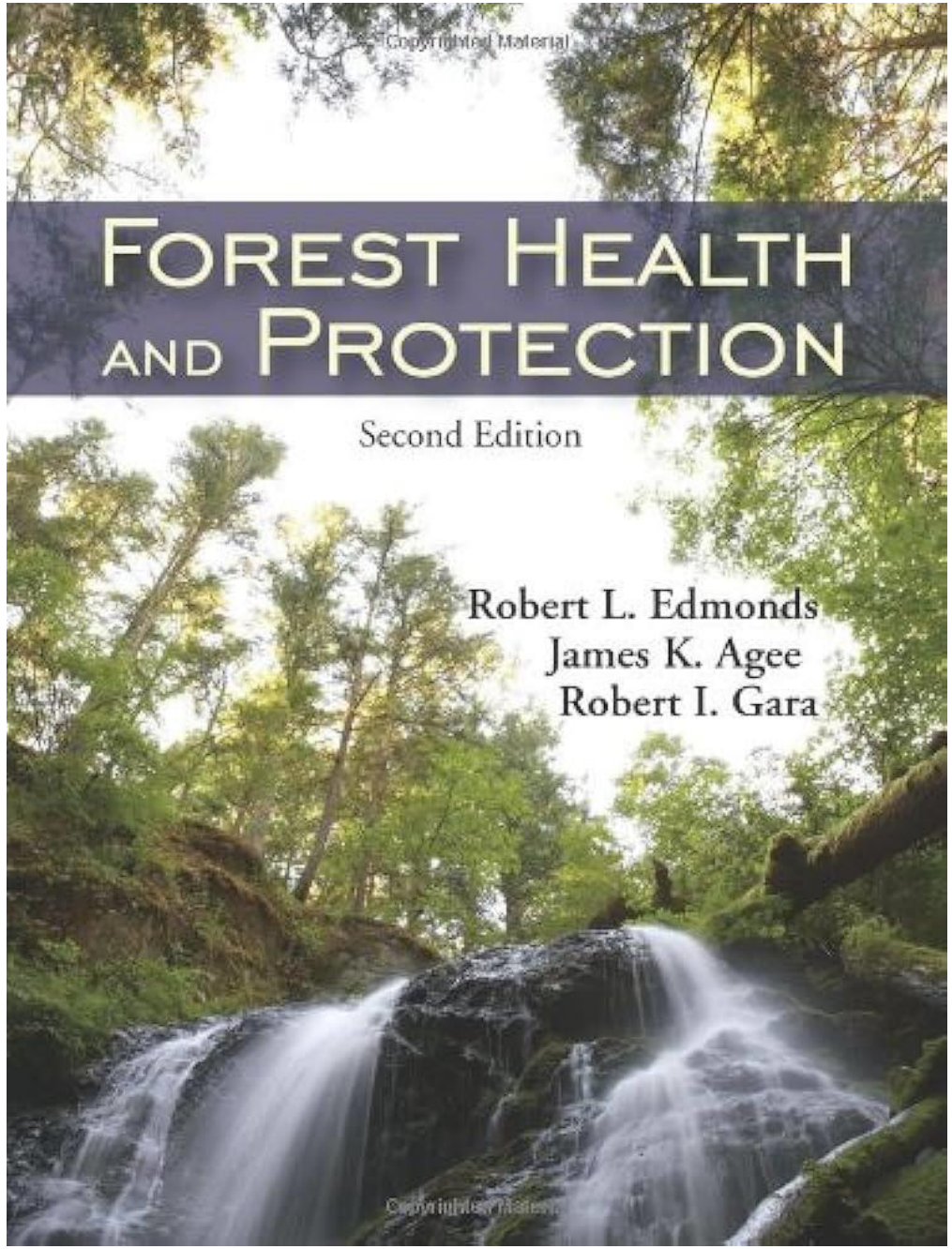

Lect. Ph.D. Dr. Zana Abubakr Ahmed Lak. Forest Ecophysiology

The Concept of Forest Health

- ✓ Natural **disturbance** agents such as **pathogens,** insects, fire, wind, drought, ice storms, flooding, and volcanic eruptions strongly influence forest **ecosystem** health. In addition, anthropogenic disturbance agents including introduced pathogens, insects, and plants; air pollution; and climate change also greatly impact the health of forests.
- ✓ Climate change, in particular, is expected to strongly influence disturbance agents .

- ✓ Disturbance agents cause economic impacts through productivity and timber losses, but they also influence forest structure; water, carbon, and nutrient cycling; plant succession; species composition, distribution, and abundance; and wildlife habitats.

- ✓ Future global warming will affect tree species composition but also drought, fire, wind, and ice storm frequencies, as well as disease and insect levels.

Definitions of Forest Health

- ✓ "Forest health" or "forest ecosystem health" are terms that are now commonly used in relation to the management of forest ecosystems .

- ✓ Ecosystem management implies that land is not managed for a single species and that it involves:

(1) ecosystem complexity

(2) biological legacies (including structures such as green trees, logs, and snags) that are important in reestablishing ecosystems after major disturbances

(3) a landscape perspective (i.e., large space and time scales)

(4) emulation of natural disturbances.

- ✓ Healthy forests are vital to our future.

- ✓ **The Montreal C&I were designed to evaluate sustainable forest management at the national level and consist of the seven criteria and 64 indicators listed below.**

One:	Conservation of biological diversity (9 indicators)
Two:	Maintenance of productive capacity of forest ecosystems (5 indicators)
Three:	Maintenance of forest ecosystem health and vitality (2 indicators)
Four:	Conservation and maintenance of soil and water resources (5 indicators)
five	Maintenance of forest contribution to global carbon cycles (3 indicators)
Six:	Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of society
seven	Legal, institutional, and economic framework for forest conservation and sustainable management.

Definitions of a Healthy Forest Ecosystem

- ✓ A condition where biotic and abiotic influences on forests (e.g., pests, pollution, thinning, fertilization, or harvesting) do not threaten management objectives now and in the future .
- ✓ A fully functioning community of plants and animals and their physical environment.
- ✓ An ecosystem in balance.
- ✓ A condition of forest ecosystems that sustains their complexity while providing
- ✓ for human needs.
- ✓ Resilience to changes.
- ✓ The ability of a forest to recover from natural and human stressors.

Characteristics of a Healthy Forest

To evaluate forest health we need good indicators, and the following list may indicate healthy conditions:

1.Trees and understory plants should be vigorous and healthy in appearance. Species, age class distributions, and stand densities should be within historical ranges for the site, and growth and mortality should be consistent with the ecosystem type and the age of dominant trees.

2.Vegetation diversity should be balanced between the supply and demand of light, water, nutrients, and growing space.

3.The forest should be capable of tolerating and recovering from known disturbances (such as fire and wind).

4.Soil erosion should be minimal. Clean water should flow from streams except during extraordinary runoff events, and stream banks need to be stable and riparian vegetation ample.

5.Aquatic species should be diverse, and aquatic indicator species should be present in expected numbers.

6.Wildlife diversity and presence need to be appropriate for the ecosystem, especially in riparian zones.

7.Insect, disease, and fire frequencies should be within the normal ranges for the ecosystem.

8.Ecological processes are operating within a natural range of variability.

Symptoms of Forest Health Problems

- ✓ **Symptoms** of forest health problems or potential problems usually can be recognized.

- ✓ If trees appear stressed or sickly under normal weather conditions (including periodic droughts) and have high mortality rates with a lack of regeneration, then a forest health problem is suspected.

- ✓ Other symptoms of problems include: tree density higher or lower than the historical range for the ecosystem involved; significant species of trees, understory plants, fish, or wildlife either missing or present in higher proportions than historical ranges suggest; low numbers of terrestrial or aquatic indicators species; one or more plant or animal species excessively impacting or dominating the stage of succession involved; invasion of exotic species that negatively affects the forest in the absence of natural controls; and excessive erosion.

- ✓ Streams may run muddy in normal events, although this depends on soil type since streams in areas with high clay or soil organic matter content may be naturally turbid, especially in tropical areas.

- ✓ Other indicators of health problems are the drying up of normally perennial streams, poor riparian vegetation, and eroding and unstable stream banks.

Possible Causes of Forest Health Problems

- ✓ The major forest health issues involve species loss; insect and disease epidemics; excessive wildfires; air pollution; water quality and quantity problems; impacted wildlife populations; nutrient imbalances; soil and watershed damage; and climate-related factors such as drought, ice storms, and wind.

These issues can result from

(1) large-area disturbances such as logging or overgrazing in areas that have been converted to uniform, even-aged, overly dense forests;

(2) an aggressive species that is not native to the region, thus disrupting species balance or ecosystem processes (e.g., the fungi that cause white pine blister rust, chestnut blight and Dutch elm disease, and insects such as the gypsy moth and the Asian long-horned beetle.

Possible Causes of Forest Health Problems

(3) a change in the environment such as a major change in nutrient cycles through atmospheric fallout (e.g., excess nitrogen), an increase in carbon dioxide or ozone, or long-term climatic change at a rate significantly faster than that occurring naturally.

(4) dead and live fuels existing in a quantity such that any wildfire ignition results in adverse effects to the vegetation, soils, and biota of the ecosystem. It should be recognized, however, after timber harvesting.

- ✓ The amount, type, distribution, and orientation that coarse woody debris is an important functional component of forest ecosystems, and some needs to be left on the site, however, will vary from ecosystem to ecosystem and should fall within natural ranges.