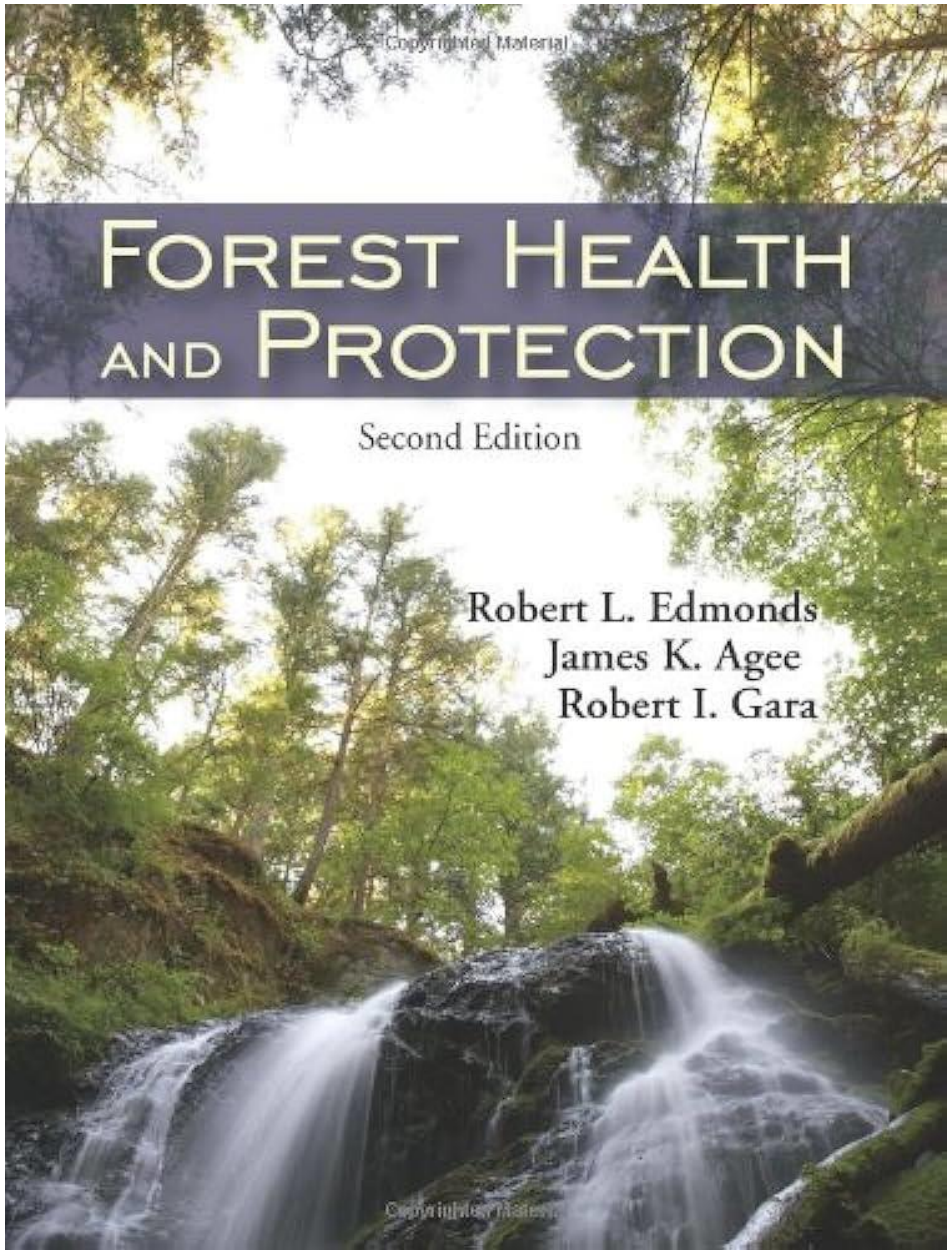
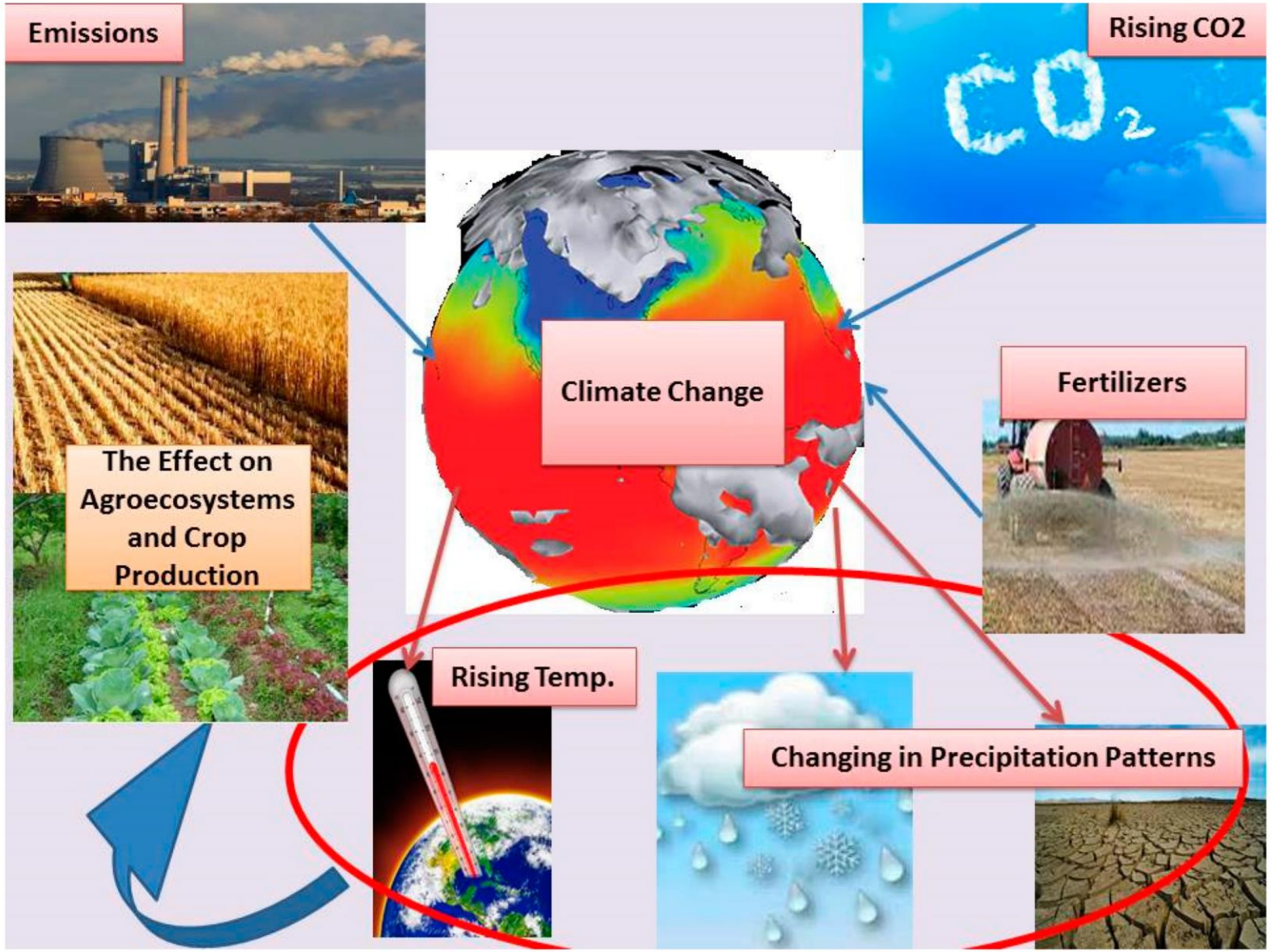


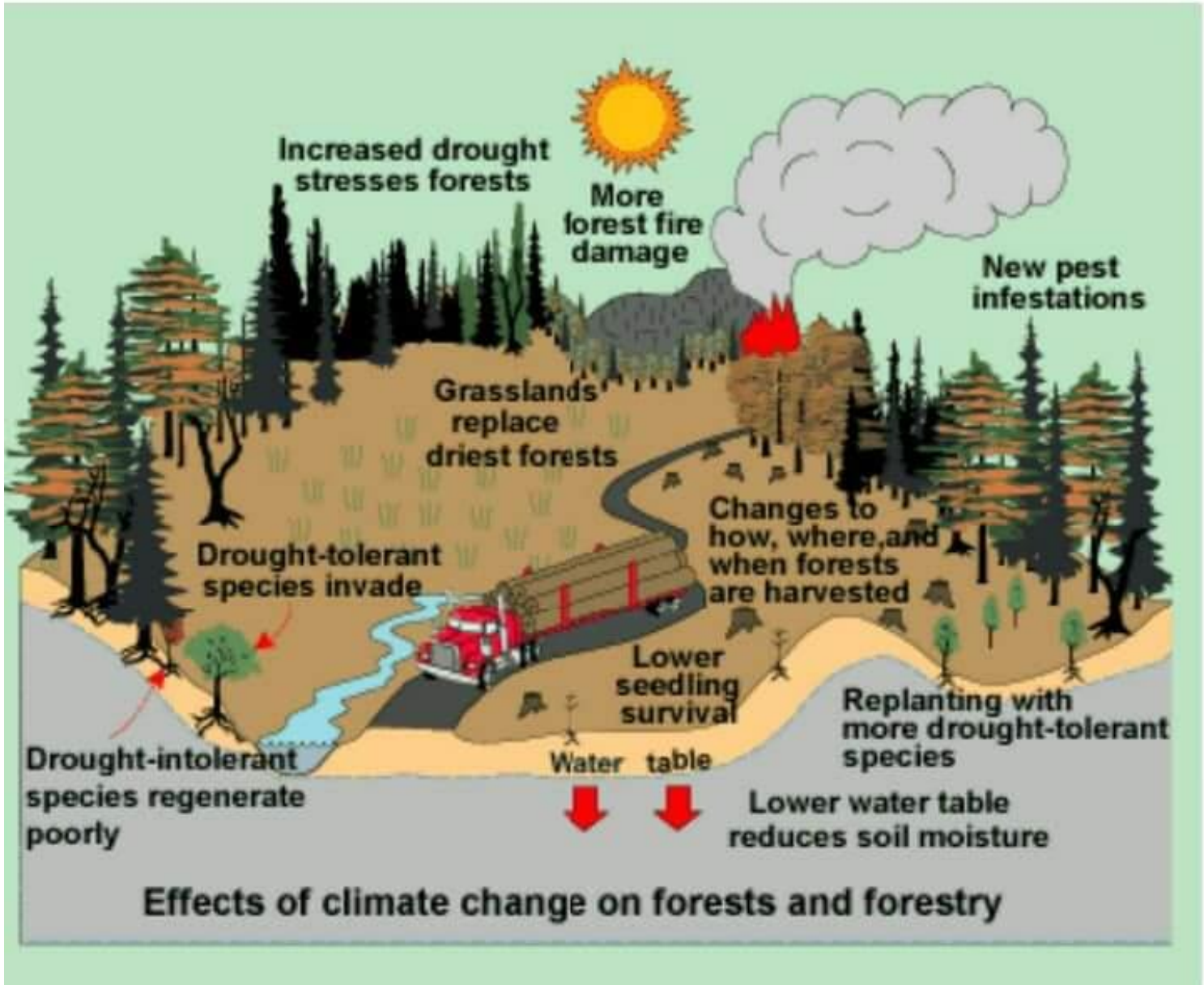
Course in Forest Protection
High Diploma Level
2023-2024

PhD. Dr. Zana Ahmed Lak. Forest Ecophysiology

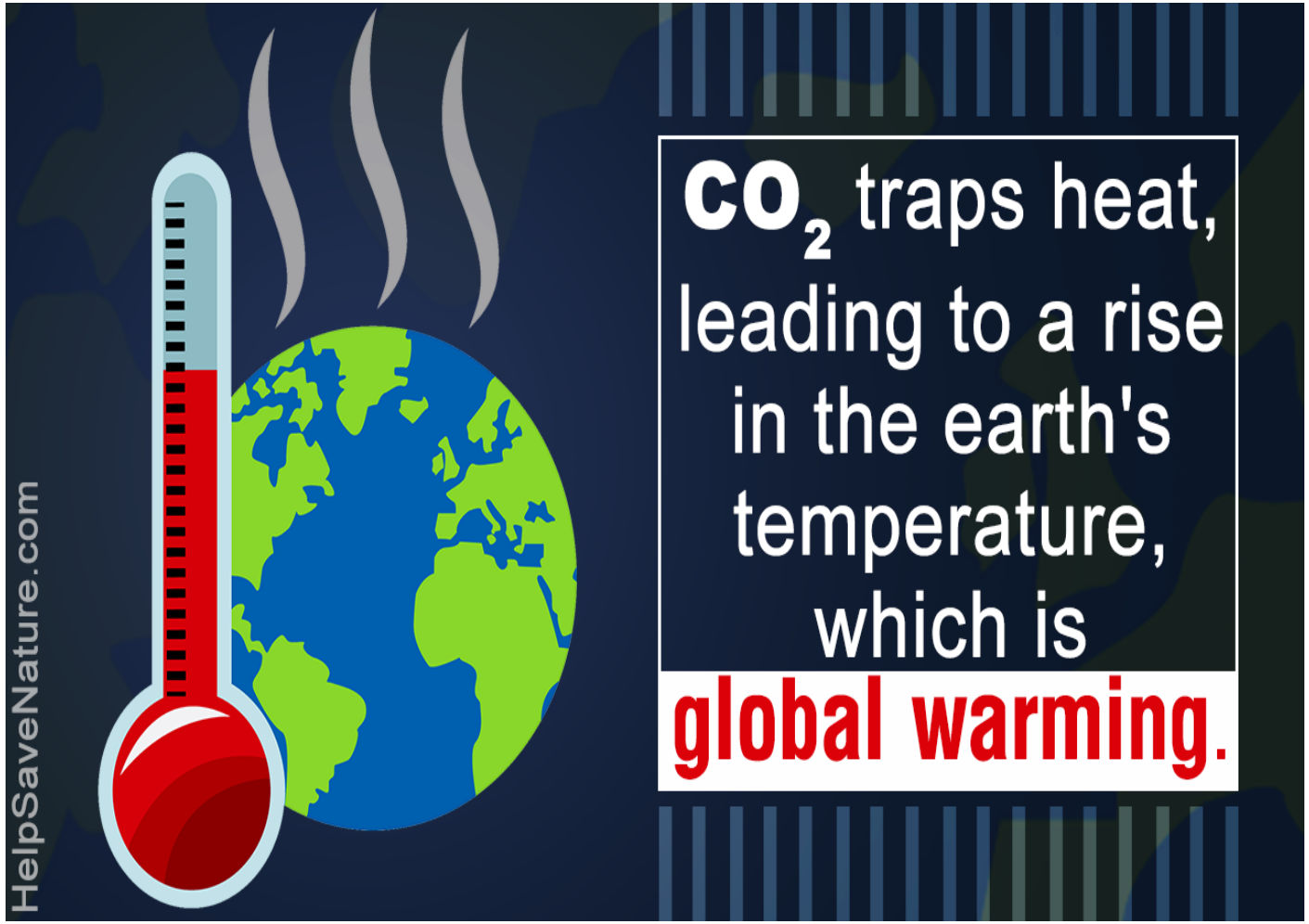
The Climate Change and Managing Forest Ecosystems

- ✓ Climate changes, particularly warming trends, have been recorded around the globe.
- ✓ For many countries, these changes in climate have become evident through insect epidemics , bark beetle), water shortages and intense forest fires, and unusual storm activities (e.g., Tsunami).
- ✓ Climate changes are expected to impact vegetation as manifested by changes in vegetation extent, migration of species, tree species composition, growth rates, and mortality.


Emissions
Rising CO2
Climate Change
The Effect on Agroecosystems and Crop Production
Fertilizers
Rising Temp.
Changing in Precipitation Patterns


Increased drought stresses forests
More forest fire damage
New pest infestations
Grasslands replace driest forests
Changes to how, where, and when forests are harvested
Drought-tolerant species invade
Lower seedling survival
Replanting with more drought-tolerant species
Drought-intolerant species regenerate poorly
Water table
Lower water table reduces soil moisture
Effects of climate change on forests and forestry

- ✓ Atmospheric CO_2 has increased from about 280 ppm in 1750 to 385 ppm in 2008.
- ✓ Global warming was 0.6°C during the 20th century. It is predicted to range between 1.8°C and 4°C (with extremes from 1.1 to 6.4°C) in the 21st century, depending on emission scenarios and on climate models (IPCC, 2007).
- ✓ The International Panel on Climate Change (IPCC) has included discussions on how forests may be impacted, and how they may be used to mitigate the impacts of changes in climate, to possibly slow the rate of change.



The Science of Carbon Dioxide and Climate

https://www.google.com/url?sa=i&url=https%3A%2F%2Fold.gips-guwahati.ac.in%2F%3Fa%3Dthe-science-of-carbon-dioxide-and-climate-ww-4qGJYqU4&psig=AOvVaw0II7tyQlQy9D0boLfgTqnP&ust=1714844227827000&source=images&cd=vfe&opi=89978449&ved=0CBQQjhxqGAoTCMjUx-CC8oUDFQAAAAAdAAAAABCyAQ

Forest Management and Climate Change

- ✓ Forests play a significant role in the climate system.
- ✓ Trees are large organisms that store carbon throughout their life and release it through decomposition.
- ✓ Since forests are important carbon sinks and sources, assessing forest carbon budgets has received much attention in recent years (IPCC, 2000, 2001, 2007).
- ✓ There is a perception that humans must alter land use practices to reduce the rates of climate changes and alleviate any resulting negative social, economic, and environmental impacts.
- ✓ Carbon losses or gains in forests may result through afforestation, reforestation or deforestation.

- ✓ Forest growth, structure and function are affected by the climate. Increasing temperatures will cause higher respiration rates while photosynthetic rates are reduced by dry conditions. The impact of climate on a forest ecosystem will vary depending upon what factors limit tree regeneration and growth.

- ✓ Where low temperature is the most limiting factor, as in parts of the boreal forest biome, increasing temperatures will result in increased tree growth. However, forests under water or high temperature stress will be more susceptible to attack by pathogens and insects.

The forest carbon cycle: generalities, definitions and scales

- ✓ Forests are open dynamic systems which exchange mass and energy with their environment.
- ✓ Both forest vegetation and soil organic matter are composed of carbohydrate molecules.
- ✓ Therefore, a practical way of describing and analyzing forest functioning is to describe and measure the carbon exchanges between system components, i.e. the atmosphere, biomass and soil.
- ✓ Carbon is also the major component of the anthropogenic greenhouse gases CO_2, CH_4 and CFCs.

- ✓ The fact that forests represent the main terrestrial reservoir of carbon has led several international programmes to study the role of forests in the carbon cycle since the pioneer International Biosphere Program .
- ✓ The storage of carbon in forest ecosystems has been identified by international agreements as a possible way of counterbalancing the anthropogenic build-up of carbon in the atmosphere.
- ✓ As a result, over the last few decades, the assessment of the amount of carbon stored in forest ecosystems, and their past and future changes, have became important issues in ecological research.

Forest management is a key factor in mitigating the effects of climate change. There are a number of possible strategies, including:

(a) conservation and maintenance of carbon stocks which have accumulated in forests;

(b) increasing carbon stocks through afforestation;

(c) modification of the forest species composition and tree size distributions;

(d) promoting the planting of more resilient tree genotypes;

(e) planting trees to provide shade, stabilize soils, and alter hydrology to reduce the expected impacts of precipitation and temperature changes.