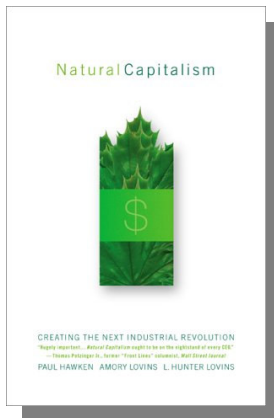


Excerpt from:



Natural Capitalism by Paul Hawken

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...from Chapter 8: Capital Gains.

Ecosystem Services

An ecosystem is a community of interacting organisms and the physical environment they live in. Every hectare of the planet is part of an ecosystem. Ecosystems sustain us. They are Earth's primary producers, solar-powered factories that yield the most basic necessities – food, fiber, water.

Ecosystems also provide essential services – air and water purification, climate control, nutrient cycling, and soil production – services we cannot replace at any reasonable price. For example...

- Production of oxygen
- Maintenance of biological and genetic diversity
- Purification of water and air
- Storage, cycling and global distribution of freshwater
- Regulation of the chemical composition of the atmosphere
- Maintenance of migration and nursery habitats for wildlife
- Decomposition of organic wastes
- Sequestration and detoxification of human and industrial waste
- Natural pest and disease control by insects, birds, bats, and other organisms
- Production of genetic library for food, fibers, pharmaceuticals and materials
- Fixation of solar energy and conversion into raw materials
- Management of soil erosion and sediment control
- Flood prevention and regulation of runoff
- Protection against harmful cosmic radiation

- Regulation of the chemical composition of the oceans
- Regulation of the local and global climate
- Formation of topsoil and maintenance of soil fertility
- Production of grasslands, fertilizers, and food
- Storage and cycling of nutrients

Thus far there are precious few if any substitutes for the services that natural capital invisibly provides. If it took a \$200 million investment to minimally keep eight people alive for two years in the Biosphere 2 project, how much would it cost to replicate functions in the preceding list? ...

... That the public does not understand the economic implications of declining ecosystem services has been frustrating to scientists. But in 1994, a group of Pew Scholars gathered in Arizona. Out of this meeting came the book *Nature's Services*, edited by Gretchen Daily, and a paper, whose lead author was economist Robert Costanza, entitled "The Value of the World's Ecosystem Services and Natural Capital," published in the British journal *Nature* on May 15, 1997. Both publications occasioned headlines, press conferences, and follow-up stories. The issues finally received proper attention because the scientists shrewdly put a price tag on the annual value of seventeen ecosystem services: \$36 trillion on average, with a high estimate of \$58 trillion (1998 dollars). Given that in 1998 the Gross World Product was \$39 trillion, the figures were surprising.

Most of the ecosystem values the scientists identified had never been economically measured. They included \$1.3 trillion a year for atmospheric regulation of gases, \$2.3 trillion for the assimilation and processing of waste, \$17 trillion for nutrient flows, and \$2.8 trillion for the storage and purification of water. The greatest contribution, \$20.9 trillion, was from marine systems, especially coastal environments. Terrestrial systems added \$12.3 trillion, with forests and wetlands each responsible for about \$4.7 trillion. The value of all terrestrial systems averaged just over \$466 per acre. Marine systems were lower, averaging \$234 per acre, but more highly concentrated in coastal environments, including the Continental Shelf, where the yield was \$1,640 per acre. The highest annual value per acre recorded was for estuaries, at \$9,240. The primary value of coastal estuaries is not as a food source but in their capacity to provide nutrient recycling services for 40 trillion cubic meters of river water every year. On land, the highest valued environments were wetlands and floodplains, at \$7,924 per acre. The greatest benefits derived from these systems are flood control, storm protection, waste treatment and recycling, and water storage.

At first glance, these numbers may seem unduly high. After all, many farmers have much more modest incomes per acre; U.S. annual gross farm income

averages about \$200 per acre per year. But bear in mind that the values measured do not simply record resources extracted and sold. An acre of ocean or chaparral can't be conventionally monetized according to the standard economic point of view, which counts only what's taken away to market, not the service of supporting life itself. ...

... When a Philippine fisherman tosses a stick of dynamite into coral reefs, harvesting stunned fish for local markets and broken pieces of coral for the pharmaceutical industry, he pockets cash at market prices. He does not pay for the loss of the coral reef, but it should be obvious that the net present value of the coral reef habitat as a future home of fish far outweighs the few pesos garnered by its destruction. Nevertheless, governments from developed and developing nations still use accounting methods that register the fish and coral harvest as net gains rather than net losses.