



Report on Economic Valuation of Oxygen Supplying Ecosystem Service of Healthy Trees



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1. Introduction

Trees are essential to life as we know it and provide various ecological services to humans and to the environment. Some of these ecosystem services provided by trees are:

- production of oxygen
- carbon sequestration
- cleaning and cooling of the air
- providing of shade and shelter
- providing habitat to birds and biodiversity
- acting as windbreaks
- preventing soil erosion
- cleaning of the soil through phytoremediation
- regulating flow of stormwater runoff
- helping in cutting noise
- helping in nutrient recycling and
- regulation of groundwater table

In addition to the above, trees also provide aesthetic pleasure and help in reducing mental stress, thereby playing an important role in improving personal health.

One of the first scientists in the world to have published a paper on quantifying the services of a tree was Dr. Tarak Mohan Das, a researcher from the University of Calcutta. He published a paper (Indian Biologist, Vol XI, No. 1-2, 1979) which quantified the services rendered by a tree during its average life span of fifty years. The total value of these services, divided into eight heads, was Rs. 15,70,000/- (Fifteen lakhs and seventy thousand rupees) in 1979. Now, it has been revised to Rs. 3,55,13,000 (Three crores fifty five lakhs thirteen thousand) due to increase in price of oxygen and other services derived from a tree for a long span of fifty years. This concept of valuation has been incorporated in the Book of Accountancy. The Film Division of Govt. of India has also made a documentary film on this concept of valuation under the title "Services of a Tree".

The most important service provided by trees to mankind is the production of oxygen. Trees, through the process of photosynthesis, absorb carbon dioxide from the atmosphere and release oxygen into the atmosphere. In doing so, trees act as a filter and purify the air we breathe. The net production of oxygen produced by a healthy tree depends on the tree species, size, health and location. Various agencies have given different values to this amount of oxygen produced. This report attempts to evaluate the average oxygen concentration produced by one tree and compare it with any kind of artificial production/ storage of oxygen, in order to better appreciate this particular ecosystem service provided by trees.

2. Relative valuation of Oxygen Producing Service of a Tree

While the exact oxygen production from one tree depends on its height, width, age, species type etc. several studies are available which have averaged out these variables and provide detailed understanding of the oxygen production capacity of one tree. According to Environment Canada (Canada's National Environment Agency, on an average, one tree produces nearly 260 pounds of oxygen each year. Two mature trees can therefore provide enough oxygen for a family of four.

Other investigations¹ also reveal a similar figure and highlight that a single mature tree can absorb carbon dioxide at the rate of 48 pounds/ year and release enough oxygen to support 2 human beings. A U.S. Forest Service report indicates that a healthy tree produces about 260 pounds of net oxygen annually while a typical person consumes 386 pounds of oxygen per year. Therefore it can be deduced that two medium-sized, healthy trees can supply the oxygen required for a single person over the course of a year.

An average adult at rest inhales and exhales 7-8 liters of air per minute. This implies that an average adult inhales approx. 11,000 liters of air per day. The air that is inhaled is about 20% oxygen, and the air that is exhaled is about 15% oxygen, so about 5% of the volume of air is consumed in each breath and converted to carbon dioxide. Therefore, **a human being consumes about 550 liters of pure oxygen per day**. It should however be noted that the amount of air inhaled by an average adult varies from 7-8 liters/minute (when at rest) to 50 litres/minute (after hard exercise) and the actual oxygen consumed figure may be much more.

According to market survey by Delhi Greens on the cost of portable oxygen cylinders, it was found that the average cost of a 2.75 liter portable (maintenance free) oxygen cylinder on an average is Rs. 6,500/-. Cheaper options are available for hospitals etc but they require high maintenance thereby enhancing the overall costs. At the rate, an average human being consumes oxygen worth approx. Rs. 13 lakhs per day. It should be noted here that the manufacturers of oxygen cylinders only filter the oxygen from the air and packs it in cylinders. They do not produce the oxygen as a tree does. The oxygen gets replenished in the world only through the chlorophyll contained in green plants and trees.

3. Conclusion

Based on existing literature and the survey report, the study concludes that two healthy trees produce enough oxygen as is required by one individual in a year. The total cost of this maintenance free oxygen (as per prevailing rates) is deduced as Rs. 47,45,00,000 (47 crore 45 lakh rupees). It can therefore be concluded that the economic value with respect to (maintenance free) oxygen production of one healthy tree is approx. Rs. 23,72,50,000/- per year.

¹ McAliney, Mike. Arguments for Land Conservation: Documentation and Information Sources for Land Resources Protection, Trust for Public Land, Sacramento, CA, December, 1993