of no occasion when any participant balked at being involved at the revision stage of manuscripts. It remains a puzzle to me though that, despite Ehrlich's and my presence, population as a factor in the human condition didn't appear in the Askö papers until many years later.

Zilberman: You recently completed an important report to the British government on the economics of biodiversity. Can you tell us about the process, major findings, and lessons of this report?

Dasgupta: Although population continued to be missing at Askö meetings, it wasn't absent from my own thoughts. Discussions with Ehrlich had made me turn from population ethics to the study of household reproductive behavior. In a series of publications (Dasgupta 1995a,b; 2000b) I studied household behavior by identifying reproductive externalities and showed that pronatalist behavior would be a natural response in the presence of adverse externalities. That analysis was extended to the global economy in Dasgupta & Ehrlich (2013). It was, however, my association with ecologists, anthropologists, and demographers at meetings Mäler and I organized at the Beijer Institute over the years that enabled me to flesh out my ideas on the PCE nexus. The result was a series of publications that caught glimpses of the bird I had been wanting to catch for so many years, namely, an understanding of consumption, saving, and reproductive choices facing people in communities that are dependent on their local ecology and the possibility of them being caught in poverty traps (Dasgupta 1993, 2000b, 2007, 2010). Given the economic regions I was studying, I constructed my analysis for a world where resource allocation is guided by social norms of behavior (Dasgupta 2000a).

That work, exciting though it was for me, lacked the deep use of demographic data that was needed, for theoretical reasoning alone can't bring the state of the world alive to those studying it. It was discussions with Carol's and my younger daughter Aisha, who was working at the UN Population Division in New York, that led us to place numbers on the demographic variables and put flesh into the theoretical reasoning I had been airing. She showed me data on trends in regional populations and said those who speak of poverty in the world's poorest regions should know that there is a desperate need for family planning and reproductive health measures there. Inclusion of those policy variables (Dasgupta & Dasgupta 2017, 2022) brought my studies alive to me and

exposed the urgency we should all feel in the face of rising human numbers and deteriorating biomes.

My understanding that the human person is embedded in nature, that we are not external to nature, advanced slowly over the years. Discussions with ecologists, Ehrlich, Peter Raven, and Simon Levin prominent among them, made me realize that humanity's growing demands for nature's provisioning goods (food, water, timber, fibers, pharmaceuticals, nonliving materials—that is, the ingredients that, with human effort, go to shape the final products reflected in GDP) have eaten into nature's ability to supply maintenance and regulating services. Among those are carbon sequestration, nutrient recycling, decomposition of waste, pollination, nitrogen fixation, soil regeneration, purification of water, and maintenance of the biosphere's gaseous composition. From there it was an easy step to appreciate that there is a tension between the global demand for the biosphere's provisioning goods and our need for maintenance and regulating services.[3] When we engage in mining, quarrying, and more broadly in the land-use changes accompanying expansions of crop agriculture, animal farming, plantations, and construction, that tension is felt. The processes that furnish us with maintenance and regulating services are for the most part silent and invisible (think of the things that are happening deep in the soils, tropical rainforests, and the ocean depths), which is why their significance is underappreciated by decision makers. But maintenance and regulating services are the foundation on which we exist. They are primary, akin to basic industries in the standard classification of industrial production sectors.

When economists speak of substitution possibilities between produced capital and natural resources, as Heal and I had all those years ago, they have provisioning goods in mind, for example, alternative sources of energy. In contrast, maintenance and regulating services are broadly complementary to one another (e.g., between nature's ability to regulate the climate and the services the oceans and tropical rainforests offer). To be sure, nature is not a house of cards, for she is resilient, but we humans are so smart that we can convert her into one if we put our minds to it.

By 2015, I had not attended an Askö meeting for some years. Scott Barrett wrote asking me to attend the one to be held in the following year. He was coming to the end of his term as Chairman of the Beijer Institute's Scientific Advisory Board and said he would propose the PCE nexus to be the basis for the next meeting were I to attend it.

Barrett worked toward his PhD with me in the late 1980s and had subsequently pioneered the study of international negotiations over the use of global public goods. His classic work (Barrett 2003) analyzing international environmental agreements that had succeeded (e.g., the 1987 Montreal Protocol over the use of chlorofluorocarbons) and those that had failed (e.g., the Kyoto Protocol of 1997 over carbon emissions) had established him as the natural heir to Tom Schelling. Like Schelling, he is a master of using theory to understand practice in negotiations.

Aisha attended the meeting to bring demography into the discussion. The idea was that she, Scott, and I would give shape to the paper that grew out of our discussions at Askö. The three of us subsequently narrowed the idea of sustainable development from (inclusive) wealth accounting to something more urgent: the gap between the demand humanity makes of the biosphere's maintenance and regulating services and its ability to meet that demand on a sustainable basis. In Barrett et al. (2020) we called the gap the impact inequality and identified the factors that give rise to our demand and the biosphere's ability to regenerate. The size of our population is of course one factor, which is where demography enters the prospects for sustainable development.

[3] I served as an advisor-at-large to the Millennium Ecosystem Assessment, which was the first ecological counterpart to the Intergovernmental Panel for Climate Change (IPCC). I was therefore familiar with the classification of nature's goods and services they were proposing (MEA 2005).

By crude estimates, the ratio of our demand to nature's ability to meet that demand on a sustainable basis is today 1.7, which explains the metaphor that we need 1.7 Earths to meet our demands (Wackernagel & Beyers 2019). The term sustainable is an all-important qualifier here, for it says that we are enjoying the overshoot at the expense of the health of the biosphere. The number 1.7 is almost certainly an underestimate, which makes it even more of a reason that the impact inequality be converted to an equality sooner rather than later. We are in a fire-fighting situation.

In Spring 2019, the United Kingdom's then Chancellor of the Exchequer Philip (now Lord) Hammond invited me to prepare an independent, global review of the economics of biodiversity. By now, with all the investment my colleagues and coauthors had made in educating me on the subject, I felt able to accept the invitation, and did so immediately. The *Review* (Dasgupta 2021) was launched in February 2021 at the Royal Society. The full text is 601 pages long, but because it necessarily contains much technical material, I prepared an abridged (99 pages), nontechnical version, and my Treasury team prepared a brief, collating the *Review*'s headline messages. All three documents are available online on the UK Treasury's website. However, the full *Review*, with several additional sections, boxes, and annexes to include themes of potential interest to graduate students, is also being published by Cambridge University Press later this year. The *Review* is my attempt to reconstruct growth and development economics and the economics of poverty by recognizing that, unlike the fisherman who sees himself external to the lake from which he catches fish in his leisure, we are embedded in nature, we are not external to her. The analytical core of the *Review* is built on my PhD thesis of 1968 (Dasgupta 1969) and the paper (Barrett et al. 2020) that grew from the Askö meeting of 2016.[4]

Zilberman: You have a wonderful family. Can you tell us how you met your wife and also of your family?

Dasgupta: I met Carol on a train from Cambridge to London, the 16:36 to Liverpool Street, on April 16, 1966. The compartment was nearly empty, but I found myself sitting opposite this young lady reading a book. It wasn't a good time for me. I was going to London to break up with a girl I was going out with then. She was a wonderful person, but I knew it wouldn't work. So, I asked the young lady sitting opposite me how I should broach the subject with my girlfriend. What she advised me was so wise and sympathetic, that when we reached London, I said it would be absurd to simply walk away (we hadn't even introduced ourselves) and asked her if we could go to a café to have a bite to eat. I didn't know then that she was on her way to meet her boyfriend, but she said yes. We met the following weekend for a walk in the countryside near Cambridge and I told her we would one day get married to each other. She replied, "we will see," which I took to mean "yes."

Carol was an undergraduate at the LSE, specializing in international relations, while I was just about to complete my transition year from mathematics to economics. We were married two years later, soon after she had sat for her final undergraduate exam at the LSE, and I had undergone my PhD orals, which as it happens was on the day before. She had just turned 21 and I was 25 years old. It was unthinkable that we would live together before marrying; our parents would have been shocked, and we wanted to spare them that.

We have three children, two girls and a boy, all now grown up and with children of their own. Our oldest child, Zubeida, is a psychologist now working for the UK's National Health Service; our next child, Shamik, is a philosophy professor at UC Berkeley; and our youngest child is Aisha,

[4]I have published an afterword (Dasgupta 2022) that reflects on what I have learned from the more than 150 events I have taken part in (almost all virtually) related to my *Review*.

currently working in Abuja for the UK government, trying to persuade both her employer and the Nigerian government to take family planning and reproductive health seriously.

My generation of fathers was far less involved in raising children than is currently the practice; moreover, I traveled a great deal when our children were growing up. Nevertheless, they assure me I was there when they needed help understanding the homework they brought from school. But it is their mother they always turned to when in need, for she created the household ethos; I believe I merely provided the laughs. Now that they are grown up, they are indulgent toward me.

Their influence on me has been enormous. My activities at Cambridge University on freedom of expression have been at the urging of Zubeida, who is forceful on the subject. My understanding of the interpretation of well-being across the generations has been shaped by discussions with Shamik, who showed me the power of Pragmatism.[5] And I have already explained Aisha's role in my understanding of the PCE nexus.

Carol taught for six years in Cambridge and London before training as a psychotherapist. In the early 1990s she and a colleague founded and worked in a Child and Adolescent Counseling Service attached to the Cambridge Family Mediation Service. The new service offered children and young people a place to talk about a parental separation. This was an innovation; their model was later adopted widely in other mediation services. Carol also worked in the University of Cambridge Counseling Service and had her private practice. She took early retirement the year I retired from my university post, in 2010. We have been married for more than 54 years. Neither of us experienced a working bachelor life; we have grown up together. I am entirely dependent on her, for she is the deeper mind.

One night some years ago, in 1989 if I remember correctly, at Stanford, I brooded about the peripatetic life I had led since childhood and felt desolate that I had no place I could call home. And then it struck me I was mistaking home for a place, and that home for me was Carol. I have never again worried about the absence of a geographic root in my life.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

LITERATURE CITED

Arrow KJ, Bolin B, Costanza R, Dasgupta P, Folke C, et al. 1995. Economic growth, carrying capacity, and the environment. *Science* 268(5210):520–21

Arrow KJ, Dasgupta P, Goulder L, Daily G, Ehrlich P, et al. 2004. Are we consuming too much? *J. Econ. Perspect.* 18(3):147–72

Arrow KJ, Dasgupta P, Goulder LH, Mumford KJ, Oleson K. 2012. Sustainability and the measurement of wealth. *Environ. Dev. Econ.* 17(3):317–55

Arrow KJ, Dasgupta P, Goulder LH, Mumford KJ, Oleson K. 2013. Sustainability and the measurement of wealth: further reflections. *Environ. Dev. Econ.* 18(4):504–16

Arrow KJ, Dasgupta P, Mäler K-G. 2003a. Evaluating projects and assessing sustainable development in imperfect economies. *Environ. Resour. Econ.* 26(4):647–85

Arrow KJ, Dasgupta P, Mäler K-G. 2003b. The genuine savings criterion and the value of population. *Econ. Theory* 21(2):217–25

[5]My review adopts Pragmatism for interpreting the familiar Ramsey formulation of intergenerational well-being.

Barrett S. 2003. *Environment and Statecraft: The Strategy of Environmental Treaty-Making*. Oxford, UK: Oxford Univ. Press
Barrett S, Dasgupta A, Dasgupta P, Adger WN, Anderies J, et al. 2020. Social dimensions of fertility behavior and consumption patterns in the Anthropocene. *PNAS* 117(12):6300–7
Dasgupta A. 1985. *Epochs of Economic Theory*. Oxford, UK: Basil Blackwell
Dasgupta A, Dasgupta P. 2017. Socially embedded preferences, environmental externalities, and reproductive rights. *Popul. Dev. Rev.* 43(3):405–41
Dasgupta A, Dasgupta P. 2022. Population overshoot. In *The Oxford Handbook of Population Ethics*, ed. G Arrhenius, K Bykvist, T Campbell, E Finneron-Burns, pp. 490–518. Oxford, UK: Oxford Univ. Press
Dasgupta P. 1969. On the concept of optimum population. *Rev. Econ. Stud.* 36(3):295–318
Dasgupta P. 1982. *The Control of Resources*. Cambridge, MA: Harvard Univ. Press
Dasgupta P. 1990. The environment as a commodity. *Oxf. Rev. Econ. Policy* 6(1):51–67
Dasgupta P. 1993. *An Inquiry into Well-Being and Destitution*. Oxford, UK: Clarendon Press
Dasgupta P. 1995a. Population, poverty, and the local environment. *Sci. Am.* 272:40–45
Dasgupta P. 1995b. The population problem: theory and evidence. *J. Econ. Lit.* 33(4):1879–1902
Dasgupta P. 2000a. Economic progress and the idea of social capital. In *Social Capital: A Multifaceted Perspective*, ed. P Dasgupta, I Serageldin, pp. 325–424. Washington, DC: World Bank
Dasgupta P. 2000b. Reproductive externalities and fertility behavior. *Eur. Econ. Rev.* 44(4–6):619–44
Dasgupta P. 2007. *Economics: A Very Short Introduction*. Oxford, UK: Oxford Univ. Press
Dasgupta P. 2010. The place of nature in economic development. In *Handbook of Development Economics*, Vol. 5, ed. D Rodrik, M Rosenzweig, pp. 4977–5046. Amsterdam: Elsevier
Dasgupta P. 2014. Measuring the wealth of nations. *Annu. Rev. Resour. Econ.* 6:17–31
Dasgupta P, ed. 2019. Birth and death. In *Time and the Generations: Population Ethics for a Diminishing Planet*. New York: Columbia Univ. Press
Dasgupta P. 2021. *The Economics of Biodiversity: The Dasgupta Review*. London: HM Treas.
Dasgupta P. 2022. The economics of biodiversity: afterword. *Environ. Resour. Econ.* 83:1017–39
Dasgupta P, David PA. 1987. Information disclosure and the economics of science and technology. In *Arrow and the Ascent of Modern Economic Theory*, ed. G Feiwel, pp. 519–42. London: Macmillan
Dasgupta P, David PA. 1994. Toward a new economics of science. *Res. Policy* 23(5):487–521
Dasgupta P, Ehrlich PR. 2013. Pervasive externalities at the population, consumption, and environment nexus. *Science* 19(340):324–28
Dasgupta P, Heal GM. 1974. The optimal depletion of exhaustible resources. *Rev. Econ. Stud.* 41:3–28
Dasgupta P, Heal GM. 1979. *Economic Theory and Exhaustible Resources*. Cambridge, UK: Cambridge Univ. Press
Dasgupta P, Mäler K-G. 1990. *The environment and emerging development issues*. Rep. 14361, World Bank Group, Washington, DC
Dasgupta P, Mäler K-G. 2000. Net national product, wealth, and social well-being. *Environ. Dev. Econ.* 5:69–93
Ehrlich PR, Ehrlich AH, Holdren JP. 1977. *EcoScience: Population, Resources, Environment*. San Francisco: W.H. Freeman
Ghate R, Jodha NS, Mukhopadhyay P, eds. 2008. *Promise, Trust and Evolution: Managing the Commons of South Asia*. Oxford, UK: Oxford Univ. Press
Haque AKE, Mukhopadhyay P, Nepal M, Shammin MR, eds. 2022. *Climate Change and Community Resilience: Insights from South Asia*. Singapore: Springer. **https://link.springer.com/book/10.1007/978-981-16-0680-9**
Haque AKE, Murty M, Shyamsundar P, eds. 2011. *Environmental Valuation in South Asia*. Cambridge, UK: Cambridge Univ. Press
IHDP-UNU/UNEP (Int. Hum. Dimens. Progr.-United Nations Univ./United Nations Environ. Progr.). 2012. *Inclusive Wealth Report 2012: Measuring Progress Toward Sustainability*. Cambridge, UK: Cambridge Univ. Press
IHDP-UNU/UNEP (Int. Hum. Dimens. Progr.-United Nations Univ./United Nations Environ. Progr.). 2014. *Inclusive Wealth Report 2014: Measuring Progress Toward Sustainability*. Cambridge, UK: Cambridge Univ. Press

Hotelling H. 1931. The economics of exhaustible resources. *J. Political Econ.* 39(2):137–75
Mäler K-G. 1974. *Environmental Economics: A Theoretical Enquiry*. Baltimore, MD: Johns Hopkins Univ. Press
Managi S, Kumar P, eds. 2018. *Inclusive Wealth Report 2018: Measuring Progress Toward Sustainability*. New York: Routledge
MEA (Millenn. Ecosyst. Assess.). 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press
Meadows DH, Meadows DL, Randers J, Behrens WW. 1972. *The Limits to Growth*. New York: Universe
Parfit D. 1984. *Reasons and Persons*. Oxford, UK: Oxford Univ. Press
Sen A. 1994. Amiya Kumar Dasgupta (1903–1992). *Econ. J.* 104(4126):1147–55
Sidgwick H. 1907. *The Methods of Ethics*. London: Macmillan. 7th ed.
Solow RM. 1974a. Intergenerational equity and exhaustible resources. *Rev. Econ. Stud.* 41:29–45
Solow RM. 1974b. The economics of resources and the resources of economics. *Am. Econ. Rev.* 64:1–21
Wackernagel M, Beyers B. 2019. *Ecological Footprint: Managing Our Biocapacity Budget*. Gabriola Island, BC: New Society