Economic Growth, Natural Capital, and Sustainability

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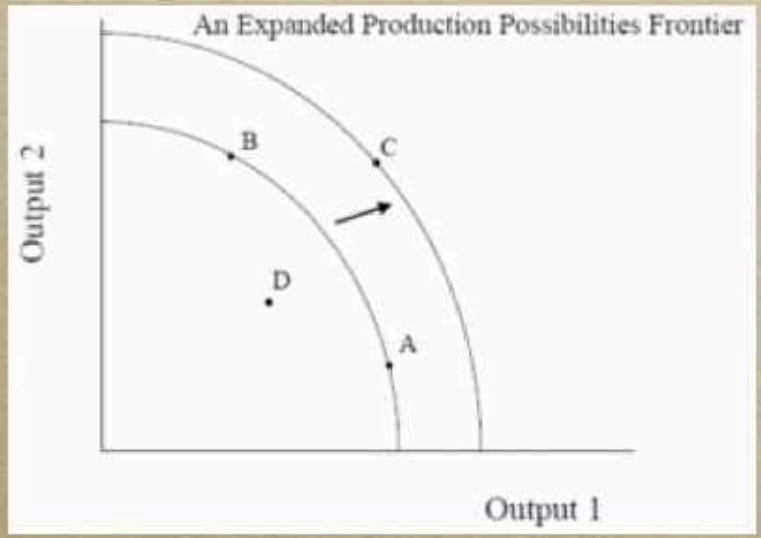
What is Economic Growth?

An economy grows when it produces more and can satisfy more wants and desires, i.e., the choice set expands (we can do everything we could do before plus some more)



Economic growth is an increase in the total output of an economy.
-Case and Fair (2004)

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How Do We Measure Economic Growth?

The most commonly used measure for economic growth is GDP (which is the value of goods and services produced) per capita. This measure equates growth with more economic activity.

The advantages of GDP:
- it's regularly and consistently measured
- it correlates with things people care about

"The rate of a nation's real gross national product...tells us how rapidly the economy's total real output of goods and services is increasing...This measure is only a very crude approximation to the rate of increase of economic welfare. For one thing, gross national product does not include one good that people prize most highly: leisure. For another gross national product does not value at all accurately new products and improvements in the quality of goods and services, and does not allow properly either for noneconomic changes in quality of life or for the costs of environmental pollution."
-Mansfield (1989)

Other Measures of Economic Growth

Human Development Index (HDI)
Employment
Human Happiness Index
Income

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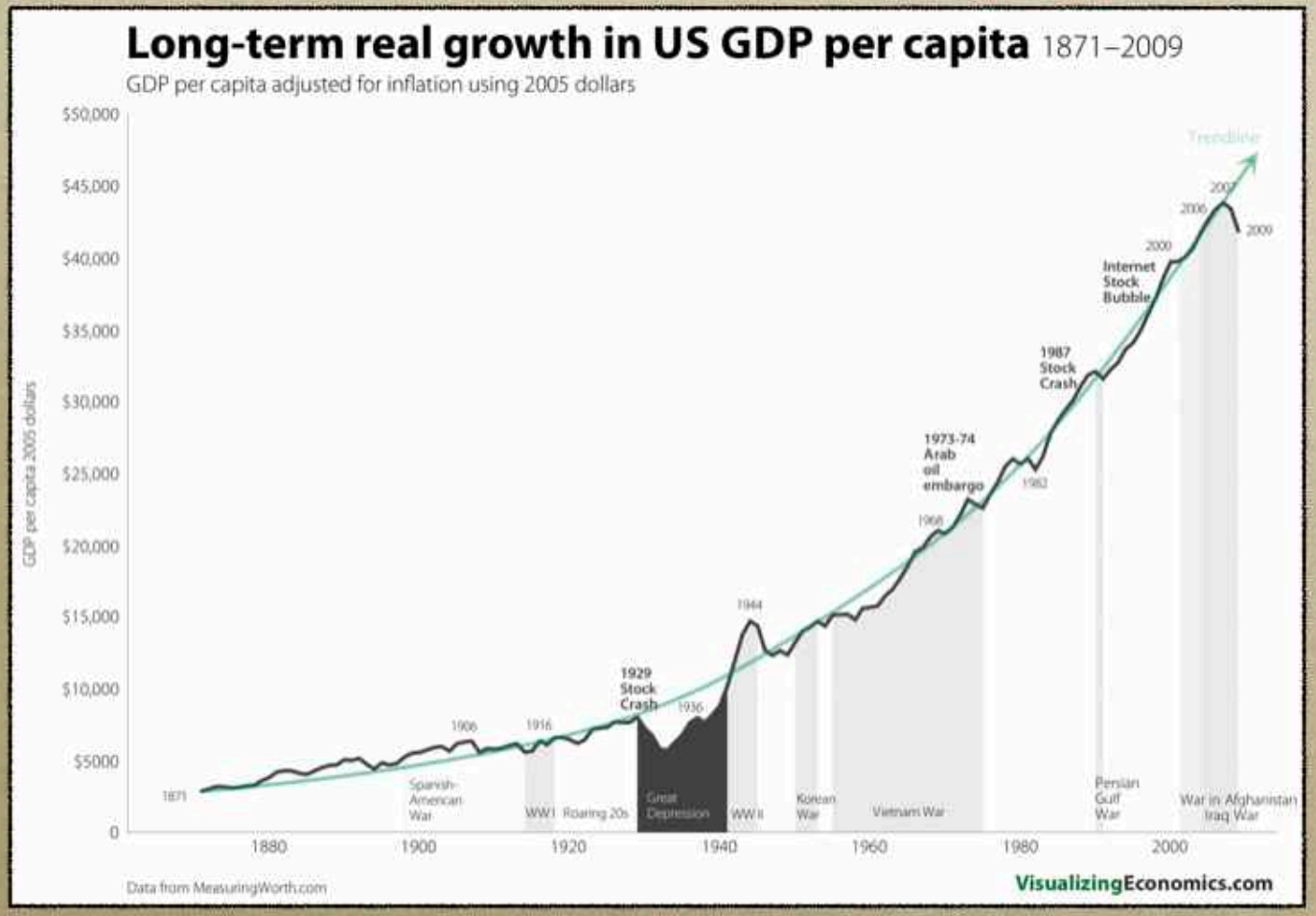
How Do We Measure Economic Growth?



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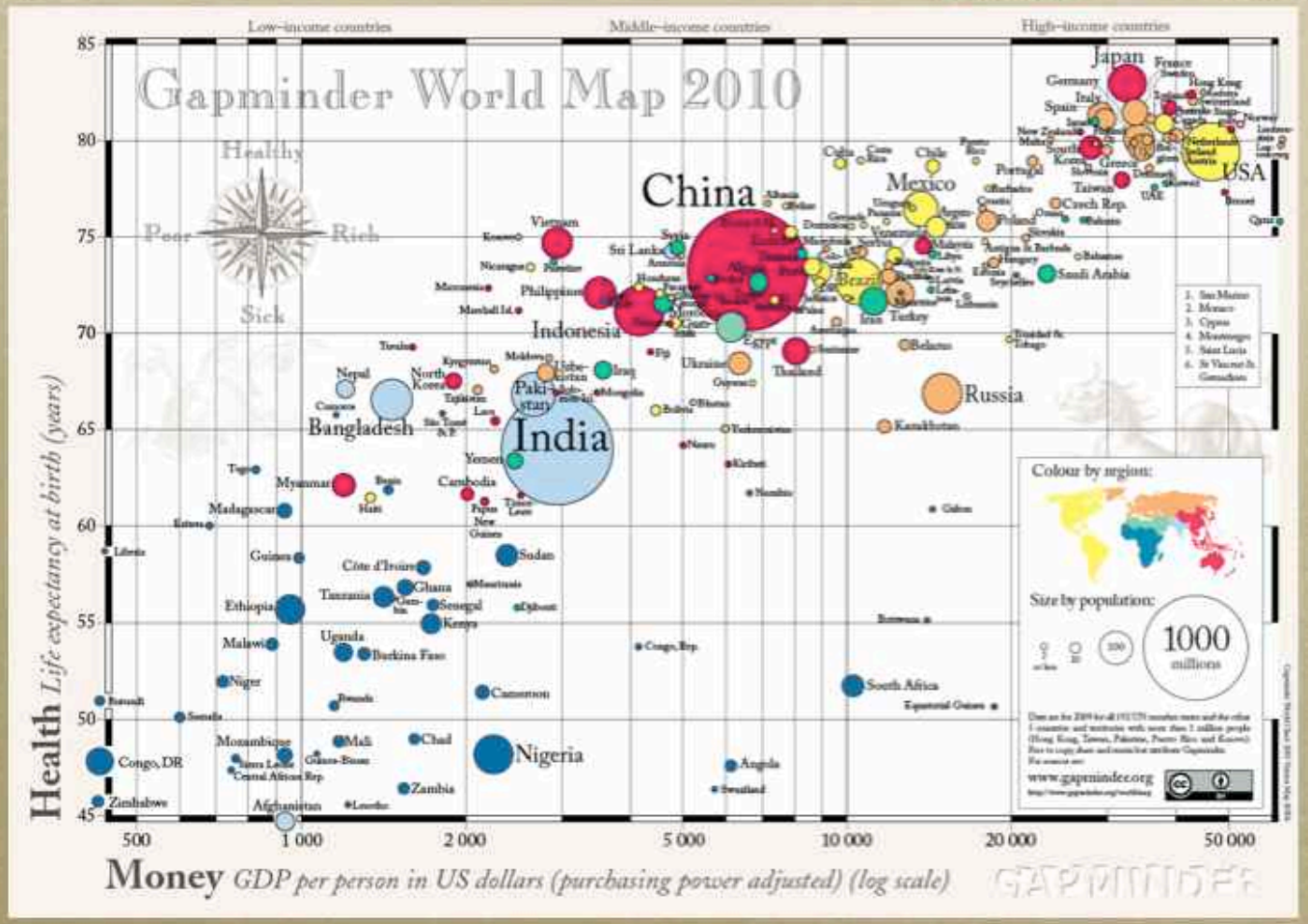

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How Do We Measure Economic Growth?

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How Do We Measure Economic Growth?

Limitations or flaws with GDP per capita

- Observable economic activity ≠ economic value, standard of living
  - Non-market or black market activity (e.g., cooking and cleaning at home, pollution, hiking on a public trail, etc.) does not count
  - Changes in assets values do not count
  - Improvements in quality (e.g. a better computer at a lower price) do not count
  - Activity stemming from "bads" (e.g. natural disasters, crime, etc.) does count
  - Distribution of income and wealth does not matter (i.e. growth in outputs that benefits a few at the expense of many still counts as growth)
  - Sustainability of activity does not matter

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How Do We Measure Economic Growth?

"Too much and too long, we seem to have surrendered community excellence and community values in the mere accumulation of material things. Our gross national product — if we should judge America by that — counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for those who break them. It counts the destruction of our redwoods and the loss of our natural wonder in chaotic sprawl. It counts napalm and the cost of a nuclear warhead, and armored cars for police who fight riots in our streets. It counts Whitman's rifle and Speck's knife, and the television programs which glorify violence in order to sell toys to our children.

"Yet the gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages; the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to our country; it measures everything, in short, except that which makes life worthwhile. And it tells us everything about America except why we are proud that we are Americans."

--Robert Kennedy

Should We Care About Economic Growth?

People generally accept that an economy that satisfies more wants and desires is good.

GDP growth is only imperfectly correlated with this measure.

While growth may be good, we always need to compare benefits to costs, i.e., what must we give up to achieve growth.

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How Do Economies Grow?

Short-Run Growth

Short-run economic growth emphasizes **increasing the utilization** of existing capital resources to produce widgets, jobs and income. In the short run, growth depends on making more efficient and complete use of the available capital resource, e.g., increasing the number of shifts at a manufacturing facility reduces downtime that machinery and unemployed workers would otherwise sit idle. Because the capital resources already exist we can make use of them relatively quickly and growth can happen relatively quickly. Growth potential in the short run is limited by the availability of existing but unused capital resources.

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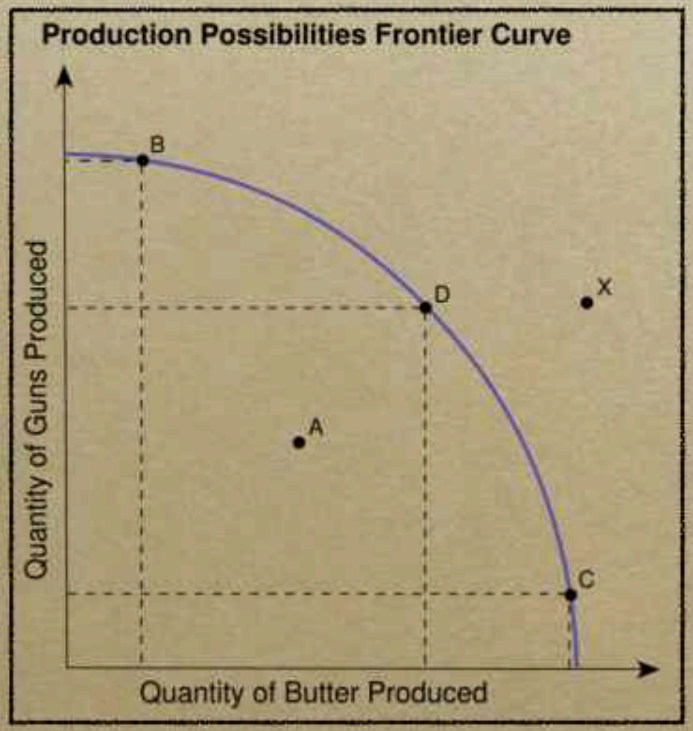
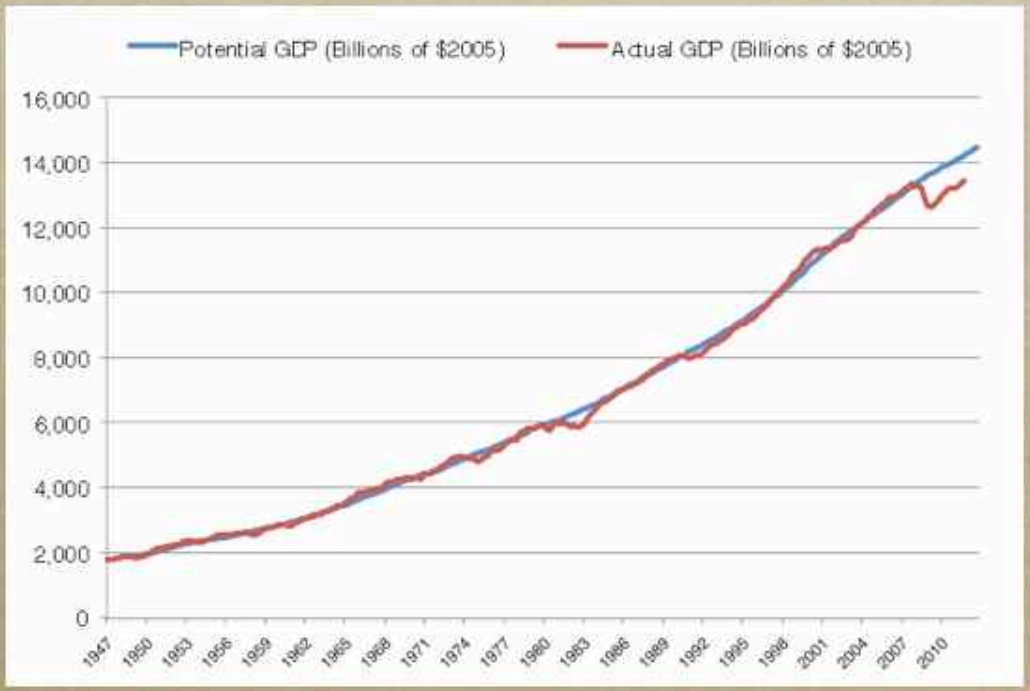
How Do Economies Grow?

Short-Run Growth





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How Do Economies Grow?

Long-Run Growth

Long-run economic growth emphasizes **increasing the economy's capacity** to produce widgets, jobs and income. Increasing economic capacity stems from increasing the supply of resources or figuring out new ways to get more output with fewer inputs (i.e., innovation). Increasing the supply of capital resources and innovation both take time.

> "New resources may mean a larger labor force or an increased capital stock. The production and use of new machinery and equipment increase workers' productivity. Give a man a shovel and he can dig a bigger hole; give him a steam shovel and...wow."
>
> -Case and Fair (2004)

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Sources of Long-Run Growth

Natural Capital

Physical Capital

Innovation

Social Capital

Human Capital

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Four Forms of Capital

Physical Capital

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Four Forms of Capital

Human Capital

Phil Knight, co-founder of Nike, born in Portland, Oregon

Bill Gates, born in Seattle, Washington

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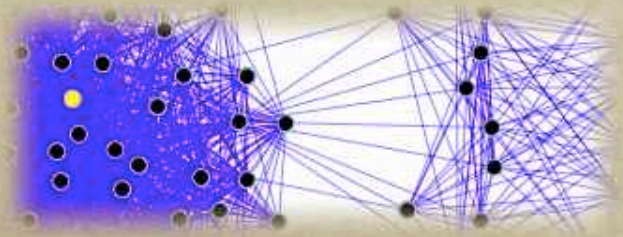
Four Forms of Capital



Social Capital

Just as a screwdriver (physical capital) or a university education (human capital) can increase productivity, so do social contacts affect the productivity of individuals and groups.

Image credits: Wikimedia Commons; wholeworldcar.blogspot.com

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Four Forms of Capital

Natural Capital

Image Credit: Wikimedia Commons

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How Does Natural Capital Contribute to Economic Growth?

Natural capital is essential for economic growth. Nature is the source of raw materials that are essential for economic activity (e.g., water, air, soil, crops, trees, an unspoiled landscape). Nature also provides a sink that absorbs the waste products generated by economic activity (e.g., CO2 absorption).

Natural Resource Source → Economy → Sinks

Image Credits: Wikimedia Commons

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Natural Capital Has Value in Several Ways...

The economy produces things of value that consume natural capital

Image Credit: Wikimedia Commons

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Natural Capital Has Value in Several Ways...

The economy produces things of value that rely on non-use or non-consumption of natural capital

Image Credit: Wikimedia Commons

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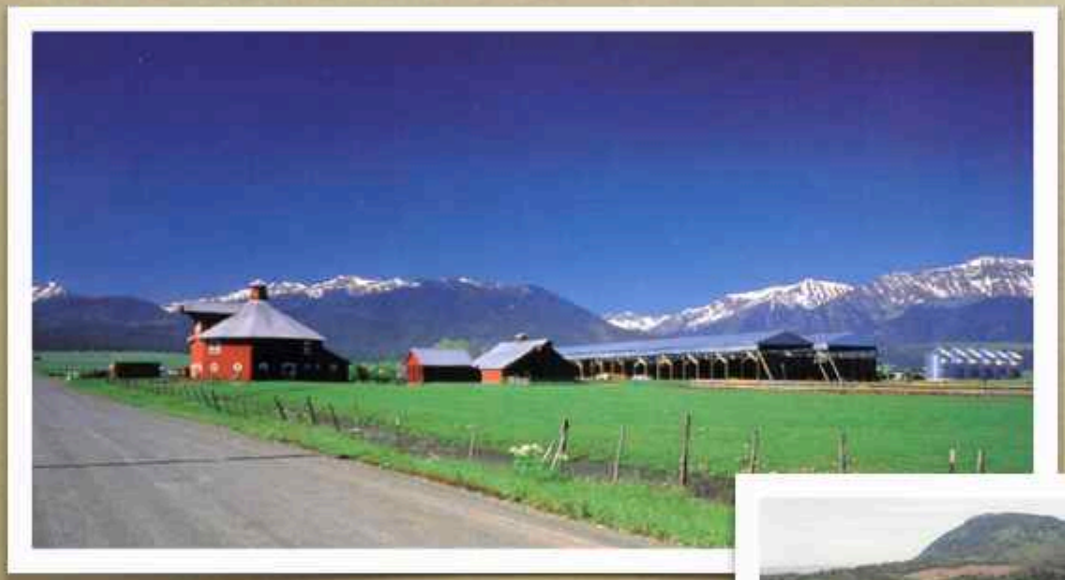
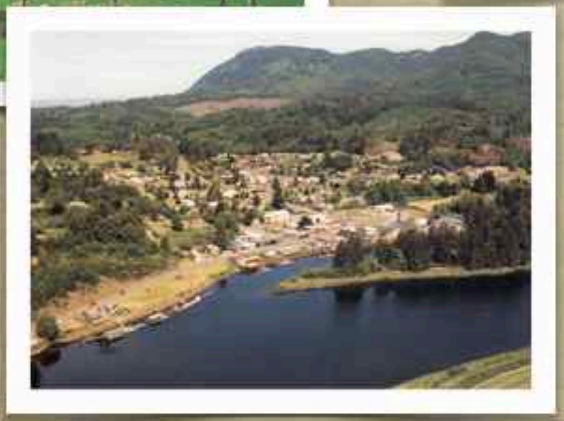
Natural Capital Has Value in Several Ways...

As a "second paycheck" or the amenity value that can attract workers, businesses, and consumers.





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Why is Natural Capital Different?

Natural capital is unique from the other three forms of capital in that the earth started with a given supply of natural capital. Over time we've degraded this capital. Mitigation projects can restore natural capital that had previously been degraded, but cannot increase the overall supply beyond what the earth started with. There are no such constraints on physical, human, or social capital.

What Does it Mean to Grow *Sustainably*?

"Development that meets the needs of present generations without compromising the ability of future generations to meet their own needs."
-Bruntland Commission (1987)

"Create and maintain the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.
-United States Environmental Protection Agency

in other words...
those in the future will be at least as well off as people today.

Or...
Ensure the supply of a **scarce** resource that supports economic growth for future generations.

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What is *scarcity*?

At its heart, economics is the study of the allocation of ***scarce resources*** *among* ***competing demands.***

physical scarcity

physical lack of a good or service.

e.g. a well runs dry or a mine is exhausted.

Image credit: Wikimedia Commons

economic scarcity

there are not enough around to simultaneously meet every possible demand.

> "Suppose a piece of land has three possible uses: agriculture, forestry, and recreation. These activities [are] mutually exclusive, in that land cannot be used for more than one purpose at the same time. Deciding to use the land for recreation purposes forgoes a return from either agriculture or forestry."
> -Hanley, Shogren, and White (2001)

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Why is it important?

Left unrestrained, competing demands can, and have in the past, degraded or exhausted the supply of scarce natural resources.

"Las Vegas was first settled for its springs, springs that made it an oasis in the desert. Although those springs have decades since run dry, water is still the most import resource to Las Vegas and the dry Southwest.

And by all indications the region is only going to get dryer. Scientists predict devastating effects from global warming, conservationists are calling for a halt to growth in Southern Nevada as a way to preserve supplies and water managers are looking to ever more creative ways to reduce reliance on the overburdened Colorado River. A Colorado River reservoir at Lake Mead is the source of 90 percent of the valley's water supply. Water levels there have fallen steadily for nearly a decade.

With expected changes in climate and no change in future water usage, **Lake Mead could run dry by 2021**."

-Las Vegas Sun, "For Want of Water."

Image Credit: Stressbone, Flickr; John Sullivan

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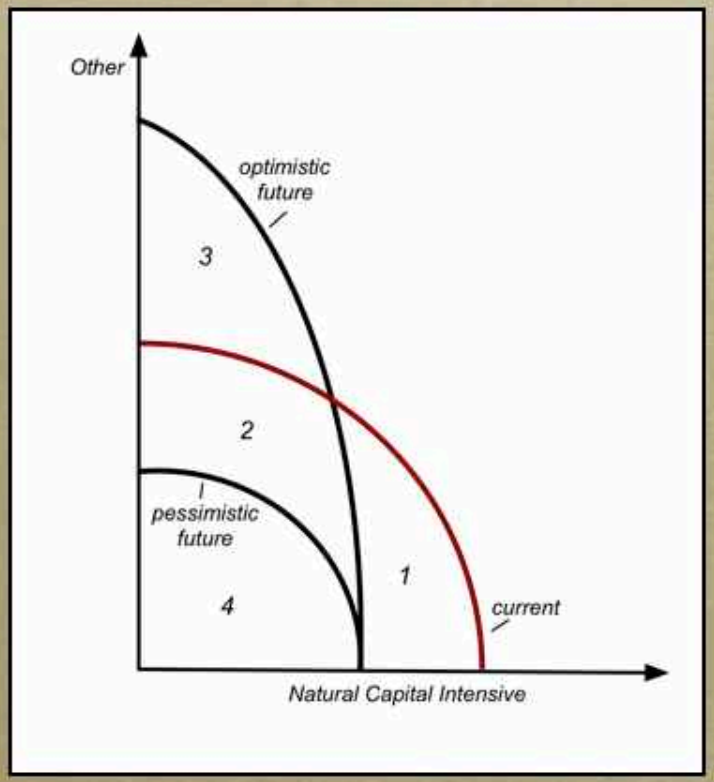
Debates about Sustainability

Choose to irreversibly consume / damage natural capital today

Loss of some choices / options for future. Current choices not available.

Future welfare better or worse? Can economy generate new choices that sufficiently compensate future generations for lost options?



Two key questions

(1) Will economy generate new choices? Will technology improve sufficiently quickly? Will ecosystems or society break down?

(2) Can new choices compensate for lost choices? Can create capital substitute for natural capital in producing choices / welfare?

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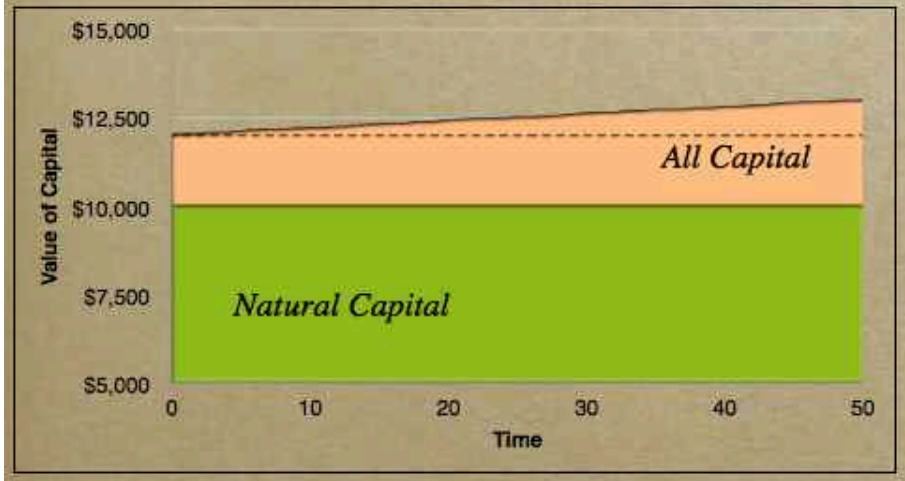
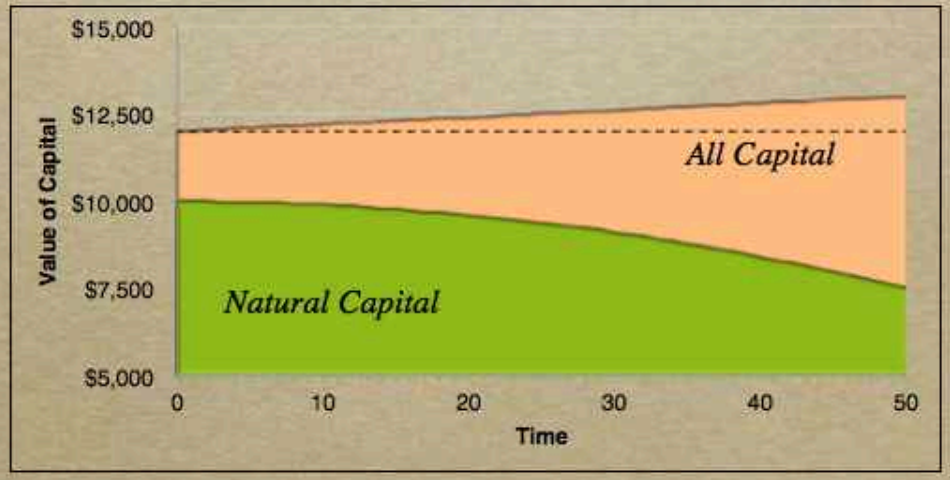
Debates about Sustainability

Do we care about the growth in total value summed across the four forms of capital? Or are there minimum amounts of natural capital that we should protect as economies grow and develop?

Maintain Minimum Amount of Natural Capital



Diminishing Amount of Natural Capital



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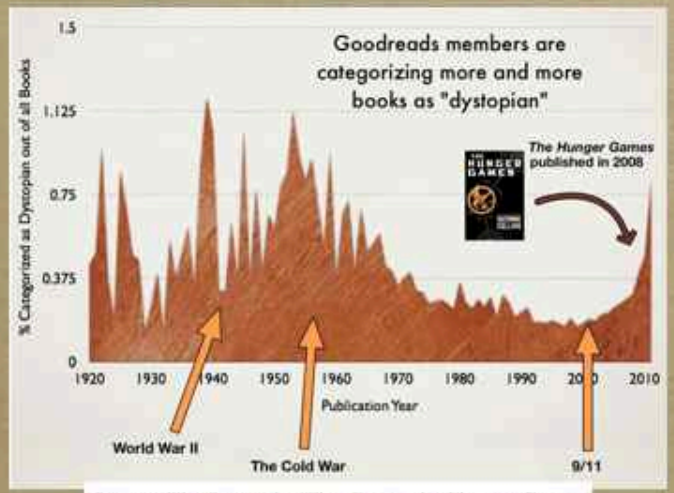
Debates about Sustainability

Should we care about protecting minimum supplies of ecosystem services from available natural capital?

Benefits of consuming natural capital occur today, many of the costs occur in the future. How can we evaluate this tradeoff without knowledge or representation by future generations (and future states of the world)? What will the future look like?



Source: The Dystopian Timeline to the Hunger Games

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What is *discounting*?

General concept: future costs, benefits, and dollars are worth less to society today than today's costs, benefits, and dollars.

"If I expect to receive something of value in the future, what is it worth today? Or, for example, if someone promised you a sum of money next year or a lesser sum of money this year, which is the better deal?"
-Field (2001)

"To take a simple example, an individual would differentiate, ceteris paribus, between receiving $100 today and receiving the same $100 in one years time. The more immediate sum might be preferred due to impatience (I want to spend the money right now). Alternatively, I may not want to spend the money for a year, but if I have it now I can invest it in a bank at an interest of say 10% and have $110 in one years time."
-Hanley and Spash (1995)

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Discounting and Net Present Value

"Suppose you are investigating an allocation that would yield the following pattern of net benefits on the last day of each of the next five years: $3000, $5000, $6000, $10,000, and $12,000. If you use an interest rate of 6%, you would discover that this stream has a *net present value* (NPV) of $29,210.

What does that number mean? If you put $29,210 in a savings account earning 6% interest and wrote yourself checks, respectively, for $3000, $5000, $6000, $10,000, and $12,000 on the last day of each of the next five years, your last check would just restore the account to a zero balance. Thus, you should be indifferent about receiving $29,210 now or in the specific five-year stream of benefits totaling $36,000. Hence, the method is called present value because it translates everything back to its current worth."
-Tietenberg (2000)

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The Importance of a Discount Rate

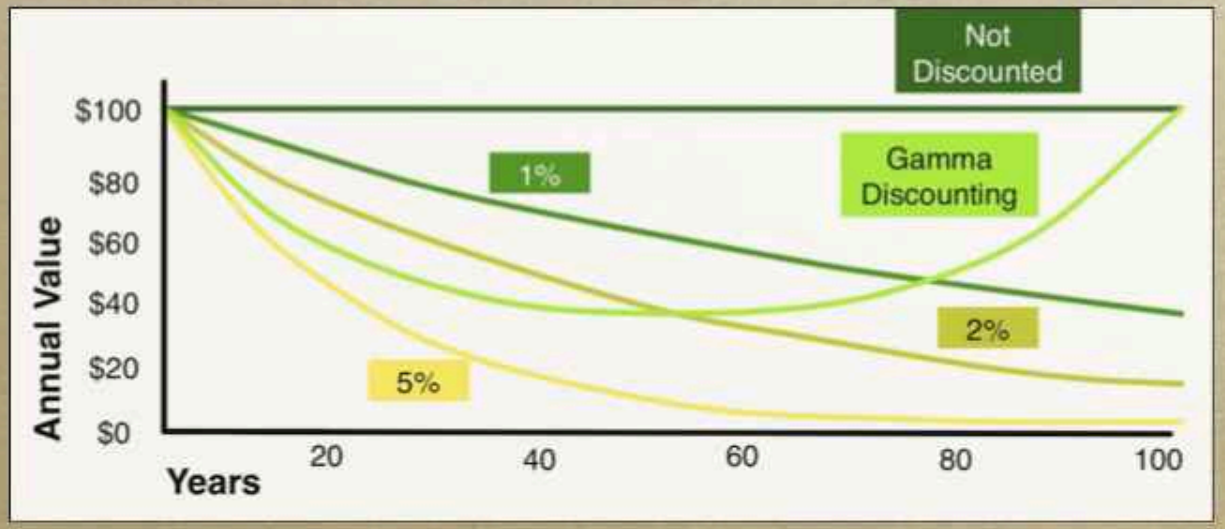
For years, the United States and Canada had been discussing the possibility of constructing a tidal power project in the Passamaquoddy Bay between Maine and New Brunswick. This project would have heavy initial capital costs, but low operating costs which presumably would hold for a long time into the future. As part of their analysis of the situation, a complete inventory of costs and benefits was completed in 1959.

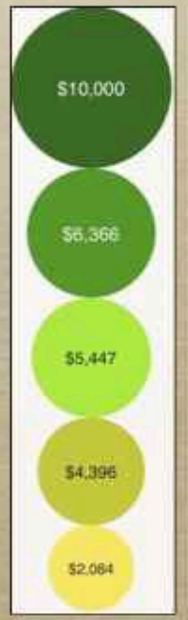
Using the same benefit and cost figures, Canada concluded that the project should not be built, while the United States concluded that it should. Because these conclusions were based on the same benefit-cost data, the differences can be attributed solely to the use of different discount rates. The United States used 2.5% while Canada used 4.125%. the higher discount rate made the initial cost weigh much more heavily in the calculation, leading to the Canadian conclusion that the project yields a negative net benefit. Since the lower discount rate weights the lower future operation costs relatively more heavily, Americans saw the net benefit as positive.

-Tietenberg (2000)

Discounting and NPV

Using a higher discount rate will result in lower NPV and vice versa.





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How is discounting relevant to sustainability?

Making sustainable choices will likely entail choices that lower the welfare of some existing people in exchange for leaving future generations potentially better off. Thus, it is necessary to determine how much weight decision makers should place on future generations when making these decisions.

What does this mean?

Over very long periods, applying a positive discount rate means that costs and benefits for distant generations have essentially no effect on current decisions.

"Decisions concerning whether to undertake projects with long-term benefits (for example, growing oak trees) or with long-term costs (for example, storing nuclear waste) frequently turn on the choice of discount rate. The further into the future benefit and cost streams occur, the lower their present value. Thus, as far as current decision-makers using the net present value criterion are concerned, growing oak trees becomes unattractive and creating and storing nuclear waste seems less onerous. As the discount rate is increased, this time bias increases."
-Hanley and Spash (1993)

What Do Economists Say?

Economists don't agree.

Some argue that not discounting the future means making decisions without respect to opportunity costs and could lead us to starve ourselves for the benefit of uncertain future generations.

> Four general justifications for discounting the future effects of present actions can be identified. First, the very temporal location of our descendants disqualifies them from equal treatment with current members of the body politic. Second, the argument has been made that we should restrict our attention to those aspects of our actions for which preferences are known and exclude unknown future preferences. Third, the human race will at some stage become extinct, so more consumption today prevents potential resource wastage tomorrow. Fourth, discounting relies upon the uncertainty of future events. For example, where this uncertainty concerns the demand for a depletable resource, it is assumed to be positively related to the distance in time from the depletion decision. The conventional answer is to reflect such uncertainty in an increase in the discount rate."
>
> -Hanley and Spash (1993)

Others argue that discounting can result in serious injustice towards future generations. For example, saving one life today could be deemed better than the entire survival of the human race at some point in the future.

> "The acceptance of discounting as the proper approach to inter-temporal distribution requires, as Page (1977) has noted, an unavoidable moral judgement. a zero social discount rate, where intergenerational decisions are involved, would prevent future environmental damages from implicitly being ignored."
>
> -Hanley and Spash (1993)

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Sources

Baumol, W.J. and A.S. Blinder. 1985. *Economics: Principals and Policy*. 3rd ed. Harcourt Brace Jovanovich, Publishers. Orlando, Florida.

Bruntland Commission. 1987. "Report of the World Commission on Environment and Development: Our Common Future." General Assembly of the United Nations. A/42/427.

Case, K. and R. Fair. 2004. *Principles of Microeconomics*. 7th ed. Pearson Prentice Hall. Upper Saddle River, New Jersey.

Clarke, M. and S.M.N. Islam. 2005. "Diminishing and negative welfare returns of economic growth: an index of sustainable economic welfare (ISEW) for Thailand." *Ecological Economics* 54:81-93.

Daniels, S., C. Gobeli, and A. Findley. 2000. "Reemployment Programs for Dislocated Timber Workers: Lessons from Oregon." *Society and Natural Resources* 13 (2):135-150.

Eckert, K. 2011. "Intel boots county, state economies." The Oregonian. October 18.

Environmental Protection Agency. No date. "What is sustainability?" Available online: http://www.epa.gov/sustainability/basicinfo.htm.

Field, B.C. 2001. *Natural Resource Economics: An Introduction*. McGraw-Hill Higher Education. New York, New York. Lipsey, R., P. Steiner, D. Purvis, and P. Courant. 1990. *Macroeconomics*. 9th ed. Harper & Row, Publishers. New York, New York.

Good Reads. 2012. "The Dystopian Timeline to the Hunger Games." Available online: http://www.goodreads.com/blog/show/351-the-dystopian-timeline-to-the-hunger-games-infographic. March 21.

Hanley, N. and C.L. Spash. 1993. *Cost-Benefit Analysis and the Environment*. Edward Elgar Publishing Limited. Vermont.

Hanley, N., J. Shogren, and B. White. 2001. *Introduction to Environmental Economics*. Oxford University Press. New York, New York.

Las Vegas Sun. 2011. "Quenching Las Vegas' Thirst: For Want of Water." Part 4. June 22. Available online: http://www.lasvegassun.com/news/topics/water/.

Mansfield, E. 1989. *Economics: Principals, Problems, Decisions*. 6th ed. W.W. Norton & Company. New York, New York.

Solow, R. 1991. "Sustainability: An Economist's Perspective." Eighteenth J. Seward Johnson Lecture to the Marine Policy Center. Woods Hole Oceanographic Institute. Woods Hole, Massachusetts. June 14.

Tietenberg, T. 2000. *Environmental and Natural Resource Economics*. 5th ed. Addison Wesley Longman. Reading, Massachusetts.