

Course in Forest Protection
High Diploma Level
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General information about air pollution

- ✓ Environmental pollution is any discharge of material or energy into water, land, or air that causes or may cause acute (short-term) or chronic (long-term) detriment to the Earth's ecological balance or that lowers the quality of life.
- ✓ Pollutants may cause primary damage, with direct identifiable impact on the environment, or secondary damage in the form of minor perturbations in the delicate balance of the biological food web that are detectable only over long time periods.
- ✓ More than 3,000 substances that are not part of the atmospheric composition, falling in the atmosphere can be considered air pollutants.
- ✓ Pollutants describe a global circuit; they are produced by different sources, are transported and transformed into atmosphere, some of them being removed, another part is reaching the earth having different effects on different bioeconomic of ecosystems.

Air pollution

- ✓ The main air pollutants are represented by gases forms, particles in suspension, different ionizing radiation and noise.
- ✓ The gases forms are: oxidized and reduced forms of carbon (CO_2 , CO , CH_4), of nitrogen (NO_2 , NO , N_2O_4 , NH_3 , NH_4^+), SO_2 , O_3 , C_6H_6 vapors, Hg, volatile phenols, Cl_2 , etc.

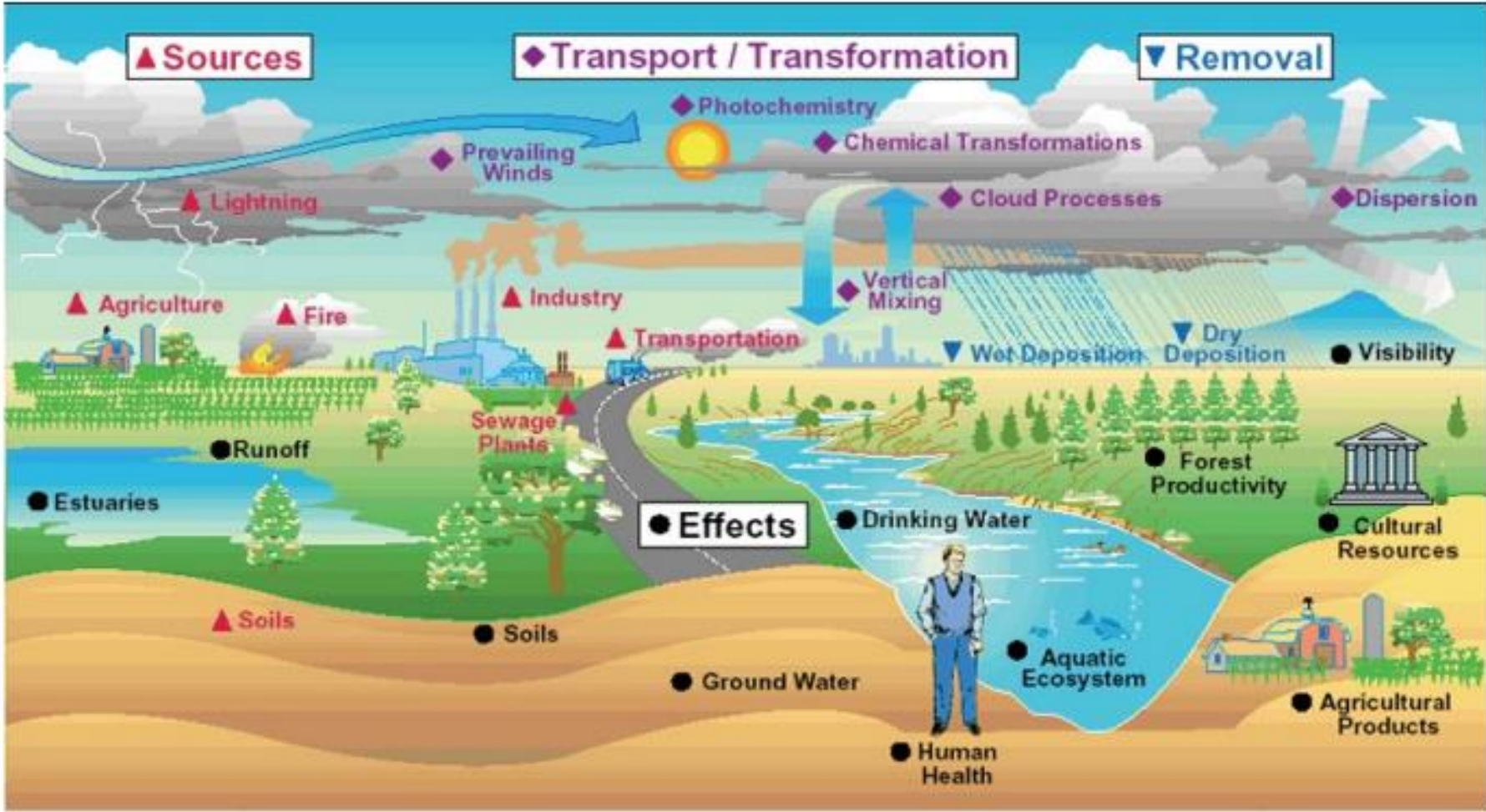


Fig. 1 Global pollutants circuit (www.cleartheair.nsw.gov.au, 2011)

Sources of pollutants

- (i) **Natural processes:** Natural processes that affect air quality include volcanoes, which produce sulfur, chlorine, and ash particulates. Wildfires produce smoke and carbon monoxide. Cattle and other animals emit methane as part of their digestive process. Even pine trees emit volatile organic compounds (VOCs).
- (ii) **Man-Made:** Many forms of air pollution are man-made. Industrial plants, power plants and vehicles with internal combustion engines produce nitrogen oxides, VOCs, carbon monoxide, carbon dioxide, sulfur dioxide SO₂ and particulates.

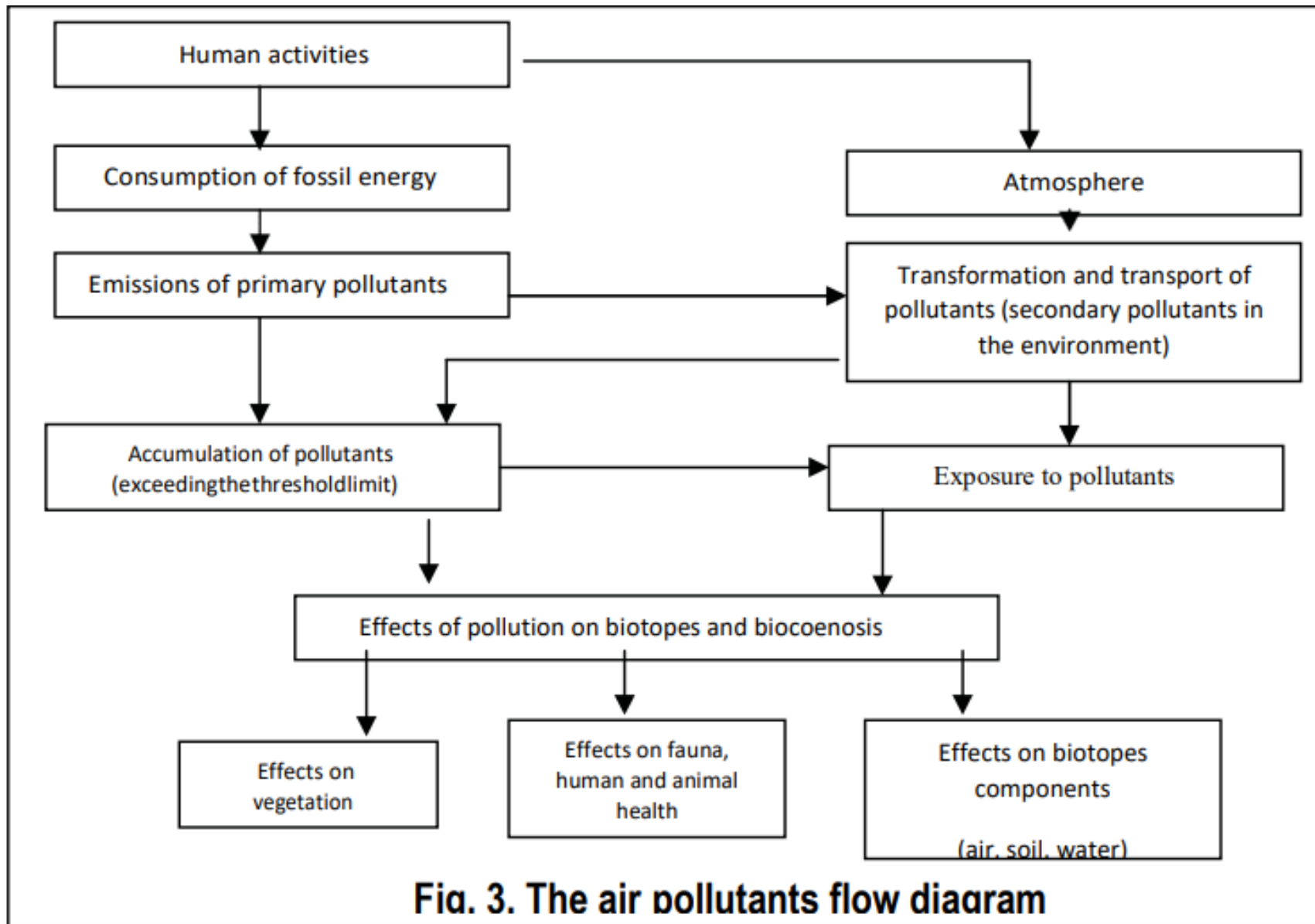


Fig. 3. The air pollutants flow diagram

Effect of pollutants on vegetation

- ✓ Dust pollution is of localized importance near roads, quarries, cement works, and other industrial areas.
- ✓ Apart from screening out sunlight, dust on leaves blocks stomata and lowers their conductance to CO_2 , simultaneously interfering with photosystem II.
- ✓ Polluting gases such as SO_2 and NO_x enter leaves through stomata, following the same diffusion pathway as CO_2 .
- ✓ NO_x dissolves in cells and gives rise to nitrite ions (NO_2^- , which are toxic at high concentrations) and nitrate ions (NO_3^-) that enter into nitrogen metabolism as if they had been absorbed through the roots.
- ✓ some cases, exposure to pollutant gases, particularly SO_2 , causes stomatal closure, which protects the leaf against further entry of the pollutant but also curtails photosynthesis.



Fig. 4. Acute sulfur dioxide injuries to raspberry [26].



Fig. 7. Ozone injuries to soybean foliage [26].



Fig. 6. Severe ammonia injuries to apple foliage and subsequent recovery through the production of new leaves following the fumigation [26].



Fig. 5. Fluoride injuries to plum foliage [26].

Effects of atmospheric pollutants on vegetation monitoring system

- ✓ The evident decline of the health state of the forest in Europe since the beginning of the 1980 due to the negative impact of air pollution were illustrated by numerous publication from this period .
- ✓ In the efforts to obtain objective and comparable data concerning the health of the European forests were developed a common methodology for the assessment of the forest state under the influence of air pollution.
- ✓ The pictures of the forests on large area were dominated by tree with defoliated crowns and an increasing rate of the death trees.
- ✓ The grid of the European Level I plots were established at 16 * 16 km, arranged on a transnational unified grid over Europe.
- ✓ The comprehensive monitoring programmed corresponds to the complex interrelations between natural and anthropogenic factors in forest ecosystems.

Protection

- ✓ The effects of injury by pollutants and its accompanying poisonous gases will usually be noted first through the **discoloration of foliage, later by defoliation, and eventually by the death of injured portions or of the entire tree.**
- ✓ Where the injury is not serious enough to kill the tree, there will at least be a decided **slowing-up in the growth rate of forest trees subjected to continuous exposure to smoke and gases.**
- ✓ Prevention of injury to forest trees from Pollutants (smoke and poisonous gases) must come through **treatment of the smoke before it leaves the stack.**
- ✓ The matter of controlling the emission of poisonous gases and smoke from industrial plants has been investigated quite thoroughly, both by men in this country and by workers abroad, because of the injuries suffered by vegetation in cities and towns and because of the deleterious effect, which smoke and its attendant fumes have upon human health.

Lightning

- ✓ Lightning is a widespread source of injury to forest trees.
- ✓ Trees are excellent conductors for electrical discharges between the clouds and the earth and are frequently struck by lightning.
- ✓ Evidences of lightning injury, varying widely in character, can be seen in practically all parts of this country.
- ✓ Lightning injures trees first by shattering the tree either in whole or in part, with a wide variation in the extent of the damage, and second by killing the tree without any splintering or mechanical injury.