Glossary

Abiotic resource A nonliving resource that cannot reproduce: fossil fuels, minerals, water, land, and solar energy.

Absolute advantage A country has an absolute advantage if it can produce the good in question at a lower absolute cost than its trading partners. It has a **comparative advantage** if it can produce the good in question more cheaply relative to other goods it produces than can its trading partners, regardless of absolute costs.

Absorptive capacity See "waste absorption capacity."

Adaptive management A basic policy principle whereby we change policies as conditions change or as we gain new information.

Aggregate macroeconomics The study of the economy from the perspective of key aggregate variables such as the money supply, aggregate price level, the interest rate, aggregate consumption and investment, exports and imports. The main focus of conventional economics is the rate of growth of GNP. In contrast, ecological economics strives to end physical growth while maintaining or improving social welfare.

Allocation The process of apportioning resources to the production of different goods and services. Neoclassical economics focuses on the market as the mechanism of allocation. Ecological economics recognizes that the market is only one possible mechanism for allocation.

Asymmetric information Occurs when either buyer or seller has information that the other does not have, and that information affects the value of the good or service exchanged.

Balance of payments The sum of the current account (exports minus imports), and the capital account (inflow of capital to the nation minus outflow of capital from the nation).

Barter The direct exchange of goods or services without using money as a medium of exchange. It is very inconvenient in that it requires an unlikely coincidence of reciprocal wants.

Basic market equation MUxn/MUyn = Px/Py = MPPay/MPPax, where MU is the marginal utility of good x or good y to person n, and MPP is the marginal physical product of factor a used to produce good x or good y.

Biotic resource A living resource, such as trees, fish, and cattle (elements of ecosystem structure), as well any of the fund-services they provide, such as climate regulation, water regulation, and waste-absorption capacity (ecosystem functions, or ecosystem services).

Bretton Woods Institutions (IMF and World Bank) Global financial institutions created in 1945 to finance short-term international trade (International Monetary Fund), and to lend for long-term investment projects in developing countries (World Bank).

Capital account A measure of inflows of investments to the nation by foreigners, and outflows of investments by nationals to foreign countries.

Carrying capacity Originally the maximum population of cattle that can be sustained on a given area of rangeland. By extension the population of humans that can be sustained by a given ecosystem at a given level of consumption, with a given technology.

Catch-per-unit-effort hypothesis The assumption of a linear relationship between effort, stock, and harvest.

Circular flow The idea that since every expenditure by anyone is at the same time an equal receipt by someone else and receipts in turn become expenditures, money or exchange value flows in a circle. But physical factors and products do not flow in a circle.

Closed system A system that imports and exports energy only, matter circulates within the system but does not flow through it. The Earth closely approximates a closed system.

Coase theorem States that in a perfectly competitive market allocative efficiency will be achieved whether property rights are given to the polluter or the "pollutee." All that is required is that someone have the property rights and that transaction costs are zero.

Coevolutionary economics The study of the mutual adaptations of economy and environment. Economic activity induces changes in the environment, and changes in the environment in turn induce further changes in the economy in a continuing process of coevolution.

Command-and-control regulation Flat prohibitions, quotas, or standards as opposed to monetary incentives that operate through prices or taxes.

Comparative advantage See "absolute advantage."

Competitive market A market in which there are many small buyers and sellers of an identical product. "Many" means "enough that no single buyer or seller is sufficiently large to affect the market price." Since everyone treats price as a parameter (a given condition) rather than a variable (something one can change), this condition is sometimes called the parametric function of prices.

Complementarity The "opposite" of substitutability—when goods or factors have to be used together in fairly strict combination with each other rather than instead of each other. Even substitutes have some degree of complementarity, unless they are "perfect" substitutes, in which case they are for all practical purposes identical goods or factors.

Comprehensive efficiency The ratio of services gained from manmade capital stock to the services sacrificed from the natural capital stock.

Congestibility Occurs when a basically nonrival asset is used so heavily that one person's use begins to interfere with or lower the quality of service to other users (e.g., a crowded road or interference from another radio station in a crowded frequency band).

Consumer surplus The maximum that a consumer would be willing to pay for all units of a good he consumes rather than do without the good, minus the amount he actually has to pay for it.

Contingent valuation Hypothetical estimates of prices of nonmarket goods and services based on survey questions asking how much one would be willing to pay for an extra unit of the good, or how much one would accept for the loss of a unit of the good.

Critical depensation The population size below which a population will likely go extinct rather than recuperate, even if exploitation ceases. Also known as "minimum viable population."

Current account A measure of the international exchange of real goods and services as well as transfer payments in the current year.

Defensive expenditure An expenditure made to protect one against the unwanted consequences of the production and consumption of other goods by other people. Also called regrettably necessary defensive expenditure.

Demand A relationship (inverse) between price of a good and the quantity of the good that consumers would purchase at that price.

Determinism The philosophical doctrine that every event or decision is the inevitable consequence of antecedents, such as physical, psychological, hereditary, or environmental conditions, that are independent of human will or purpose.

Development The improvement in quality of goods and services, as defined by their ability to increase human well-being, provided by a given throughput.

Differential rent See "rent."

Diminishing marginal physical product See "law of diminishing marginal physical product."

Diminishing marginal utility See "law of diminishing marginal utility."

Discount rate The rate at which the present is valued over the future, as a result of uncertainty, or of productivity, or of pure time preference for the present. See "intertemporal discounting."

Disinflation A reduction in the rate of general price increase. See "inflation."

Distribution The apportionment of income or wealth among different people.

Doubling time The fixed time period it takes for a population to double when growing at a constant rate. A handy rule of thumb is that doubling time equals 70 divided by the percentage rate of growth (e.g., a population growing at 2% annually will double every 35 years).

Ecological economics The union of economics and ecology, with the economy conceived as a subsystem of the earth ecosystem that is sustained by a metabolic flow or "throughput" from and back to the larger system. See "throughput."

Ecological reductionism The idea that the human economy is entirely governed by the same laws and forces as the rest of the ecosystem, so there is no necessity to distinguish the human economy as a subsystem.

Economic imperialism The idea that the entire ecosystem can be priced and all values internalized into prices, with the result that price calculations are reliable guides for all decisions.

Ecosystem function An emergent phenomenon in ecosystems, such as energy transfer, nutrient cycling, gas regulation, climate regulation, and the water cycle. As is typical of emergent properties, ecosystem functions cannot be readily

explained by even the most extensive knowledge of system components or ecosystem structure.

Ecosystem services Ecosystem functions of value to humans, though given the tightly interconnected nature of ecosystems, it would be difficult to say with certainty that any particular ecosystem function is not of value to humans. See also "fund-service resources."

Ecosystem structure The individuals and communities of plants and animals of which an ecosystem is composed, their age and spatial distribution, and the abiotic resources present. The elements of ecosystem structure interact to create ecosystem functions as emergent properties generated of such a large complex system.

Efficient allocation See "Pareto Efficient Allocation."

Efficient cause An agent of transformation, such as labor or a machine. See also "fund-service resources" and "material cause."

Elasticity The responsiveness of a change in quantity demanded (supplied) to a change in price—measured by percentage change in quantity divided by percentage change in price.

Entropic dissipation The gradual erosion and dispersion into the environment of the matter of which all human artifacts are composed in a one-way flow of low entropy usefulness to high entropy waste.

Entropy See "Second Law of Thermodynamics."

Environmental economics The branch of neoclassical economics that addresses environmental problems such as pollution, negative externalities, and valuation of nonmarket environmental services. In general, environmental economics focuses almost exclusively on efficient allocation, and accepts the pre-analytic vision of neoclassical economics that the economic system is the whole, and not a subsystem of the containing and sustaining global ecosystem.

Equimarginal principle of maximization This is known as the "when to stop" rule. The point at which a consumer reaches an allocation that maximizes her total satisfaction or total utility. That point occurs when the marginal utility per dollar spent on each good is equal. Only when utilities were equal at the margin would it no longer be possible to increase total utility by reallocation of expenditure.

Exchange rate The rate at which one nation's currency is traded for that of another nation. Exchange rates can be either fixed by central banks, floating according to daily supply and demand, or some combination of the two.

Exchange value The value of a good in terms of its ability to be traded for other goods, as opposed to its use value.

Excludability A legal concept that when enforced allows an owner to exclude others from using his asset. An institution is always required to make an asset excludable, but some by their very nature are nonexcludable (e.g., the ozone layer). If the asset is rival (a physical property), then excludability is more or less natural. If the asset is nonrival, then excludability is typically more difficult, but sometimes possible, as in the case of patents.

Exponential growth Growth at a constant percentage rate (fixed doubling time). Exponential growth leads to very large numbers surprisingly quickly.

Externality An unintended and uncompensated loss or gain in the welfare of one party resulting from an activity by another party.

Fallacy of composition The argument that what is true for the part must necessarily be true for the whole, or vice versa.

Fallacy of misplaced concreteness To mistake the map for the territory, to be unmindful of the degree of abstraction in an argument, especially to draw conclusions at a level of abstraction (or concreteness) different from the level of abstraction of the concepts in which the argument is conducted.

Federal Reserve System A coordinated system of district central banks in the U.S. that influences interest rates and money supply by means of open-market operations, discount rate changes, and reserve ratio requirements.

First Law of Thermodynamics Neither matter nor energy can be either created or destroyed.

Fiscal policy The attempt to influence GNP, employment, interest rates, and inflation by manipulating government expenditure and taxes.

Fixed exchange rate regime A regime in which the value of one country's currency is pegged to another country's (typically the US dollar).

Flexible exchange rate regime A regime in which exchange rates are determined by the global supply and demand for currencies, and central banks play no direct role.

Floating exchange rate regime See "flexible exchange rate regime."

Fossil fuels Petroleum, coal, natural gas. Fuels formed over geologic ages from biotic materials, but now treated as nonrenewable abiotic resources.

Fractional reserve banking The practice of keeping on hand reserves against deposits that are only a small fraction of deposits, so that banks can lend the difference. This practice allows the private banking sector to create money, since demand deposits are counted as money.

Free rider One who enjoys the benefit of a public good without paying a share of the cost of its provision and maintenance.

Fund-service resources Resources not materially transformed into what they produce (efficient cause); which can only be used at a given rate, and their productivity is measured as output per unit of time; cannot be stockpiled; and are worn out, rather than used up. See "stock-flow resources."

General equilibrium model The vision of the economy as a giant system of thousands of simultaneous equations balancing the supply and demand, and determining the price and quantity, for each commodity in the economy.

Gini coefficient A measure of the inequality of the distribution of wealth or income across a population. A Gini coefficient of one implies perfect inequality (one person owns everything) and a coefficient of zero indicates a perfectly equal distribution.

Globalization The economic integration of the globe by free trade, free capital mobility, and to a lesser extent by easy migration. It is the effective erasure of national boundaries for economic purposes. See "internationalization."

Gross national product (GNP) The market value of final goods and services purchased by households, by government, and by foreigners (net of what we

purchase from them), in the current year. Alternatively, it is the sum of all value added to raw materials by labor and capital at each stage of production, during the given year.

Growth A quantitative increase in size, or an increase in throughput.

Hotelling rule States that at the margin the rate of return from holding a resource in the ground (its expected price increase) must be equal to the rate of return from exploiting it now and investing the profits.

Hubbert curve A curve showing the cumulative extraction of a nonrenewable resource over time. The vertical distance for each year is annual extraction for that year. The total area under the curve is total reserves. The typical curve is bell-shaped, rising from zero, reaching a maximum, and falling to zero again with exhaustion.

Human needs assessment A multidimensional concept of welfare that goes beyond income and wealth to include capabilities, capacities, and other existential categories.

Hyperbolic discounting The act of giving more weight to what happens now over what happens in the near future, while being nearly indifferent between the same outcome occurring at different times in the more distant future. Empirical studies suggest that this is a far more accurate representation of the human psyche than exponential discounting.

Hyperinflation Inflation greater than 50% per month.

Inalienability rule An entitlement that holds if a person is entitled to either the presence or absence of something, and no one is allowed to take away that right for any reason.

Income The maximum that a community could consume in a given time period and still be able to produce the same amount in the next time period. In other words, the maximum that can be consumed without reducing productive capacity, that is, without reducing capital.

Individual transferrable quotas (ITQs) See "transferable quotas."

Inflation An increasing general level of prices (not a state of high prices, but a process of increasing prices).

Internationalization The increasing importance of relations among nations, and among citizens of different nations. The nation remains the basic unit of community and policy, controlling to some extent trade, capital flows, and migration. National economies are interdependent, but not integrated. See "globalization."

International Bank for Reconstruction and Development (World Bank) An international financial institution composed of member nations and created at Bretton Woods, New Hampshire, in 1945. Originally designed to focus on long-term lending to promote the development of underdeveloped countries, in recent decades it has strayed from its charter.

International Monetary Fund (IMF) An international financial institution composed of member nations and created at Bretton Woods, New Hampshire, in 1945. Originally designed to focus on short-term balance of payments financing to promote international economic stability, in recent decades it has strayed from its charter. See also "World Bank."

Intertemporal allocation The apportionment of resources across different stages in the lifetimes of basically the same set of people (same generation).

Intertemporal discounting The process of systematically weighting future costs and benefits as less valuable than present ones.

Intertemporal distribution The apportionment of resources across different generations (different people).

ISEW Index of Sustainable Economic Welfare—calculated by adjusting Personal Consumption for various factors that affect either sustainability or welfare either positively or negatively, such as depletion of natural capital, increasing inequality in income distribution, defensive expenditures, and so on.

IS-LM model A two-sector general equilibrium model showing how the real and the financial sectors interact to simultaneously determine the national income and the interest rate.

Isolated system An isolated system is one in which neither matter nor energy enters or exits.

Law of diminishing marginal physical product As a producer adds successive units of a variable factor to a production process, other factors constant, then the extra output per unit of the variable factor diminishes with each addition (i.e., total output increases at a decreasing rate). This is sometimes called the law of diminishing returns.

Law of diminishing marginal utility As one consumes successive units of a good the additional satisfaction decreases (i.e., total satisfaction increases, but at a decreasing rate). With a law of constant or increasing marginal utility consumers would spend all their income on only one good.

Law of entropy See "Second Law of Thermodynamics."

Law of increasing marginal cost As one produces more and more of a product, one must use resources (factors of production) that are of lower quality or are more expensive, so that the cost of producing each additional unit is greater than that of the previous unit.

Liability rule An entitlement rule that holds if one person is free to interfere with another or prevent interference, but must pay compensation.

Linear throughput See "throughput."

Liquidity preference A general preference for holding assets in a form easily convertible into money, so as to meet unexpected transaction needs and avoid the inconvenience of barter.

Liquidity trap The failure of lowering interest rates to stimulate economies with low demand.

Lorenz curve A curve plotting the cumulative percentage of the population against the cumulative percentage of total income held by that percentage of the population—illustrates the degree of equality/inequality in the distribution of income.

Macro-allocation The allocation of resources between market and nonmarket goods and services.

Marginal cost The increment in total cost resulting from producing one more unit of the commodity in question.

Marginal external cost The cost to society of the negative externality that results from one more "unit" of activity by an economic agent.

Marginal extraction costs The extra total cost required to extract one more unit of a resource from the ground.

Marginal revenue The increment in total revenue from selling one more unit of the commodity in question.

Marginal user cost The value of one more unit of the resource in its natural state. In a perfectly competitive economy, marginal user cost would in theory equal the price of a resource minus its marginal extraction cost.

Marginal utility The additional pleasure or satisfaction to be gained from consuming one more unit of a good or service.

Material cause A resource that is transformed in the production process. See also "stock flow resource" and "efficient cause."

Materialism The philosophical doctrine that physical matter (its movements and modifications), is the only reality, and that everything in the universe, including thought, feeling, mind, will, and purpose can be explained in terms of physical laws.

Matrix of human needs (Max-Neef) A cross-classification of basic dimensions of existence with basic human values, yielding a much richer and more detailed description of welfare than the abstract notion of "utility."

Maximum sustainable yield Each level of an exploited population has a growth rate that can be harvested leaving the population undiminished in the following year. There is one level of population for which the sustainable yield is a maximum. In general, however, the biologically maximum sustainable yield is not the economically optimal yield.

Micro-allocation The allocation of resources within the private sector, as opposed to between the private and public sectors. See "macro-allocation."

Mineral resource A useful element or compound, such as copper, iron, petroleum—a class of abiotic resource.

Minimum viable population The population level below which a population is not likely to recuperate, but rather will dwindle to extinction. See "critical depensation."

Monetary policy The attempt to influence interest rates, GNP, employment, and inflation by manipulation of the money supply.

Money A unit of account, medium of exchange, and a store of value. Money can be a commodity (gold) whose supply is limited by its real cost of production, or a token (fiat money) whose supply is determined by government authority and social conventions.

Monopoly A single seller of a commodity.

Moral hazard A situation in which the existence of insurance against a hazard actually increases the risk of the hazard by making the insured less vigilant in its prevention.

Multi-tier pricing The act of charging different prices at different times or for different users.

Natural capital Stocks or funds provided by nature (biotic or abiotic) that yield a valuable flow into the future of either natural resources or natural services.

Natural dividend The unearned income from the harvest of renewable resources. As nature and not human industry produces renewable resources, all profits above "normal" profit (included in the total cost) are unearned, and the natural dividend is equivalent to the total return minus the total cost.

Neoclassical economics The currently dominant school of economics, characterized by its marginal utility theory of value, its devotion to the general equilibrium model stated mathematically, its individualism and reliance on free markets and the invisible hand as the best means of allocating resources, with a consequent downplaying of the role of government.

Net present value The amount of money if available today that would generate the future stream of net income in question.

Nihilism In ethics the rejection of all distinctions in moral value, the rejection of all theories of morality. The view that nothing is better than anything else, or basically "anything goes."

Nonexcludable resource A resource for which no institution or technology exists to make it excludable.

Nonmarket value A value recognized by people but not usually expressed in prices because the valuable thing either is not currently, or cannot conceivably, be traded in markets.

Non-price adjustments The adjustment of the relative desirability of goods by advertising, or the relative possibility of producing goods by research and development. These are ways to satisfy the "basic market equation" without adjusting prices.

Nonrenewable resource Low entropy matter-energy useful to humans and present in fixed stocks whose quantity declines over time. This includes mineral resources, fossil fuels, and fossil aquifers. As fresh water is naturally recycled through the hydrological process, we do not classify it as a nonrenewable resource.

Nonrival resource A resource whose use by one person does not affect its use by another.

Normal profit The opportunity cost of the time and money the entrepreneur has put into an enterprise (i.e., what she could have earned from her time and money in her next best alternative).

Open access A rival resource that all are free to exploit, no one can be excluded, such as noncoastal fisheries.

Open system An open system takes in and gives out both matter and energy. The economy is such a system.

Opportunity cost The best alternative given up when a choice is made, i.e., if a farmer cuts down a forest to expand his cropland, and if the consequent loss of timber, firewood, and water purification is the next best use of the land, then the value of timber, firewood, and water purification is the opportunity cost of the expanded cropland.

Optimal scale of the macroeconomy Occurs when the increasing marginal social and environmental cost of further expansion are equal to the declining marginal benefits of the extra production. Beyond the optimal scale growth becomes

uneconomic, even if we conventionally refer to the expansion of the economy as "economic growth."

Paradox of thrift Occurs when everyone trying to increase their savings rate in the aggregate leads to declining consumption, growing unemployment and lower aggregate income. People are saving a higher percentage of their income, after increasing their savings rate, but total income has fallen, so that actual savings are less than before.

Pareto efficient allocation Occurs when no other allocation could make at least one person better off without making anyone else worse off. This is also known as a Pareto optimum.

Pareto optimum See "Pareto efficient allocation."

Pigouvian subsidy See "Pigouvian tax."

Pigouvian tax A tax designed to equal the marginal external cost of production of a commodity. It is added to the price, which measures only marginal private costs. The price plus tax now measures marginal social cost, thus internalizing the original external cost. If there originally was an external benefit, then a Pigouvian subsidy would be paid to the producer.

Principle of subsidiarity A basic policy principle that the domain of the policy-making unit must be congruent with the domain of the causes and effects of the problem with which the policy deals.

Principle of substitution The assumption that one good or service (or factor of production) can replace another in providing consumer utility (or in the production process). Theoretical utility functions and production functions often exhibit this property, but in reality, many goods, services, and factors of production are complements rather than substitutes. See also "substitutability" and "complementarity."

Producer surplus The difference between the price (equal to marginal cost) at which the producer sells his total output and the lower marginal costs at which all inframarginal units were produced.

Production function A production "recipe" describing how certain quantities of inputs are combined to yield a certain quantity of output or product.

Property rule An entitlement rule that holds if one person is free to interfere with another, or free to prevent interference.

Public bad Something that is nonrival, nonexcludable, and undesirable.

Public good A resource that is nonrival, nonexcludable, and desired by the public. Because they are nonexcludable, they will not be produced by profit-seeking firms. Because it is nonrival, the marginal cost of another person using one is zero, so its efficient price should also be zero. A public good should be supplied collectively by the government or other social institution.

Pure time rate of preference The rate at which we prefer goods in the present over the future, independently of considerations of productivity.

Renewable resource A living resource that is capable of regeneration and growth in perpetuity if exploited in a sustainable manner and that provides raw materials for the economic process.

Rent A payment over and above minimum necessary supply price (cost of production). Since land has zero cost of production all payment for land is rent. Part

of payment for labor may also be rent if the laborer would still do the job for less. If Tiger Woods would still play golf even if he earned only a million dollars a year, then all his earnings over a million dollars is rent. Producer surplus is also an example of rent.

Ricardian land Land as an extension, surface area, substrate for holding things (i.e., the "indestructible" characteristics of land, excluding its fertility, or underground minerals).

Risk The known probability (relative frequency) of occurrence of an event. Risk is insurable. See "uncertainty."

Rivalness An inherent characteristic of certain resources whereby consumption or use by one person reduces the amount available for everyone else.

Royalty The payment to the owner of a resource for the right to exploit that resource. Theoretically, in a competitive market, the per-unit royalty should be equal to the marginal user cost.

Say's "Law" Supply creates its own demand. In production the payments to factors, plus residual profit, generates exactly enough income to purchase, if spent, the total amount produced.

Scale The physical size of the economic subsystem relative to the ecosystem that contains and sustains it. It could be measured in its stock dimension of population and inventory of artifacts, or in its flow dimension of throughput required to maintain the stocks.

Scarcity rent See "rent."

Second Law of Thermodynamics Entropy never decreases in an isolated system. Although matter and energy are constant in quantity (first law), they change in quality. The measure of quality is entropy, and basically it is a physical measure of the degree of "used-up-ness" or randomization of the structure or capacity of matter or energy to be useful to us. Entropy increases in an isolated system. We assume the universe is an isolated system, so the second law says that the natural, default tendency of the universe is "shuffling" rather than "sorting." In everyday terms, left to themselves, things tend to get mixed up and scattered. Sorting does not occur by itself.

Seigniorage The benefit that accrues to the issuer of token money, resulting from the fact that the issuer receives real goods and services in exchange for a mere token, whereas everyone else has to give up a real asset to get money to exchange for another asset. There is a transfer of real wealth from the public to the issuer of money, equal to the exchange value of money stock minus the cost of production of the tokens (negligible). That amount is seigniorage. Sometimes the term is used to refer only to the interest that could be earned on such an amount.

Sink That part of the environment that receives the waste flow of the throughput and may, if not overwhelmed, be able to regenerate the waste through biogeochemical cycles back to usable sources.

Social discount rate A rate of conversion of future value to present value that reflects society's collective ethical judgment, as opposed to an individualistic judgment such as the market rate of interest.

Solar energy Radiant energy flowing from the sun, our basic long-run source of low entropy that sustains life and wealth.

Source That part of the environment that supplies usable raw materials that constitute the throughput by which the economy produces, and which ultimately returns as waste to environmental sinks.

Steady-state economy The economy viewed as a subsystem in dynamic equilibrium with the parent ecosystem/biosphere that sustains it. Quantitative growth is replaced by qualitative development or improvement as the basic goal.

Steady-state subsystem See "steady-state economy."

Stock-flow resources Resources materially transformed into what they produce (material cause); can be used at virtually any rate desired (subject to the availability of fund-service resources required for their transformation); their productivity is measured by the number of physical units of the product into which they are transformed; can be stock-piled; are used up, rather than worn out. See "fund-flow resources."

Subsidy A bonus or payment for doing something, the opposite of a tax.

Substitutability The capacity of a one factor (or good) to be used in the place of another, the opposite of "complementarity." Substitutability is never perfect and the further a substitution is carried the less satisfactory it becomes (the more the force of complementarity is felt). Goods and factors may be thought of as varying in a continuum from perfect substitutes to perfect complements.

Supply The relationship between the price of a commodity and the quantity that would be supplied at each price.

Sustainable yield The amount of an exploited population that can be harvested leaving the population undiminished in the following year; the growth rate of the existing stock. See "Maximum sustainable yield."

Thermodynamics The branch of physics that tells us that matter and energy can be neither created nor destroyed, and that entropy in the total system always increases. This branch of physics is the most relevant to economics because it helps to explain the physical roots of scarcity.

Throughput The flow of raw materials and energy from the global ecosystem's sources of low entropy (mines, wells, fisheries, croplands), through the economy, and back to the global ecosystem's sinks for high entropy wastes (atmosphere, oceans, dumps).

Total allowable commercial catch (TACC) An aggregate quota limiting the total fish catch per year or season. The quota can be distributed among individuals in many different ways.

Tradeable permits (quotas) Shares of an aggregate quota that are in some way divided up among individuals, who can then buy and sell their quota rights among themselves.

Transaction cost The costs of making a transaction, including legal fees, the cost of gathering information, locating the interested parties, the time costs of bargaining, and so on.

Transaction demand for money The demand for money balances to carry out everyday plus unforeseen transactions and avoid the inconvenience of barter or the delay of converting a nonliquid asset into money.

Ultimate end The vaguely perceived, yet logically necessary ordering principle with reference to which we rank our intermediate ends.

Ultimate means The low-entropy matter/energy, consisting of the solar flow and the terrestrial stock—that which we require to serve our ends and which we cannot ourselves create but can only receive from nature.

Uncertainty A situation in which we may know the range of possible outcomes but do not know the probability distribution of outcomes. Uncertainty is uninsurable. See "risk."

Uneconomic growth Growth of the macroeconomy that costs us more than it is worth. A situation in which further expansion entails lost ecosystem services that are worth more than the extra production benefits of the expanded economy.

Unemployment Refers usually to involuntary unemployment, the number or percentage of the workforce without a job who are actively looking for a job.

Use value The actual service or utility from using a commodity for its intended purpose, as opposed to its exchange value, its capacity to purchase us another good through exchange.

User cost The opportunity cost of nonavailability of a natural resource at a future date that results from using up the resource today rather than keeping it in its natural state.

Utility function A psychic relationship showing the amount of utility or satisfaction yielded to a consumer by the consumption of differing amounts and combinations of commodities.

Virtual wealth A concept introduced by Frederick Soddy, similar to "seigniorage." The total value of real assets that the community voluntarily abstains from holding in order to hold money instead. Since individuals can easily convert their money into real assets they count their money holdings as wealth. Yet the community as a whole cannot convert money into wealth because someone has to end up holding the money ("fallacy of composition"). Money wealth is therefore "virtual."

Waste absorption capacity The capacity of an ecosystem to absorb and reconstitute wastes into usable forms through biogeochemical cycles powered by the sun. This capacity is a renewable resource that can be overwhelmed and destroyed, or used within sustainable limits.

Welfare A psychic state of want satisfaction or enjoyment of life—an experience, not a thing—the basic reason to be of economic activity.

World Bank See "International Bank for Reconstruction and Development."

World Trade Organization (WTO) The successor organization to the General Agreement on Trade and Tariffs (GATT) that seeks liberalization of both international trade and investment and generally promotes globalization.