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sustainability

Sustainability concerns the specification of a set of actions to be taken by present persons that will not diminish the prospects of future persons to enjoy levels of consumption, wealth, utility, or welfare comparable to those enjoyed by present persons. Sustainability grows out of a need for intertemporal ethical rules when one generation can determine the endowment of natural and constructed capital that will be passed on to all subsequent generations. Economic models of sustainability seek axiomatic guidance for the selection of rules regarding natural resource use. Ecologists approach sustainability from a related – though not identical – ethical stance.

The World Commission on Environment and Development (1987) popularized an idea that can be traced to Frank Ramsey's seminal work on the pure theory of savings (1928). Sustainable development meets '...the needs of the present without compromising the ability of future generations to meet their own needs'.

Some natural scientists discuss sustainability as it relates to human well-being. For instance, environmental sustainability

seeks to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. (Goodland, 1995, p. 3)

In a related article, Goodland and Daly (1996, p. 1003) assert that environmental sustainability means 'maintaining natural capital'. The strict maintenance of natural capital has come to be called 'strong sustainability'. There are also efforts to connect sustainability with the idea of the earth's carrying capacity:

Sustainability characterizes any process or condition that can be maintained indefinitely without interruption, weakening, or loss of valued qualities. Sustainability is a necessary and sufficient condition for a population to be at or below carrying capacity...Carrying capacity ...always embodies the concept of sustainability. (Daily and Ehrlich, 1996, p. 992).

Notice two key premises here. First, reflecting what Pigou called a ‘faulty telescopic faculty’, the absence of some form of collective action implies that the future is not secure if left to the whims of atomistic agents seeking their best advantage. Second, natural resources are an indispensable asset upon which the future depends. In addition to these two premises, Lele and Norgaard (1996) remind us of the central value judgement inherent in discussions about sustainability, namely, that we *ought* to care about the future.

Modelling sustainability

Following Ramsey’s early work, Harold Hotelling (1931) developed the general theory of production from non-renewable resources. But economists started to devote consistent attention to the problem of sustainable production from nature only in the mid-1970s, when *The Review of Economic Studies* published a symposium issue on the subject (Dasgupta and Heal, 1974; Solow, 1974; Stiglitz 1974a; 1974b). An economy produces goods and services in the current period under constant returns to scale, by using previously constructed capital and a pool of labour, and by drawing down some increment of a non-renewable natural resource (such as oil, titanium, copper, magnesium) (Solow, 1986). If population is held constant, and if there is no technical change, Hotelling’s condition asks that the shadow value of the natural resource left in the ground should show instantaneous rates of increase that exactly match the current value of the marginal product of the reproducible capital. If labour and constructed capital are fully employed, if the conditions of intertemporal efficiency are met, and if the economy invests in reproducible capital at each instant the exact amount (value) by which the non-renewable capital stock is being diminished, then society will just be able to maintain a constant stream of consumption into the infinite future. This latter investment policy concerning the augmentation of reproducible capital is known as Hartwick’s rule (Hartwick, 1977; 1978a; 1978b). Martin Weitzman (1976) showed that the maximum welfare along a competitive path from any point

into the future is formally identical to what might be obtained from the path of constant consumption.

Unavoidable inconveniences

The formal models of Ramsey, Hotelling, Dasgupta and Heal, Stiglitz, Solow, Hartwick and Weitzman set out the essential logic of how economists think about sustainability. The models' austerity is their strength. But, William of Ockham notwithstanding, spare and austere models do not always offer coherent policy guidance. This recognition gave rise to two dominant concepts of sustainability in economics – weak and strong.

The early models deriving optimal trajectories of constant consumption (and utility) provided the conceptual basis for *weak sustainability* – replace used-up or degraded natural capital with constructed capital in order to assure continued consumption (utility). To the environmental community, weak sustainability is not sustainability at all. Indeed, a better term for this view of sustainability is derived from the realm of medicine, where we encounter organ transplants and replacement therapy. (Technically, replacement therapy is the regular introduction of necessary chemicals into the body that are no longer produced naturally.) To the environmentalist, *sustainability as replacement* resembles a doctor who says to you, ‘go ahead and drink all you want, and when your liver or kidneys eventually fail we will give you mechanical ones, or we will put you on dialysis.’

Recall that for *some* aspects of nature it may not matter if we run out of them. That is, for many objects, it is the attributes they bring to us, not the unified bundle that we call ‘coal’ or ‘titanium’, that are the object of our interest. If one worries about the exhaustion of coal, that is simply an expression of concern about where energy will come from when the coal is gone. But the Grand Canyon and Victoria Falls are not coal or titanium. And this brings us to *strong sustainability*. Strong sustainability concerns specific bundles of attributes that are regarded as valuable in their own right; that is, they are valuable, not because of what they will *produce* for us, but because of what they *mean* to us. Their meaning is the cultural imprint we seek to project on to future persons as our legacy to them. The issue of strong sustainability concerns differing perceptions across a population – whether living now or in the future – of the imagined purposes of nature. What, exactly, is nature for? Its meaning *to* us is what it does *for* us. When we figure out what nature is for and craft policies accordingly, we are also prefiguring how future persons

will come to see the natural assets we have bequeathed to them. We transmit, indeed we impose, our values on to future persons.

For those who worry about nature in terms of its meaning to contemporary and future persons, the idea of replacement sustainability is ethically defective. However, the term ‘strong sustainability’ is also unhelpful. Strong sustainability seems to suggest that all (or most) things must be locked up and preserved indefinitely. Few take it this far, but the terminology suggests as much. The central issue here is a justifiable concern for particular settings and circumstances that ought not to be compromised under any plausibly foreseeable circumstances. In fact, the matter can be put as *justified commitments* to the protection of specific settings and circumstances that must not to be compromised under any plausibly foreseeable circumstances. The concept of ‘justified commitment’ suggests that the advocates of lasting protection of particular settings and circumstances are under an obligation to offer a plausible and coherent justification to the wider political community. Why, exactly, does this particular setting or object deserve the sort of irrevocable protection you seek for it? Give me good reasons for doing so (Bromley, 2006). Notice that the concept of justified commitments requires the general agreement of a large number of others to whom the reasons advanced are found compelling. Only then can we say that the reasons advanced were sufficient. This is what it means to formulate public policy in a democracy.

Several important clarifications and elaborations have entered the literature since the early formal models were advanced (Asheim, 1994; Pezzey and Toman, 2002). A paper by Asheim, Buchholz and Tungodden (2001) derives the properties of a set of economic pathways that are non-decreasing and efficient. It suggests that, since any such path is sustainable, efficiency and equity can be cited to indict an unsustainable path as ethically flawed. Richard Howarth (1997; 1998) has offered a synthesis of much of the early work, and he writes that ‘optimal’ policies depend on ethical propositions that are impossible to resolve from within economics. We must look outside our models and our analytical apparatus for clear guidance. That is, we must turn to discussions of what is thought to be ‘right’ rather than what is thought to be ‘good’. An intergenerational (intertemporal) golden rule offers some help, but it can be a weak thing indeed. Moral fibre is strongest when not threatened by the sharp blade of self-interest. Like Ulysses, we need to bind ourselves to *some* mast since we cannot be trusted to do

the right thing for the future. The Sirens are too alluring. But which mast will provide sufficient restraint?

Some possible alternatives

One alternative concerns the *precautionary principle*: (a) safeguard options for future generations by protecting thresholds of resilience in desirable states of nature; and (b) contain the fundamental uncertainties associated with economic activity – either by restricting the level of that activity to preserve a degree of system predictability, or by containing the quantifiable risks associated with innovative activities that test the resilience of the system (Perrings, 2001, p. 196).

A related approach, advanced by S. V. Ciriacy-Wantrup, is the *safe minimum standard* (Ciriacy-Wantrup, 1968; Bishop, 1978; Woodward and Bishop, 1997). Unique natural assets—particular species, habitats, and situations crucial to ecosystem functions—must be protected unless the costs of doing so are too high. Unfortunately, there are no clear rules to determine whether a level of costs is ‘too high’. But a focus on the safe minimum standard (SMS) of conservation serves to reframe the decision problem along the following lines: ‘are you *really* sure you want to do that?’ The SMS connects to the earlier idea of justified commitments.

In this vein, Bromley (1989) offers an approach that features the ‘projection of rights’ onto future persons. Specifically, he suggests two possible approaches: (a) an inalienability rule; and (b) a liability rule. Under inalienability, revered natural assets must be justified to a sufficiently large share of the polity as being inviolable. Think of this as *civic sanctification*. Once recognized, future persons hold inalienable rights, and members of all prior generations, including the present generation, are the reciprocal bearers of a duty towards those future right holders. This approach requires that irrevocable legal steps be taken by those of us now living to make sure that natural assets will be protected in the future. National parks, wilderness areas, and the US Endangered Species Act are of this sort – moral commitments towards future persons that are assured through organized and official legal obligation.

Under a liability rule there are two possible options. First, if those of us now living violate our commitment to the future – if we are unable to resist the Sirens – then we owe future persons some form of offsetting compensation. Perhaps we agree to set aside yet larger areas of wilderness, or make special efforts to increase the protection of an expanded list of endangered habitats or valuable species. Second, we atone for our violation of the interests of future persons

by establishing an annuity that would pay dividends to future persons in some amount thought commensurate with the harm we have done them. While neither approach adequately accounts for future uncertainty, they both acknowledge our obligation to the future, and both approaches force us to indemnify that obligation. If we are going to become richer by squandering some part of nature that morally belongs in their (future persons) bequest package, then we need to set aside something to make future persons better off than they would otherwise be.

In a recent paper that builds on Bromley (1989; 1990) and Stern (1997), Gerlagh and Keyser (2001) advocate a ‘trust fund policy’. The trust fund of Gerlagh and Keyser is a long-lived organization – comparable to a central bank – that oversees the entitlement of all members of present and future generations to an equal *claim* over natural resources. The arrangement would have precise rules of conduct to guarantee that members of future generations receive their claims independently of the preferences of the members of intervening generations.

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See also ethics and economics: exhaustible resources; Hotelling, Harold; intertemporal equilibrium and efficiency; precautionary principle; Ramsey, Frank Plumpton

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