Oregon State Bar
Sustainable Future Section

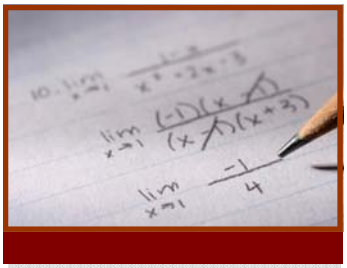
Photo: J. Michael Mattingly

A Formula For Life

By Dick Roy

Over time, the evolution of life produced diversity and complexity of species and their biotic habitat. We now marvel at their curious behavior and specialized niches. *Why do monarch butterflies found in Eastern North America migrate thousands of miles each year to spend the winter in Mexico nestled in high-altitude oyamel fir forests?*

Humans evolved with the means to adapt to diverse bioregions, from the Arctic Circle to the deserts of the Arabian Peninsula, and to escape reliance on nature's bounty by growing our own food. One cost of our immense success is to reverse the evolutionary process by simplifying the natural world. Example: by subdividing a landscape forest into parcels of timber, we create many "edges" and simplify the forest ecosystem, thereby supplanting deep forest species with those that thrive along the edges, such as crows.



"In both developed and developing countries the resource and energy use per person in on the increase."

This impact of human activity on the biotic world was rolled into a now classic formula in the late 1960s by Paul Ehrlich, a Stanford University scientist:

Impact = Population x Affluence x Technology

In the IPAT formula, an increasing human *population* requires more space (encroaching on and simplifying habitat for other species) and more resources for basic needs. *Affluence* refers to the per capita use of products and energy. *Technology* refers to both the physical damage to the natural world and the pollutants emitted into the environment per product or unit of energy.

As a species, we have flourished and become the most populous large mammal on earth. Our numbers nearly quadrupled during the last century alone, from 1.6 billion in 1900 to 6.1 billion in 2000 and, as noted in Marilyn Hempel's article on page 5, will surpass 7.0 billion in 2011. Although the rate of annual worldwide population increase is declining, and population is expected to level off by mid-century, it remains a very significant factor in defining our future.

The last two determinants in the IPAT formula, affluence and technology, are closely connected. Both are manifestations of the industrial-growth society that produces goods through the use of technology.

In both developed and developing countries the resource and energy use per person is increasing. In America, as of 2008 home sizes had more than doubled since 1950, even though fewer people live in each home. A larger house requires more construction materials, energy, and furnishings, and it has plenty of space to store more possessions. Even the poor in our country often have luxuries not imagined sixty years ago, such as TVs and disposable diapers. Now, the people of Asia seek to catch up. In fact, China overtook the U.S. in the number of TV sets purchased and the number of refrigerators produced in 2000, and it surpassed the U.S. in total (not per capita) carbon dioxide emissions in 2006.

Although technology can raise or lower the impact, over time it has greatly increased it. For example, the leaf blower, which emits harmful air pollutants, has replaced the rake and broom. When synthetic detergents replaced soap, phosphorus became a water pol-

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lutant. On the other hand, compact fluorescent light bulbs are designed to reduce overall energy use.

With advanced technology, extraction of the earth's resources has increased. Bigger fishing vessels, better nets, and new technology for spotting fish have produced a 90 percent reduction in the ocean's large fish population. Advanced equipment and techniques enable us to extract reserves of oil that previously were too small or remote, and to extract oil directly from oil shale and tar sands. With these new techniques come adverse environmental impacts. With many coal deposits in Appalachia now too deep for traditional strip mining, mountaintop mining opens access to deposits as deep as 1000 feet below the surface. The mountaintop is first clear-cut and then leveled by explosives so that the coal can be removed, and the unused rubble is pushed into a nearby valley. With the technique of cyanide heap-leach mining, small particles of gold can be extracted economically, but at great cost to the natural world. To extract a single ounce of gold for ornamental use, 30 tons of ore may be taken from the earth.

A question is often asked, "How many humans might the earth support on a sustainable basis?" Although scientists can determine the carrying capacity for a herd of elk in a specific ecosystem, they seldom attempt to determine the earth's carrying capacity for humans. The variables are too great. Cornell biologist David Pimentel figures that the earth can support only two billion people over the long run at a middle-class standard of living. Another researcher, comparing dozens of carrying capacity studies, found the medians of the low and high estimates ranging from 2.1 to 5 billion people, depending on the metric used and the standard of living and technologies assumed.[1]

Returning to the IPAT formula, and the political and economic climate today, we can see how public policy initiatives (largely unsuccessfully at this point) are focused on finding technology to reduce impact, without a serious attempt to reduce affluence as that term in defined. On the other hand, there are ways in our personal lives in which we can joyfully focus on reducing affluence without any loss in life quality.

Footnotes

[1] Cohen, Joel, *How Many People Can the Earth Support?* 1995

Dick Roy is co-founder of the Center for Earth Leadership, the Natural Step Network, and the Northwest Earth Institute—three Portland-based non-profits.