

***Review Paper (SS-I)***

# **ISSUES AND CHALLENGES FOR EMISSION TRADING SCHEME FOR PARTICULATE MATTER IN INDIA**

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## **ABSTRACT**

After the success of Emissions Trading Schemes (ETS) in United States of America and European Union, it is established that ETS has a great potential to reduce pollution along with decreasing compliance cost as against the command-and-control regulation. It is high time for India to step in and introduce such flexible market mechanisms for abatement of air pollution. This paper discusses some of the challenges and issues that India will have to face for implementing ETS. Such change in environmental regulations will elevate position of India and place her as a leader in emerging economies.

**Key Words :** Particulate matter, Emissions Trading Scheme, Continuous Emissions Monitoring System, Climate change, Environmental policies

## **INTRODUCTION**

The Intergovernmental Panel on Climate Change (IPCC) reports brought to the notice to the world the true state of global warming and they gave support to the environmental efforts already being done to address this extraordinary problem.

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) is a 1997 International Treaty adopted by Conference of Parties (COP) that came into force in 2005. In this treaty, most developed and industrialised nations agreed to legally binding targets for their emissions of the six major greenhouse gases in two commitment periods.<sup>1</sup> The Protocol defines several mechanisms also known as flexible mechanisms that are designed to allow Annex I countries to meet their emission reduction commitments (caps) with reduced economic impact. Emission quotas or better known as assigned amounts were agreed by each participating Annex I country, with the intention of reducing the overall emissions by

5.2% from their 1990 levels by the end of 2012. USA is the only industrialized nation under Annex I that has not ratified the treaty, and is therefore not bound by it.<sup>2</sup> Annex I parties may also use International Emissions Trading (IET). Under the treaty, for the 5-year compliance period from 2008 until 2012, nations that emit less than their quota will be able to sell assigned amount units to nations that exceed their quotas. It is also possible for Annex I countries to sponsor carbon projects that reduce greenhouse gas emissions in other countries. These projects generate tradable carbon credits that can be used by Annex I countries in meeting their caps. The project-based Kyoto Mechanisms are the Clean Development Mechanism (CDM) Projects and Joint Implementation (JI) Projects.

### **About ETS**

Emissions Trading Scheme or A Cap and Trade Scheme is a market-based approach used for pollution abatement by providing economic incentives for achieving reductions in the emissions of pollutants (**Fig. 1**). A limit or cap on the amount of one or more pollutants that may be emitted is set by a

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central authority which usually is a governmental body. The limit or cap is allocated or sold to firms in the form of permits which represent the right to emit or discharge a specific volume of the specified pollutant. Firms are required to hold a number of permits or allowances or carbon credits equivalent to their emissions. The total number of permits cannot exceed the total cap specified by the regulatory authority, limiting

total emissions to that level. Firms that need to increase their volume of emissions must buy permits from those who require fewer permits.<sup>3</sup> The transfer of permits is referred to as a trade wherein, the buyer pays a charge for polluting, while the seller is being rewarded for having reduced emissions. Thus, in theory, those who can reduce emissions most cheaply will do so, achieving the pollution reduction at the lowest cost to society.

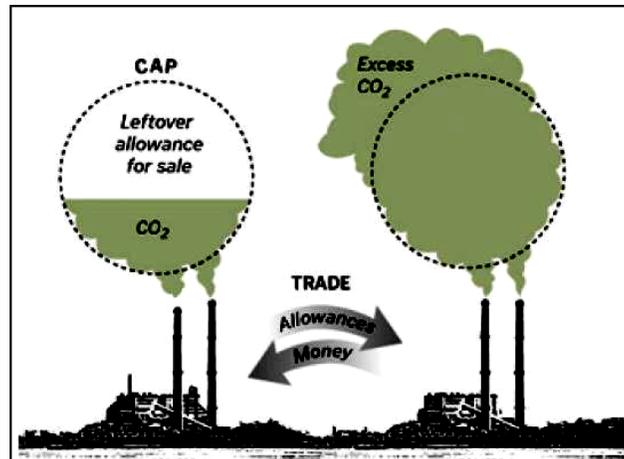


Fig. 1 : Emission trading scheme or ACAP

The three most critical keystones of any scheme would be the following :

- Monitoring, reporting and verification
- The nature of the cap and whether there are price controls, which in part determines the burden that entities in the schemes must bear
- The method of issuing the tradable instruments

The above would also determine the whether the scheme is linkable to any other scheme globally.<sup>4</sup>

#### Various schemes around the globe

There are active trading programs in several air pollutants. For greenhouse gases the largest is the European Union Emission Trading Scheme, whose purpose is to avoid dangerous climate change. In the United States there is a national market to reduce acid rain and several regional markets in nitrogen oxides. Santiago Metropolitan Area in Chile has implemented Emissions Trading for Particulate Matter smaller than 10 microns (PM<sub>10</sub>). Markets for other pollutants tend to be smaller and localized.

The EU ETS covers the 27 member states of the EU, plus European Economic Area (EEA) members Norway, Iceland and Liechtenstein. The wide geographical scope meant that, in the design phase, it was decided to focus on large fixed point sources of emissions to make implementation easier. Therefore installations in the energy-intensive user sectors, plus energy generation were targeted as the point of regulation.<sup>5</sup>

Then there are national schemes in place such as Australia, Switzerland and New Zealand, and further five sub-national/regional schemes, which includes the three in North America (California has the second-largest scheme after the EU-ETS) and Tokyo. One of the key aspects in terms of the characteristics of the different schemes is the scope, both in terms of the sectors and also whether emissions are accounted for through assigning the point of liability either upstream or downstream.

For example, the scheme in Tokyo, where offices and other commercial buildings are liable entities. In the context of a metropolis such as Tokyo, the policy choice was between targeting

the electricity consumers within the city or the electricity producers in the city-region, as most power generation installations are outside the city. Air quality in the Santiago Metropolitan Region has improved significantly after the implementation of the Emissions Trading Program from 1997. Between 1992 and 2005, PM<sub>10</sub> concentrations decreased by almost 40%. Stationary sources had reduced potential PM<sub>10</sub> emissions significantly more than required to meet the emission reduction goal of Region.<sup>6</sup>

Although there were a number of factors that influenced the attainment of the emission reduction goal but perhaps the most influential were the availability of natural gas and the desire to be removed from the list of highest polluters that must shutdown during air quality emergency and pre-emergency episodes.

**Issues, challenges and road ahead for India**

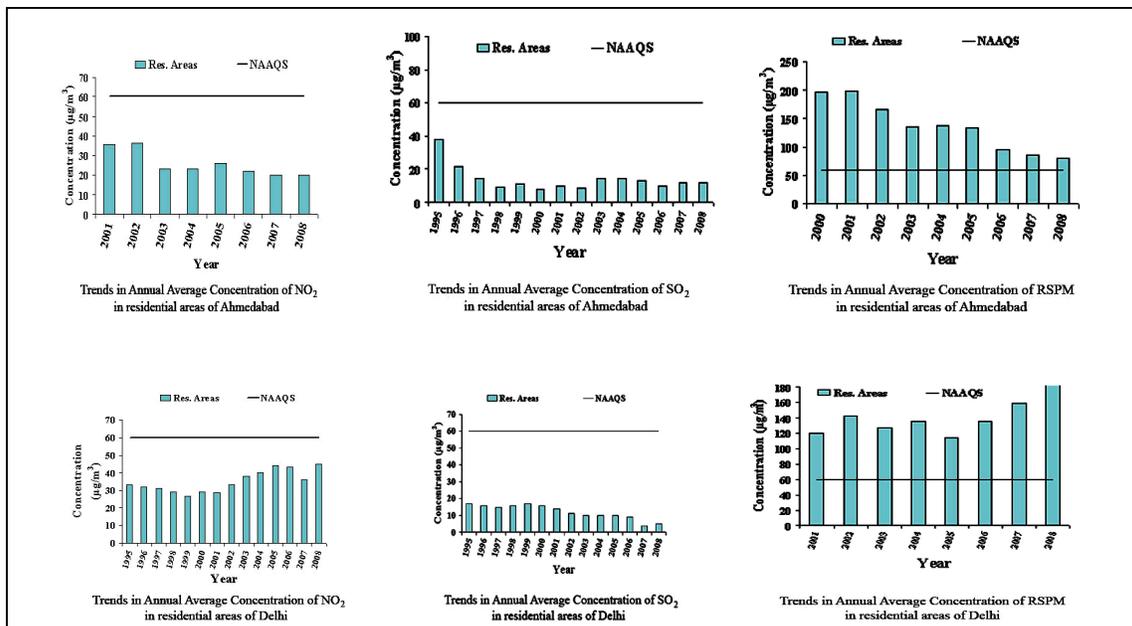
By implementation of Emissions Trading Program India would be positioned amongst the few top leading countries in environmental regulation amongst emerging economies. The advantages will be well beyond the immediate goal of achieving compliance of air emissions at a lower cost to society. By having a trading scheme in place it is easier to adjust regulation as environmental goals change.

Tighter environmental standards can be achieved with a drop in the level of the cap, which would raise the price of emissions permits and give incentives to pollute less, rather than abruptly throwing certain areas or sources out of compliance. The country may also reap advantage by tying the system for local emissions trading to global emissions trading schemes for carbon dioxide through some scientific mechanism.

A successful cap-and-trade system will establish the infrastructure required for putting a price on carbon dioxide as well as local pollutants and thus positioning the country to easily receive payments for the contribution of its innovative regulations to reducing greenhouse-gas emissions.

Particulate Matter has been selected for Emissions Trading in India. If we analyse the Air Quality data generated under the National Air Quality Monitoring Program (NAMP) it can be observed that :

- Almost half of the total cities monitored under NAMP have critical levels of PM10.
- Indian cities are reeling under heavy particulate pollution.
- As far as data on SPM is concerned, a mixed trend was observed and it has exceeded the notified standards in a number of cities (**Fig. 2**).



**Fig. 2 : Different trends in annual average of CPCB**

## DISCUSSION

According to some epidemiological studies, health effects such as manifestation of respiratory and cardiovascular ailments are associated with Particulate Matter air pollution. Thus, since particulate matter being the significant pollutant it was selected so that effectiveness of this innovative regulatory method could be verified.<sup>7</sup>

Emissions trading for particulate matter in India will be the first of its kind to be implemented in the world especially with Continuous Monitoring System. The major challenges and issues that will be confronted during this program are discussed under :

### Legal

Currently the Environmental Legislation in India is based on concentration based standards wherein the each type of emission is allowed in a particular concentration which is normally in ppm or mg/Nm<sup>3</sup>. While the Emission Trading System deals with Load based emissions or in simpler words the emitters are allowed to emit specific quantity of pollutant in a decided particular interval. For example specifically for Particulate Matter the current concentration based norms are 150 mg/Nm<sup>3</sup> whereas the load based standards could be few tons per year of particulate emissions.

Hence, to achieve the same the current Legislations dealing with Air Pollution especially Air (Prevention and Control of Pollution) Act, 1981 and as amended time to time needs to be amended again so as to specify load based standards in the particular air pollution control area during pilot phase and in the areas where ETS will be implemented thereafter.

To decide the Load Based Standards is a herculean task in itself for a country like India where there are a number of industrial units within various sectors using variety of fuels. Hence to decide the Load Based Standards, national organisations like Ministry of Environment and Forests and Central Pollution Control Board will have to come up with scientifically supported methodology considering the flow and fuel in individual industrial units.

### Permit allocation

Once the systems for measurement of pollutants and its transmission to the regulatory authorities are in place, a prime issue that is to be faced is of permit allocation. There are various ways of allotting allowances or permits. The three main ways are usually referred to :

1. Grandfathering
2. Auctioning and
3. Benchmarking

### Grandfathering

Means that permits are allocated free of charge to the participating units depending on historical emissions or on the basis of their past emissions. Units would then have to buy extra permits if they increased their emissions or would be able to sell those they don't need because they have reduced their emissions.

### Auctioning

Means that permits are auctioned or selling permits off to the highest bidder industrial units. This option may be less attractive to industrial units because it means emissions permits are not free of charge.

### Benchmarking

It is a process of gathering information on emissions from industrial units within a specific sector and using this data to compare performance and to allocate allowance. A benchmark does not represent an emission limit or even an emission reduction target but merely a value used to calculate free allocation per installation. The benchmarks have to be developed per product to the extent feasible. Usually, a product benchmark is based on a value reflecting the average emission performance of the 10% best performing installations producing that product.<sup>8</sup>

But in a country like India where such Cap and Trade System is being introduced for the first time a systematic permit or allowance allocation needs to be followed so that the scheme is well welcomed by all the participants.

During the initial or first phase of trading, the permits may be allocated on grandfathering basis, so that the participating units can understand the system and they don't feel the extra burden of buying permits and can save or

earn money by trading the excess permits they have in case they comply the norms.

But in the later phases of trading, a combined system of grandfathering with auctioning can be adopted wherein a portion of basic necessary permits can be allocated on grandfathering basis but the remaining can be auctioned within the participating units.

A system involving benchmarking along with auctioning can also be adopted at a suitable time wherein certain allowances can be allocated on basis of benchmarking while the remainder of allowances can be allocated through auctioning.

### **CEMS technology**

The Emissions Trading Scheme relies on accurate data on emissions from each individual industrial unit. The term CEMS (Continuous Emission Monitoring System) refers to the instrumentation and software required to measure pollution emissions from a stationary source on a real time and continuous basis. For carbon dioxide or energy consumption measurements, input-based methods of measurements are used. Whereas for measurement of particulates such methods are not reliable since particulate emissions are a complex function of combustion conditions and pollution abatement technology. The role of CEMS is therefore very important to measure the total load of particulate matter (SPM) coming from each source. Total emissions can then be reconciled against permit holdings in the trading scheme.

Hence looking to the importance of CEMS for success of ETS for Particulate Matter the first step would be to select a CEMS device (or combination of devices) optimally suitable for the stack characteristics to be dealt with. Currently the technology configurations for measuring the Particulate Matter on continuous basis can be broadly divided into two categories :

1. Mass flow based
2. Mass concentration based with or without flow measurement.

For Emissions Trading Scheme, concentration based technology without a flow measurement would not be recommended since it would include assumed flow for determining estimated Particulate Matter calculation which

would be against the accuracy of data required for such schemes.

Here it would be important to note that the monitoring regime for Emission Trading Scheme is based upon CEMS but not limited only to the instrumentation but it comprehends a complete institutional and technical ecosystem warranting high-quality emissions data.

Also it is essential that the CEMS installed must be robust, tamperproof and accurate.

### **Baseline Emissions Inventory**

One of the important aspects to measure the success of the Scheme and to ascertain whether there is any improvement in the Ambient Air Quality due to the Scheme lies on the existing Ambient Air Quality of the area where the scheme is implemented. To ascertain the same Baseline Emissions Inventory needs to be done.<sup>9</sup>

Considering the existing industrial scenario of India where multiple fuels ranging from firewood, coal and lignite to petcock and natural gas are used, it would be very tough job to do a baseline emissions inventory. In the inventory the existing ambient air quality and also the various factors affecting the ambient air quality like vehicular emissions, fugitive emissions due to construction, natural sources are also needed to be considered.

### **Infrastructure costs**

The implementation of Emissions Trading Scheme involves two fold infrastructure and framework requirements viz.

- 1) Installation of monitoring and CEMS equipment or the analysers including system for transmission of data generated
- 2) A central resources framework for data acquisition and handling comprising of hardware and software, systems for tracking emissions, infrastructure for market trading of allowances etc.

Both of the above require huge amount of financial investments and who will bear the cost of the same is an important matter to be addressed for successful implementation of the Emission Trading Scheme.

As far as the cost of monitoring and CEMS equipment or the analyzers including system for transmission of data generated, ideally it should be borne by the participant industrial

units so that they can install the best available technology at the best available price. Care should be taken that the participant industrial units install equipment or instruments which are compatible with the Central Resources Framework and can be forward integrated.

The Central Resources Framework should be owned and operated by the Government or the Regulatory Authorities or by Special Body formed for implementing the Emissions Trading Scheme and hence the expenses can be initially done by the owner which can later on be funded or reimbursed from the auctioning of allowances.

#### **Establish monitoring, data acquisition and transmission and data validation protocols**

Once the CEMS instruments and the related central resources are in place the most important subject to be addressed is the monitoring protocol and data validation protocol.

#### **Monitoring, data acquisition and transmission protocol**

Once data from the CEMS analyzers starts reaching the servers, it is very vital that the data received is as per the monitoring protocol. The monitoring protocol may consist of but would not be limited to :

- Data that should be submitted (date, time, location, type of CEMS etc.),
- The frequency and interval of data submission (polling interval in seconds or minutes),
- The format of data submission (text file, .csv file, encrypted or not etc.),
- The manner in which the data would be transmitted and what measures would be taken so that the data transmission is tamperproof and that the data that reaches the server is as it is generated from the analyzer and it is not modified or edited.
- The specification of data acquisition and handling system which will categorically address all the issues related to the hardware and software required for the storage and analysis of the data generated from the analyzer and transmitted in tamperproof manner.

Considering that the monitoring protocol can differ due to various vendors in the market it is

always advisable that a generalized protocol is derived and according to this generalized protocol the vendors should modify their software and hardware. Care should also be taken that the system used for data transmission to be tamperproof and be such that the data is in encrypted form (to be decrypted only at the receiving server) and that it is not editable or modifiable at the point of generation.

#### **Data validation protocol**

In vast country like India with varied operating conditions of the participant industrial units, it is most likely that inspite of utmost care being taken in installation and transmission of data generated from the analyzers there are all chances that there are gaps in the data that reaches the central resources.

The various reasons that can be attributed to the failure in transmission of data or the data gaps can be like failure of analyzer, electric supply failure, failure of transmission system, failure of connectivity to the central resource (it can be GPRS based or a broadband connectivity etc.) or the failure at recipient server end.

But since the data is finally to be used for deriving the allowances and trading and since there is financial value attached to the data it would be utmost necessary that there is a data validation protocol which addresses the issues of data gap due to various reasons some of which are stated above.

The data validation would address two issues - filling up of data gaps if any due to above reasons as well as erroneous data transmitted by the analyzer.

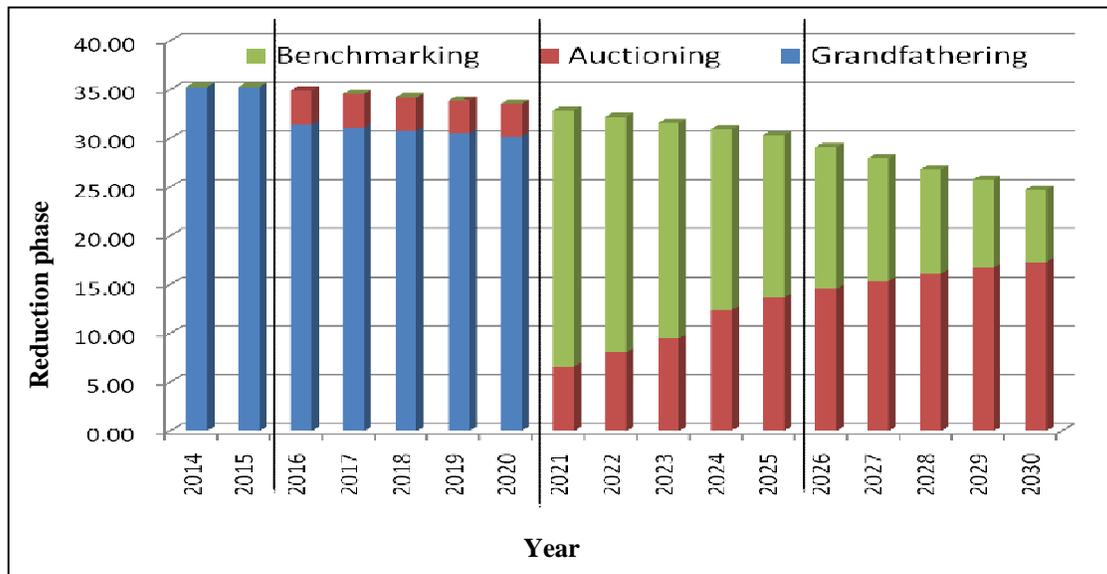
Hence this protocol needs to be partially automatic wherein the system applies some logic based on the history of the emission of the particular participant industrial unit and fills the data gap accordingly as per the protocol decided. While for correcting the erroneous data received at the server needs human intervention to decide whether the data is really erroneous and if so how it should be corrected.

The data validation protocol should also speak on the penalty provisions for intentional submission of erroneous data.

**Ambient pollutants reduction targets and national goals**

The ultimate national goal of implementing Emission Trading Scheme is to improve ambient air quality by reducing ambient pollutants. But is it very important to see that the ambient pollutants reduction targets are realistic and achievable. Else if too steep targets for reduction are fixed then the Scheme

might fail giving wrong indications regarding the scheme itself. Also if the targets set are too lenient then there won't be significant reduction in ambient pollutants and hence there would not be improvement in air quality which would again give a false signal of failure. Hence, the reduction targets or the cap as it is said is very important for the scheme to succeed (**Fig. 3**).



**Fig. 3 :** A typical target over a period of time divided into 3 to 4 phases of 2 to 5 years

Phase 1 – No reduction (so that the participant units get familiar with the system)

Phase 2 –About 3% reduction every year thus giving 9 to 15% overall reduction in ambient pollutants

Phase 3 –About 5% reduction every year thus giving 15 to 25% overall reduction in ambient pollutants and so on

Considering the above reduction target program and overall reduction of 25 to 30% in ambient pollutants would be achieved over a decade but would give the participant industrial units ample time to know the system and take appropriate steps for abatement measures for measureable reduction of ambient pollutants in a cost effective manner.

Also under the target reduction mechanism there should be an arrangement to set additional parameters, such as hard caps or other limits on high-frequency emissions, which prevent local accumulation of pollutants.

If such mechanism or additional parameters are not set then it would result into high emissions in a short period of time leading to deteriorating effect on the ambient environment inspite of being well within the limits of average loads and allowances allocated to the participant industrial units.

**Trading region limitations**

One very vital characteristics of this particular Emission Trading Scheme for Particulate Matter (PM) is that unlike the ETS for GHG where the trading can take place in a larger geographical area or globally, here the trading can take place within a limited geographical area since the pollutant selected i.e. Particulate Matter has more of a localized effect and has almost no significant globalized effect.

Hence PM emission at one geographical location cannot be traded with the PM emission at some other distant location. Therefore the regulating agencies would have to come up with a geographical area

distribution for trading platforms for such trading schemes for Particulate Matter Emissions.

### Tracking the progress

Once the Emissions Trading Scheme is implemented and after Phase I or its portion is over, it would be necessary to take stock of the situation specially track the progress of the scheme.

The progress and intermittent success of the scheme has to be checked in multifold way :

- a) Progress of the emissions trading system through reductions in emissions
- b) Allowance or permit market functioning, and
- c) The reduction in costs for pollution abatement to firms themselves.

### Cautiousness towards ETS related crime, Cybercrime, VAT fraud

As is the case with other market exchanges like stocks and multi-commodities, after implementation of Emissions Trading Scheme care has to be taken by the regulatory authorities and the government for ETS related crime. These can be in the form of cybercrime for VAT fraud or for illegal transfer of allowances or permits or illegal trade of allowances or permits. The cyber-crime law has to address such issues effectively so that these instances can be reduced or discouraged.<sup>10</sup>

### Use of ETS experience and infrastructure for other programmes

Once the Emission Trading Scheme has completed successfully the phase – I, the experience gained by the regulatory agencies and all other stake holders in the scheme and the basic infrastructure like central resources etc. can be used for other programmes like GHG emissions trading (similar to EU-ETS) or for SO<sub>2</sub> emissions trading (similar to US – Acid Rain Program). If such programmes are implemented in future the participant industrial units in India can trade with their counterparts in other parts of the world and can reduce their pollution abatement cost.<sup>11-14</sup>

## CONCLUSION

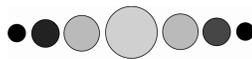
Thus, as it is evident from the above facts that the implementation of Emissions Trading Scheme for Particulate Matter in India has lot

of challenges and issues to be addressed right from baseline inventory to market trading and crimes related to it. But considering the success of such schemes in other parts of the world especially their role in reducing ambient pollution and thus improving overall ambient air quality at an optimal cost of pollution abatement, the scheme should be surely welcomed in India and it would be a step forward for betterment of environment for the days and generations to come.

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*If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos.*

***Edward O. Wilson***