Environment economics and policies

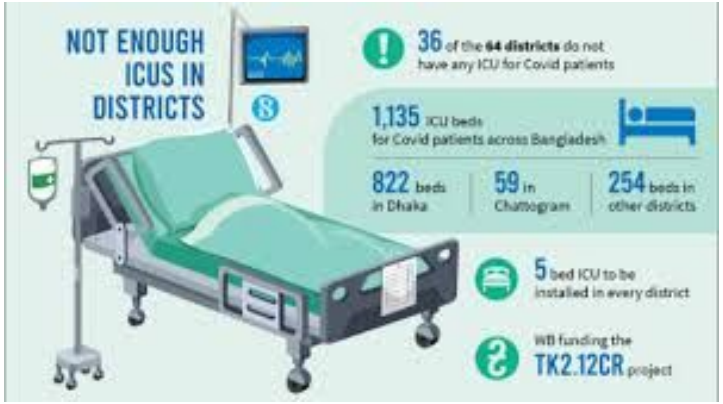
EC 506

Chapter 2: Economists’ perspectives on the environment

Scarcity or shortage

In a particular desert town, there's a limited amount of freshwater available due to decreased rainfall over the years. The town's population, however, has been growing, leading to an increased demand for water for drinking, agriculture, and industry.

Scarcity or shortage



Scarcity refers to the limited availability of resources to meet unlimited wants and needs. It is a central concept in economics, explaining the situation where resources are significantly below demand (Turner, 2019).

Types of scarcity

Absolute or Physical resource scarcity It may occur if any economic activity or a whole system of economic activities depends upon an essential natural resource which has a finite limit on its physical availability. **Example: Uranium**

Where a market exists for a resource, the existence of any positive price is viewed as evidence of absolute scarcity.

Relative natural-resource scarcity Economics is a science which studies human behavior as a relation between ends and scarce means which have alternative use. Thus there always exits the solution of relative scarcity as the resources are limited with respect to human demand and human wants are unlimited in relation to resources. **Example: coal**

A rising opportunity cost of obtaining the resource is an indicator of scarcity – this use of the term relative scarcity.

Types of scarcity

Smulders (2005), in modern economics- **whether an increase in physical scarcity translates into economic scarcity depends on the "neoclassical trinity" of diminishing returns, substitution and technological change in production.** According to this view, whereas the diminishing returns from combining more capital and labor with the same amount of natural resource inputs leads to scarcity, technological change and substitution of other inputs for natural resources will counteract this scarcity.

Malthusian scarcity reflects a situation of absolute or physical scarcity. The finiteness of resources – the physically limited stock of land and other natural resources – act as a constraint on the production of more output.

Ricardian scarcity exhibits all the characteristics of relative scarcity. As resources are used in successive grades of declining quality, the costs of their use rises. The less fertile the land or lower grade the resource, more capital and labor needs to be applied to generate the same level of output, which leads to higher costs of production. Consequently, as soon as the initial stock of the highest quality resource is completely utilized, diminishing returns translates into relative scarcity and thus higher prices for output that uses this resource.

Phases of modern economic views of natural resource scarcity

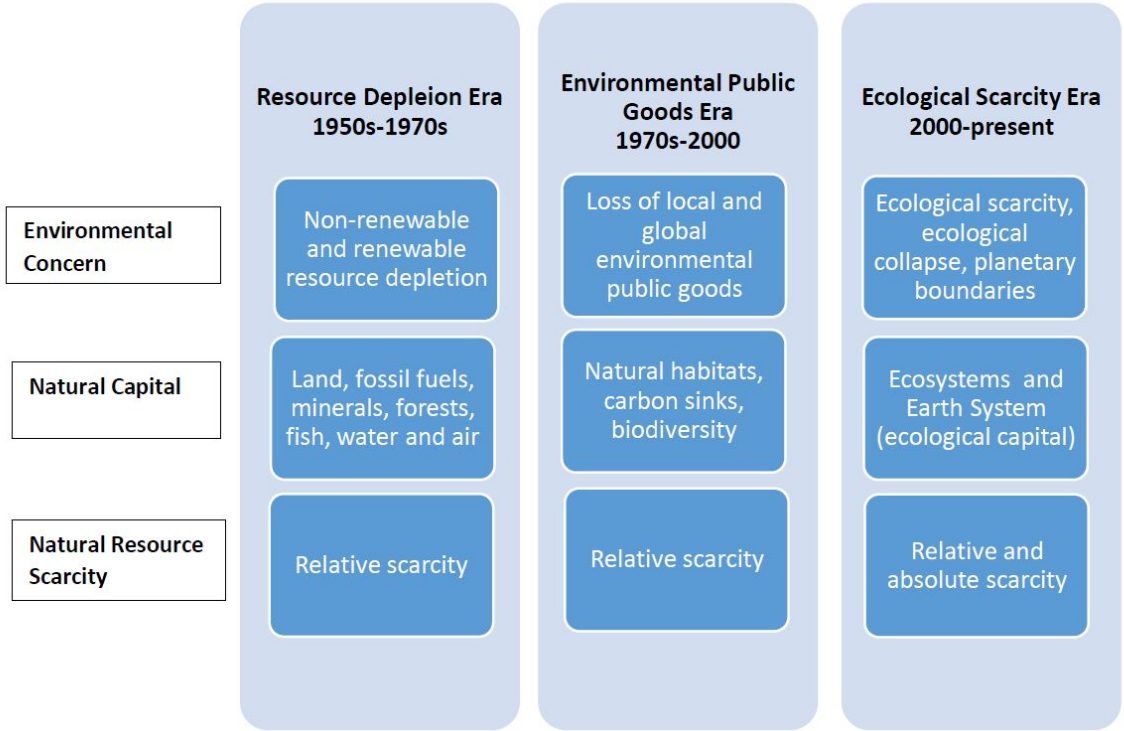
Three distinct phases are discernible in the evolution of modern economic views of natural resource scarcity.

From the 1950s through the 1970s, the concern was mainly with whether there were physical “limits” on the availability of natural resources as economies expand and populations grow. This period can be referred to as the **“Resource Depletion Era”.**

From the 1970s to the end of the 20th century, attention shifted to the state of environment, and especially the loss of global and local environmental public goods and their important non-market values. This phase is denoted as the **“Environmental Public Goods Era”.**

Since 2000, there has been growing alarm over the state of the world’s ecosystems and Earth system processes, and the need to respect “planetary boundaries” on the environmental impacts from human activities. This final period is the **“Ecological Scarcity Era”.**

Phases of modern economic views of natural resource scarcity



How the scarcity of natural resources has evolved

- The First Debate: The British Classical Economists- Thomas Malthus (1798) and John Stuart Mill (1862)
- The Second Debate: The U.S. Conservation Movement (1890-1920) and the Studies by Hotelling (1931) and Barnett & Morse (1963)
- The Third Debate: The Limits to Growth Report for the Club of Rome
- The Fourth Debate: “Pre-Sustainability” Research in Economics, from 1974 Onwards

The First Debate: The British Classical Economists- Thomas Malthus (1798) & John Stuart Mill (1862)

In 1798 Thomas Malthus published his well known essay on the principles of population.

Malthus believed instead that the human race would always breed until the limits of natural resources are met, and at that equilibrium societies are characterized by misery, starvation, and a subsistence level of wages.

Technological development only produces a short-term increase in well-being until the limits are again met. Long-term development would be possible only if mankind makes the moral decision not to breed during economically stable times when wages exceed the subsistence level. However, Malthus deemed this impossible.

John Stuart Mill (1862) emphasized that while the limited quantity of natural resources could in principle constraint increases in production, this limit had not yet been reached and would not be reached in any country over any meaningful time frame. Mill based his argument on future developments in agricultural knowledge and because social institutions and increases in economic welfare may slow down population growth.

An interesting feature in Mill's thinking was the argument that the quality of living space is an important part of economic well-being. According to Mill, a world where the environment is used completely for industrial and agricultural purposes is not an ideal world.

The Second Debate: The U.S. Conservation Movement (1890-1920) and the Studies by Hotelling (1931) and Barnett & Morse (1963)

The Conservation Movement, with U.S. president Theodore Roosevelt among its leaders, was a highly successful political ideology in the United States between 1890 and 1920.

According to its doctrines, economic growth has clear physical boundaries that cannot be avoided by technological development. Too rapid use of nonrenewable resources was considered a major threat to future generations. It was argued that the lower the use of nonrenewable resources, the better.

Economic competition and monopolies were seen as major enemies to the wise use of natural resources, which was defined in physical and ethical terms. Government control of natural resources was deemed desirable. Needless to say, many of the ideas being discussed in the present-day debate on nature conservation and sustainability were conceived during this period.

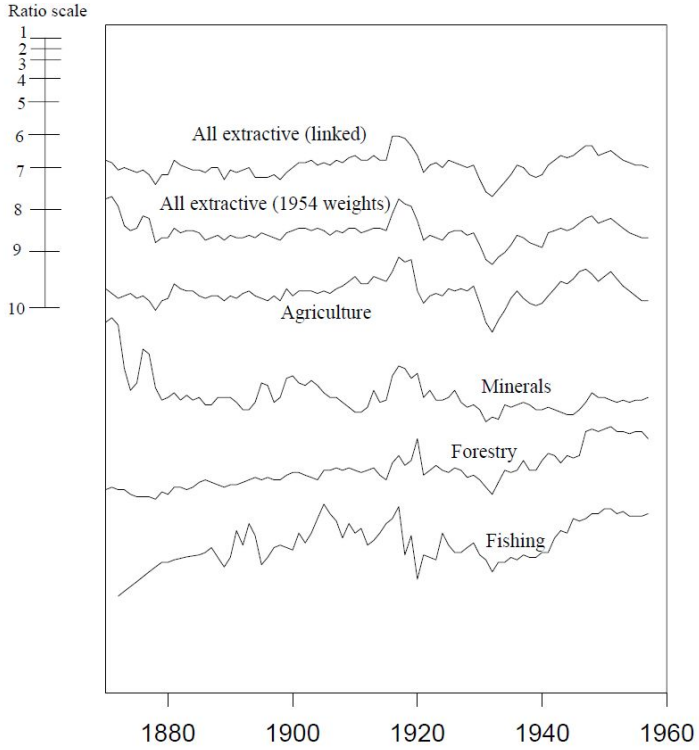
Partly as a reaction to the Conservation Movement, an economist, Harold Hotelling, published a study “The Economics of Exhaustible Resources” in 1931. In this study he constructed a theoretical model in which social well-being from nonrenewable resources was maximized over an infinitely long period; he then showed that in a market economy, profit maximizing mining firms would extract nonrenewable resources at the “socially optimal rate.”

The Second Debate: The U.S. Conservation Movement (1890-1920) and the Studies by Hotelling (1931) and Barnett & Morse (1963)

Thirty years later there were data available for studying the question of natural resource scarcity empirically. In the study Scarcity and Growth, two U.S. economists (Barnett and Morse 1963) collected price and cost time series data on minerals, agriculture, and renewable resources.

Their purpose was to test whether the hypothesis of increasing natural resource scarcity obtains empirical support. The results were quite surprising: for agriculture and minerals, price and production costs had fallen or remained constant within the period from 1870 to 1957. Only the price level in forestry had shown an upward trend. According to the study, these findings can be explained by technological development, which produces substitutes for scarce resources, decreases extraction costs of minerals, and thus expands the size of economic reserves.

Authors questioned many of the basic premises of the conservation movement as well as the pessimistic Malthusian view.



The Third Debate: The Limits to Growth Report for the Club of Rome

a group of scientists from the Massachusetts Institute of Technology (MIT) published the Limits to Growth report for the Club of Rome (Meadows et al. 1972), based on new digital computers and on a modeling method called “system analysis.” The study presented a large new type of model in order to predict the future development of five global variables: population, food, industrialization, nonrenewable resources, and pollution.

The prediction of the study was highly pessimistic: The future world population level, food production, and industrialization would first grow exponentially but then collapse during the next century. The collapse follows because the world economy will reach its physical limits in terms of nonrenewable resources, agricultural production, and excessive pollution. The study also predicted that eleven vital minerals could be exhausted before the end of this century. Among these were copper, gold, lead, mercury, natural gas, oil, silver, tin, and zinc.

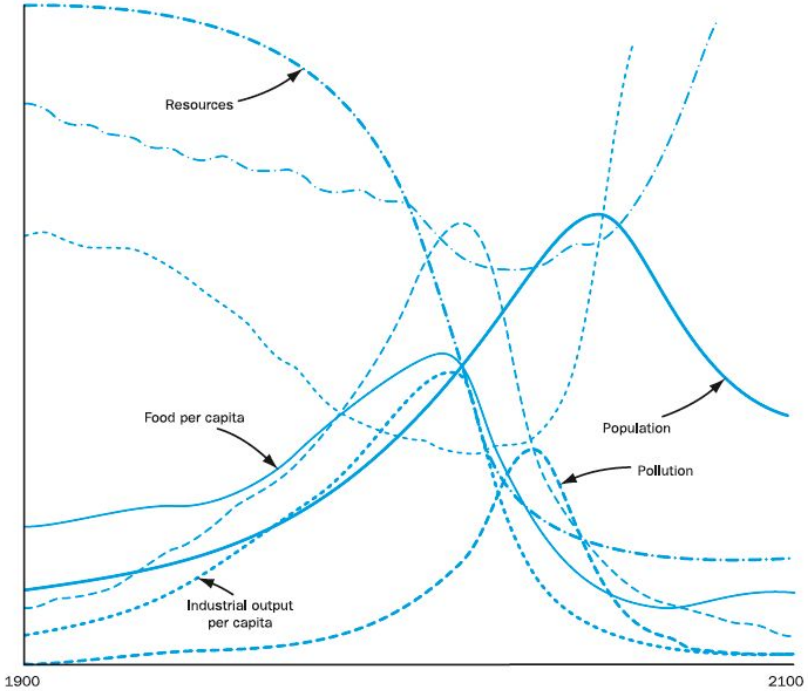


Figure 2.13 Base run projections of the ‘limits to growth’ model
Source: Meadows *et al*. (1972), page 124

The Fourth Debate: “Pre-Sustainability” Research in Economics, from 1974 Onwards

One year after publication of the Limits to Growth report, oil prices rose about threefold over a very short time. This caused the first energy crisis. There were very few then who questioned the view that the world was entering a future of increasing scarcity of energy and natural resources. Perhaps the most well known work of this time is the 1974 economic growth and nonrenewable resource model of Partha Dasgupta and Greffrey Heal.

These economists ask whether an economy can maintain a positive consumption level forever, given that there is no technical development and that the production of commodities is possible only by using limited nonrenewable resources like oil. This is clearly a question of sustainability. According to their analysis it is possible to maintain a positive consumption level forever only if capital can be substituted for nonrenewable resources without technical difficulties. If the substitution possibilities are limited, future consumption per capita must finally fall to zero.

Another interesting result of this research is that even in cases where it would be possible, in principle, to maintain positive consumption forever and thus achieve sustainable development, the market system may lead to an outcome where consumption per capita in the long run falls to zero. This unfortunate outcome occurs if consumers are not willing to continuously save a high enough proportion of their income to invest in capital, or if population growth is too rapid.

Studies in this field have shown that sustainable development may be possible if the economy invests all of its economic surplus or profits from using nonrenewable resources in capital accumulation (Hartwick 1977). In a market economy, governments would have to create an incentive for this using taxation or other methods.

The Fourth Debate: “Pre-Sustainability” Research in Economics, from 1974 Onwards

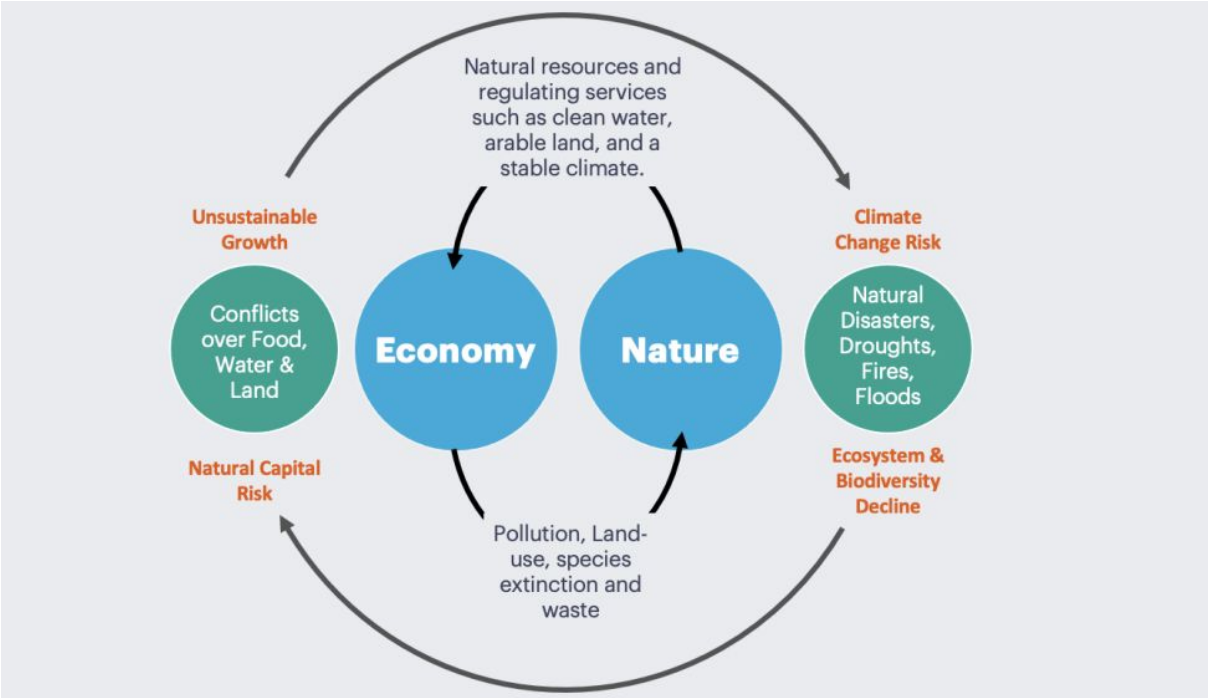
Another line of research includes renewable resources, like solar and wind energy, in models of long run economic growth. This changes the pessimistic outcome noted above. The economy first uses up its nonrenewable resources and simultaneously invests in some revolutionary technology that decreases the cost of using renewable energy (Dasgupta and Stigliz 1981). When nonrenewable resources are used up, there is a switch to the use of renewable energy sources.

The Earth in the Balance Sheet

The Earth in the Balance Sheet

The Earth in the Balance Sheet

Because of overpopulation and overconsumption, human activity is now beyond Nature's carrying capacity — a sign of lack of self-balancing checks and mechanisms. **In the 50 years since the Club of Rome Limits of Growth study, world population has doubled to 8 billion, with GDP growing by 25 times, and GDP per capita by 12 times.** The planet cannot continue to sustain consumption and population growth at the same levels, given **fundamental resource limits, unhealthy lifestyles, governance failures, natural disasters and human conflicts.**



The Earth in the Balance Sheet

No accounting is complete without the preparation of a balance sheet statement, it is a key component which provides insights into the health of the enterprise.

It is an accounting equation that lists at a point of time the balance between the value of assets and liabilities of an entity, with the remaining part being the equity (owned value).

The balance sheet reflects stock situations at a point of time and the flow over a period of time is shown separately in the profit or loss accounts that together make up the financial condition of an entity.

The resilience of any entity is directly proportional to the excess of assets over liabilities which forms the equity.

If at any given point of time the liabilities exceed assets it results in negative equity, which means the stakeholder’s value in the entity has been eroded and the future of that entity is in deep trouble unless it has concrete plans to be able to regenerate its assets to match & exceed its liabilities again.

Economic accounting, therefore, needs to evolve and lead to the compilation of local, regional and ultimately a consolidated One Earth Balance sheet. This would inform decision-making and ensure that the earth's resources are used in a sustainable way for the benefit of current and future generations. It is a step towards a more sustainable and equitable economic system that respects the Earth's carrying capacity.

The Earth in the Balance Sheet

The data for a One Earth Balance Sheet would be represented in a similar format to a traditional balance sheet, with assets, liabilities, and equity.

Assets

the natural stocks, their health condition, and the potential flow they can sustainably generate at a given state of technology, measured per capita and on an aggregate basis.

For example, the total and per capita agriculture land area and the potential sustainable yearly produce from it.

Liabilities

the required flows from the natural stocks to sustainably fulfill the needs and wants of the population and mitigate the environmental damage resulting from economic activity, measured per capita and on an aggregate basis.

For example, the amount of food produce required to feed the estimated population measured per capita and on an aggregate basis.

Equity

Equity corresponds to the residual balance between assets and liabilities of the natural stocks and the potential flows from it, measured per capita and on an aggregate basis.

Positive Equity- the Earth's natural resources are sufficient to meet human needs and wants while preserving surplus natural stocks and resources.
Zero Equity- the Earth's natural resources are being used at their maximum capacity, without any surplus or deficit.
Negative Equity- human needs and wants and the environmental damage caused by economic activity exceed the Earth's capacity to sustainably supply and absorb them, resulting in a deficit of natural stocks and resources.

The Earth in the Balance Sheet

The concept of a One Earth Balance Sheet that has a holistic view of the planetary and human condition and change attempts to improve our understanding of where we are and what needs to be done.

By building on available financial, economic, social and physical data, we try to measure, compare and integrate a composite picture of imbalances at the planetary and human levels. As stewards of human and natural destiny, we should try to do minimal harm to arrive at harmony between man and nature. This requires a common, shared understanding but different actions at the state, market, community and individual levels.

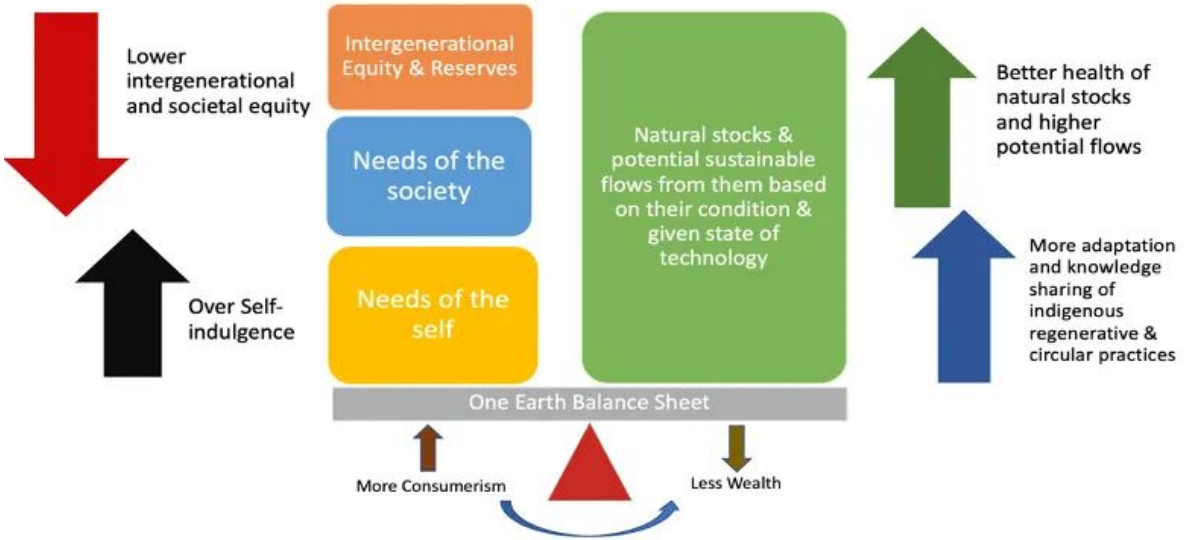
In the global consolidated One Earth Balance Sheet, **a positive net equity situation demonstrates that the situation is under control, merely requiring the coordination of political and economic actions among surplus and deficit nations.** On the other hand, **a deficit situation (negative net equity) indicates a critical bankruptcy situation and the need for strong changes in countries' strategic decisions.**

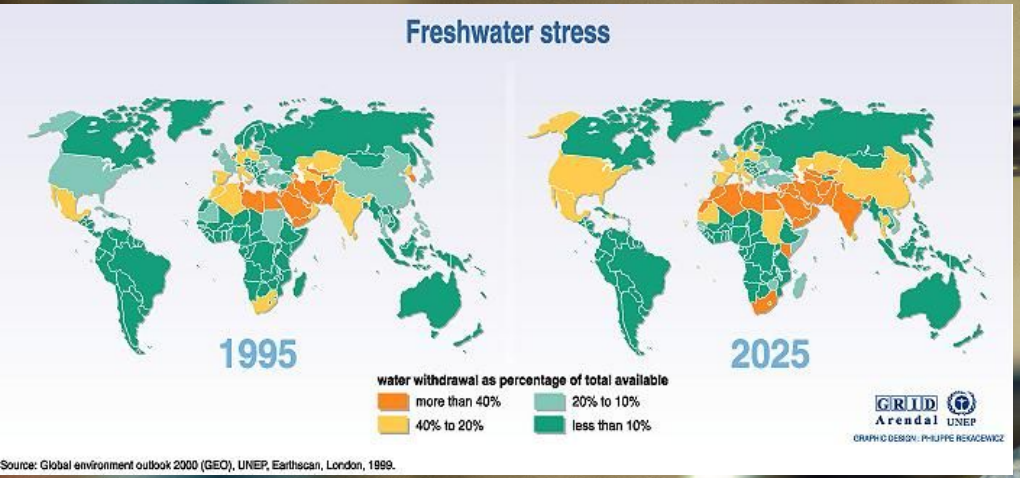
The compilation of **a One Earth Balance Sheet** is therefore a collective effort that forms a framework to:

1. Ensure that economic activity remains within safe planetary boundaries
2. Promote social cohesion, shared prosperity and wellbeing
3. Safeguard intergenerational equity

The Earth in the Balance Sheet

Moving towards a balanced One Earth Balance Sheet will require a long-term committed, integrated, coordinated and comprehensive effort at the state, market, community and individual levels that address both the ecological and socio-economic dimensions. This will involve ***gathering reliable data and monitoring progress, taking a holistic approach to decision-making, implementing a range of policies and regulations, investing in sustainable infrastructure, changing consumption patterns, and raising awareness and education.***





Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.