Sustaining Terrestrial Biomes & Biodiversity

Lecture 6

ENHL 220

OUTLINE

- 1- Forests: Management & Sustainability

✓ 1.1- Benefits of Forests
✓ 1.2- Categories of Forests
✓ 1.3- Modes of Tree Harvesting
✓ 1.4- Reduction of Tree Harvesting
✓ 1.5- Extent & Main Causes of Deforestation
✓ 1.6- Harmful Environmental Effects of Deforestation
✓ 1.7- Forest Fires
✓ 1.8- Reduction of Forest Fires' Damage
✓ 1.9- Managing Forests More Sustainably

- 2- Grasslands: Management & Sustainability

✓ 2.1- Benefits of Grasslands
✓ 2.2- Managing Grasslands More Sustainably

- 3- Ecological Restoration: Definition & Operations

Reference Book for this Lecture: Miller, T. & Spoolman, S. (2009).Living in the Environment (16th ed.). Canada : Cengage Learning
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1- Forests: Management & Sustainability

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1.1- Benefits of Forests

- Forests provide many ecological & economic services. These mainly are:

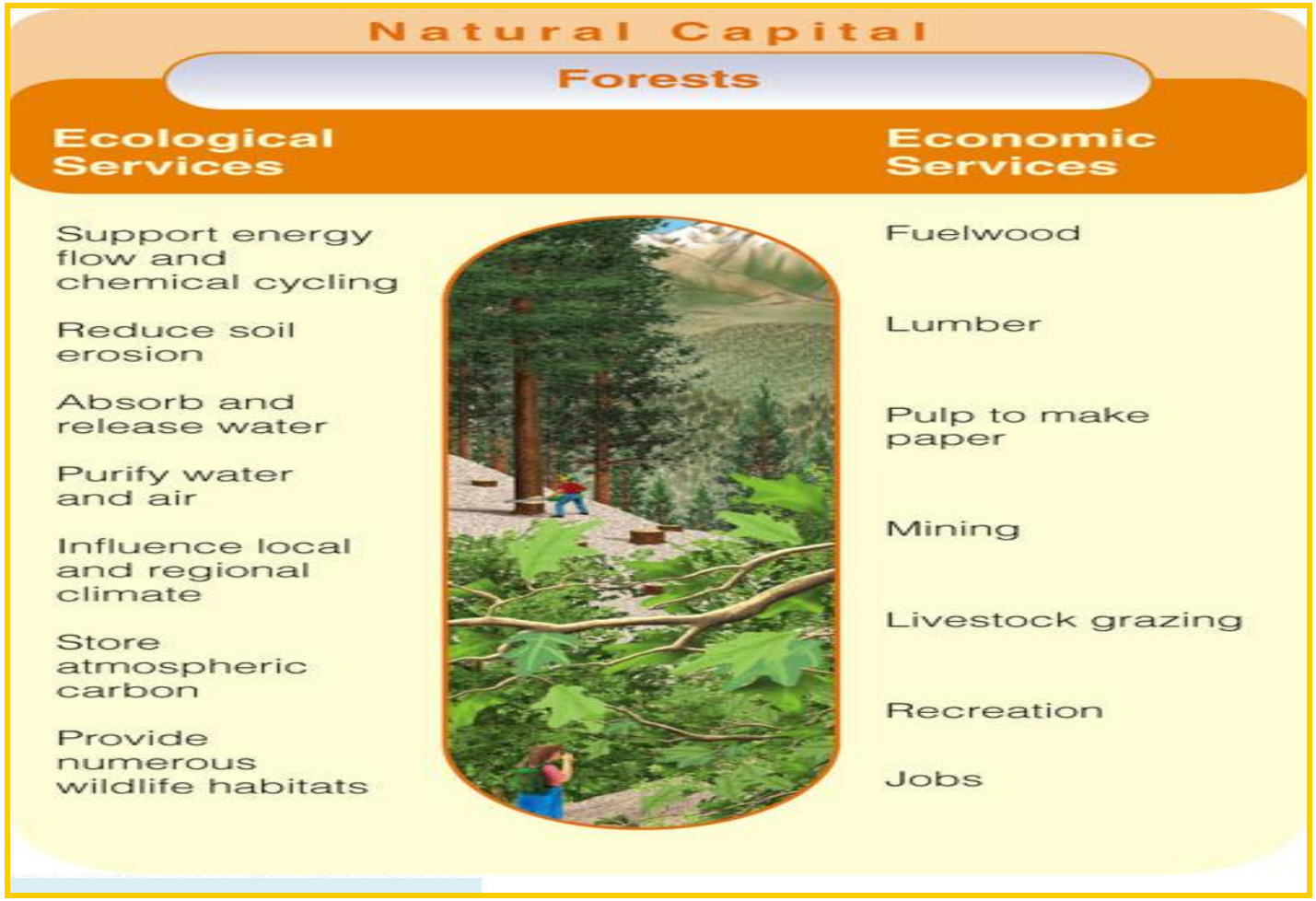

Figure 1: Ecological & Economic Services of Forests (Miller, 2009/7)

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1.2- Categories of Forests

- Forests are classified into 3 main categories. These are:

✓ 1- Old-Growth Forest (about 22% of the world's forests):

- forests → uncut or not seriously disturbed by human activities or natural disasters (for at least 700 years).
- high biodiversity.

✓ 2- Second-Growth Forest (about 63% of the world's forests):

- Forests → develop after disruption by human activities or natural disasters → trees resulting from natural secondary ecological succession.

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1.2- Categories of Forests (Cont'd)

- ✓ 3- Tree Plantation or Tree Farm (about 5% of the world's forests):

  - managed forests
  - uniformly aged tees
  - one or two genetically uniform tree species
  - harvested by clear cutting when they become commercially valuable → replanting → clear cutting again in a regular cycle.

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1.3- Modes of Tree Harvesting

- Harvesting trees can take place in 3 different modes. These are:

✓ 1- Selective Cutting

✓ 2- Clear Cutting

✓ 3- Strip Cutting

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1.3- Modes of Tree Harvesting (Cont'd)

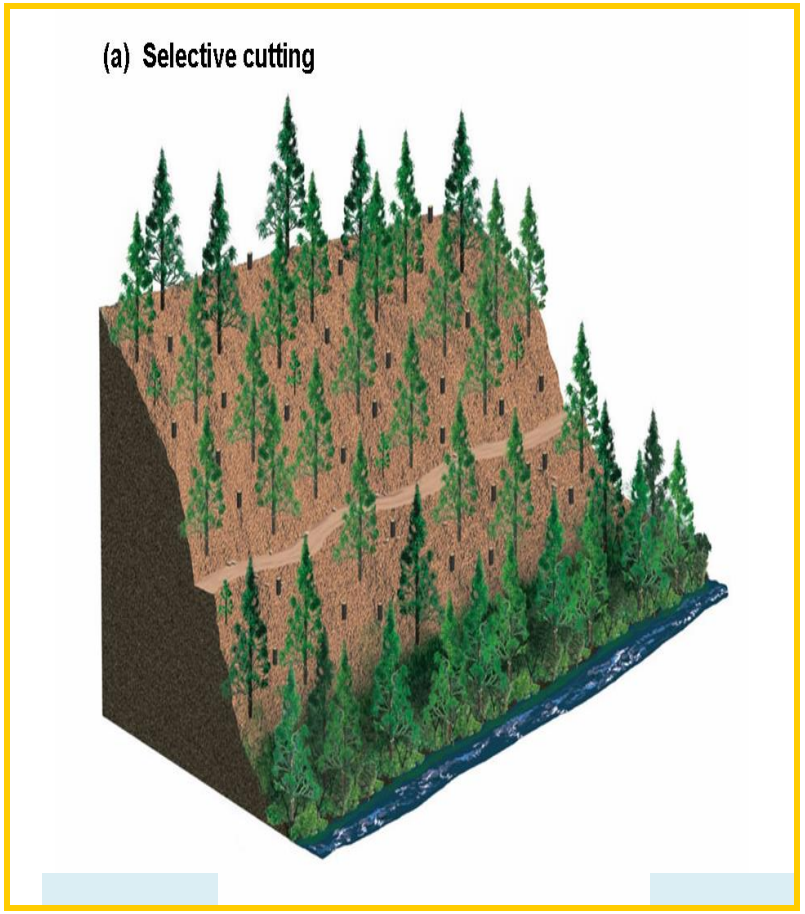

Figure 2: Selective Cutting (Miller, 2009/7)

- ✓ 1- Selective Cutting:
  - o "cutting of intermediate aged, mature or diseased trees in an uneven aged forest stand, either singly or in small groups" (Miller, 2009/7).
  - o Advantages:
    - reduces crowding,
    - removes diseased trees,
    - encourages growth of younger trees,
    - maintains a stand of trees of different species & ages.
  - o Disadvantages:
    - selective cutting in which most or all of the largest trees are removed (known as "creaming") → environmental degradation & loss of biodiversity.

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1.3- Modes of Tree Harvesting (Cont'd)

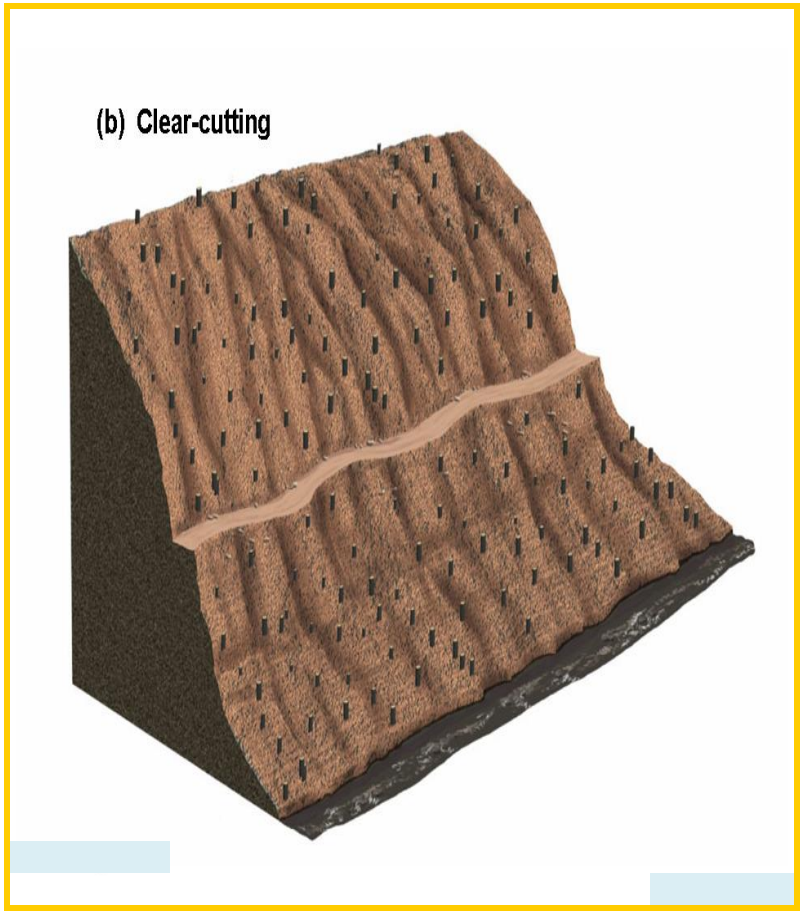

Figure 3: Clear Cutting (Miller, 2009/7)

- ✓ 2- Clear Cutting:
  - "method of timber harvesting in which all trees in a forested area are removed in a single cutting" (Miller, 2009/7).

  - Advantages:
  - higher timber yields
  - maximum profit in shortest time
  - needs less skills & planning
  - good for tree species needing full or moderate sunlight

  - Disadvantages:
  - reduces biodiversity
  - disrupts ecosystem processes
  - destroy & fragment wildlife habitat
  - leaves large openings
  - increase water pollution, erosion & flooding
  - eliminates most recreational values

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1.3- Modes of Tree Harvesting (Cont'd)

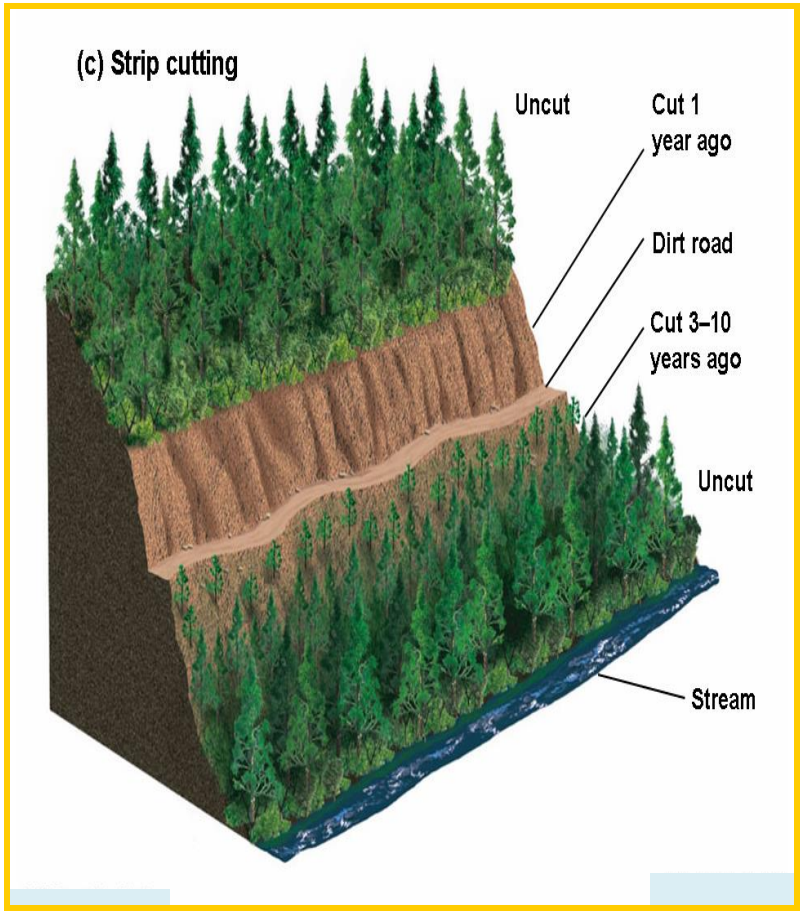

Figure 4: Strip Cutting (Miller, 2009/7)

- ✓ 3- Strip Cutting:
  - "cutting a strip of trees along the counter of a land, with the corridor narrow enough to allow natural regeneration within few years" (Miller, 2009/7).
  - after regeneration, loggers cut another strip above the first and so on.

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1.4- Reduction of Tree Harvesting

- Tree harvesting can be reduced by two major ways. These are:

✓ 1- wasting less wood

✓ 2- making paper from fibers that do not come from trees

(ex: woody annual plant called “Kenaf”)

Figure 5:The “Kenaf” Plant (Miller, 2009/7)

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1.5- Extent & Main Causes of Deforestation

- Extent of deforestation:

✓ Water Resource Institute (WRI) → human activities reduced the forest cover by:

- 22% since the beginning of the 20th century
- 50% over the past 8000 years

✓ these losses are concentrated mostly in developing countries.

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1.5- Extent & Main Causes of Deforestation (Cont'd)

- Main Causes of Deforestation:

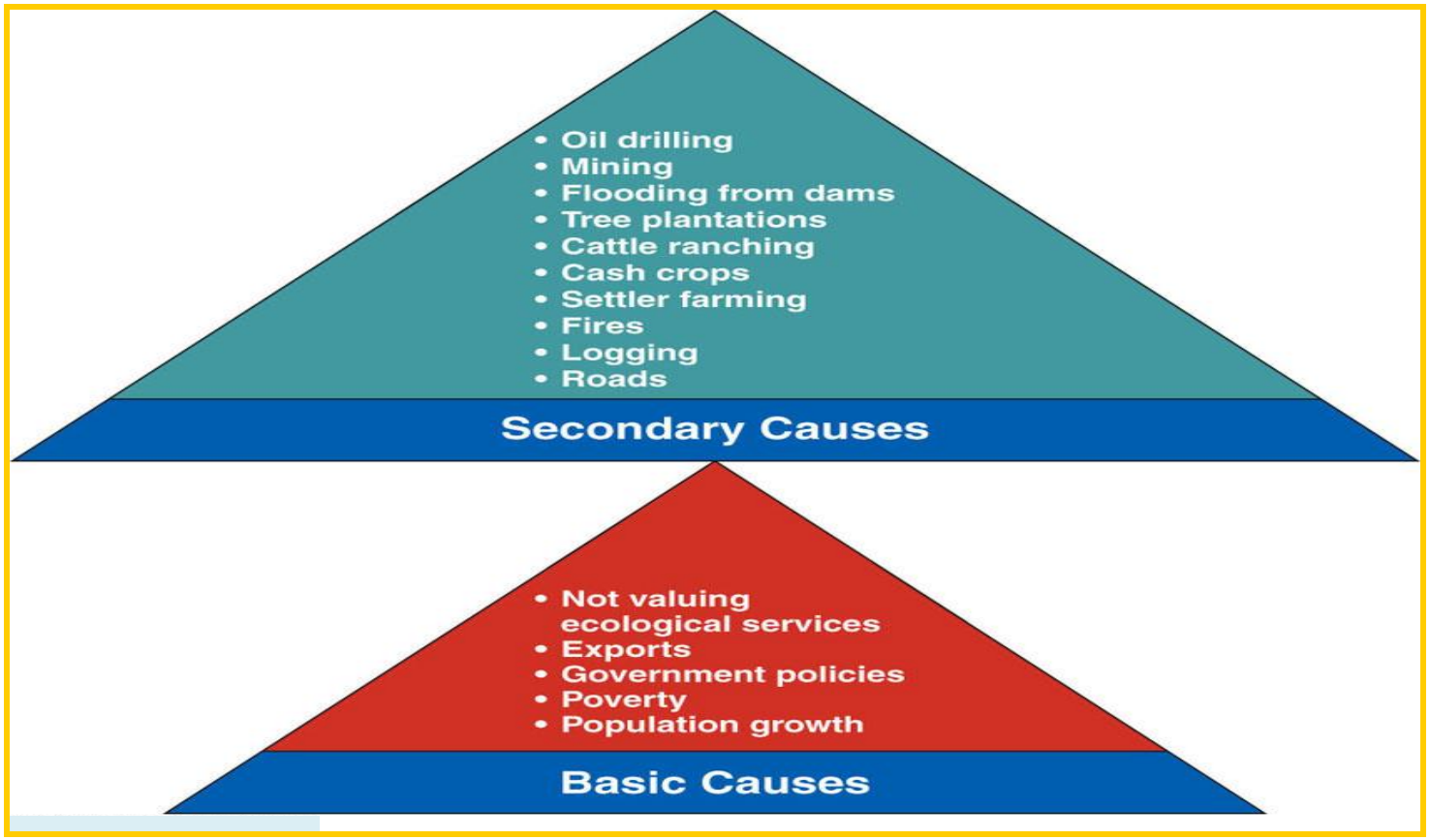

Figure 6: Some Important and Common Causes of Deforestation & Degradation (Tropical Forest and other types of forests) (Miller, 2009/7)

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1.6- Harmful Environmental Effects of Deforestation

- The harmful environmental effects of deforestation are:

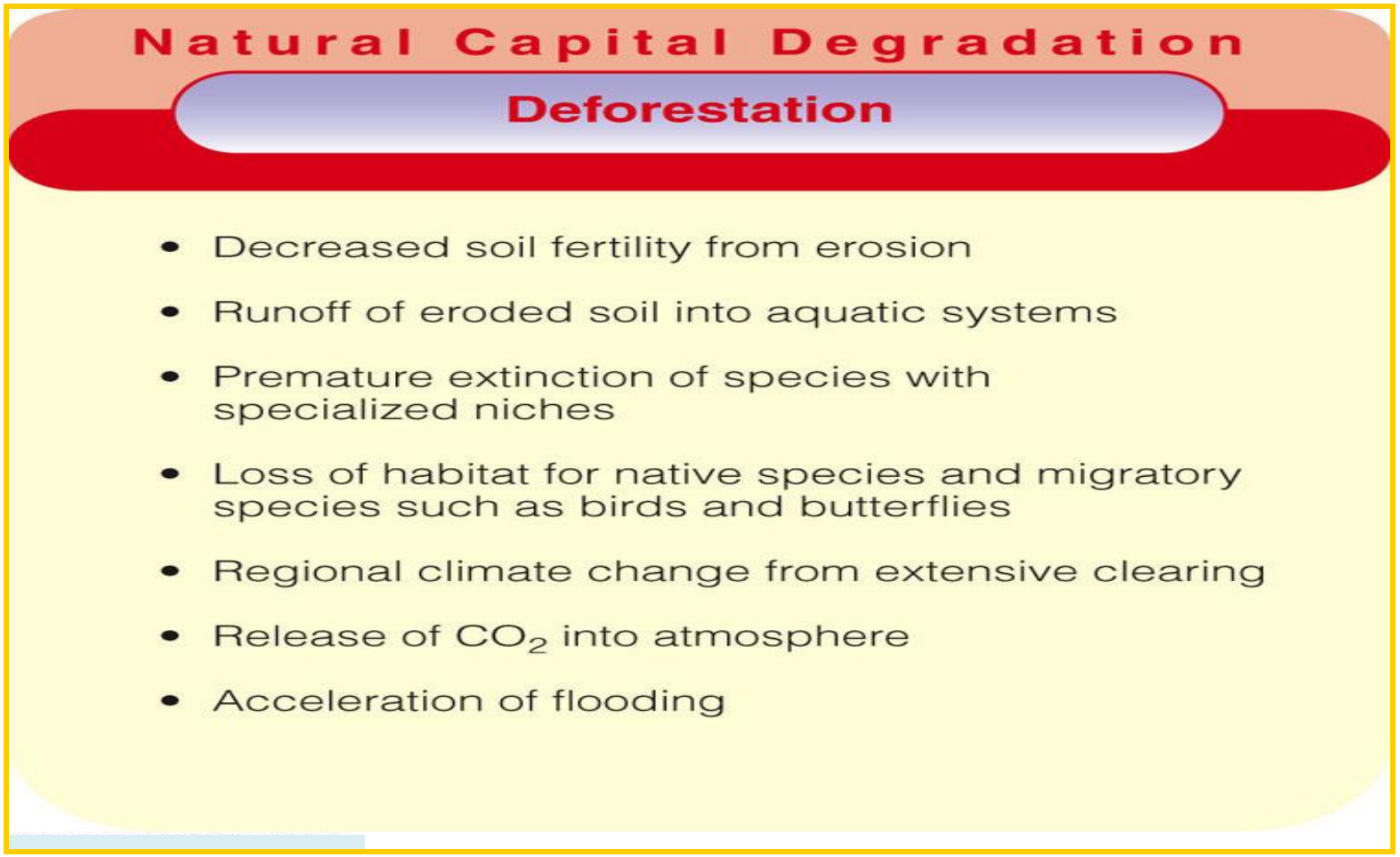

Figure 7: Main Harmful Effects of Deforestation (Miller, 2009/7)

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1.7- Forest Fires

- Three types of fires can affect forest ecosystems: These are:

✓ **1- Surface fires**

✓ **2- Crown fires**

✓ 3- Ground fires

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1.7- Forest Fires (Cont'd)

✓ 1- Surface Fires:

- usually burns only undergrowth & leaf litter on the forest floor.

- Disadvantages:

Figure 8: Surface Fire (Miller, 2009/7)

- may kill seedlings & small trees
- most wild animals escape

- Advantages:

- burn away flammable ground matter
- help prevent more destructive fires
- release valuable mineral nutrients & seeds from cones of pine
- stimulate the germination of certain tree seeds & species that sprout after fires.
- help control pathogens & insects

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1.7- Forest Fires (Cont'd)

- ✓ 2- Crown Fires:
  - extremely hot & rapidly burning fires.
  - may start on ground but eventually burn whole trees & leap from treetop to treetop.
  - usually **occur in forests that have not experienced surface fires** for several decades.

  - disadvantages:

- destroy most vegetation
- kill wildlife
- increase soil erosion
- burn human structures.

Figure 9: Crown Fire (Miller, 2009/7)

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1.8- Reduction of Forest Fires

- Main strategies exist to reduce fire damage. These are:

✓ 1- set controlled surface fires

✓ 2- clear small areas around buildings in places subject to fire.

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1.9- Managing Forests More Sustainably

- Managing forests more sustainably is based on targeting the two most important forest problems / threats which are:

  Tree Harvesting (deforestation) & **Forest Fires.**

- As such, managing forests more sustainably is based on 3 main principles These are:

✓ 1 -protecting old-growth & vulnerable species and emphasizing the economic & ecological values of forests.

✓ 2- harvesting trees no faster than they are replenished

✓ 3- protecting trees from fire

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1.9- Managing Forests More Sustainably (Cont'd)

If you were to manage/sustain a forest ....

what would you do????

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1.9- Managing Forests More Sustainably (Cont'd)

- Few more specific & common actions for better forest management and sustainability:

✓ Stop cutting old growth forests
✓ Rely more on selective cutting & strip cutting
✓ Reduce illegal cutting
✓ Concentrate farming and agricultural activities on already cleared areas
✓ Reduce road building into cut forests
✓ Encourage tree plantation (reforestation) in damaged forests
✓ Protect the most endangered areas & high biodiversity areas
✓ Educate people about sustainable agriculture and forestry
✓ Reduce poverty
✓ Reduce population growth
✓ Include the ecological services of forests in estimating their economic value
✓ Shift government subsidies from harvesting trees to planting trees
✓ Initiate laws related to forests and their protection

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2- Grassland: Management & Sustainability

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2.1- Benefits of Grasslands

- Grasslands → the ecosystems most widely used & altered by human activities, after forests.

- Some main ecological services provided by grasslands:

✓ soil formation

✓ erosion control

✓ nutrient cycle

✓ atmospheric carbon storage

✓ gene pools for crossbreeding grain crops

✓ biodiversity maintenance

✓ habitat & food provision for a variety of organisms

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2.2- Managing Grasslands More Sustainably

- Preserving and managing grasslands more sustainably can take place by targeting the three most important Grassland problems / threats which are:

  Overgrazing, Undergrazing & Rangelands Disruption

- As such, preserving and managing grasslands more sustainably can be done mainly in 3 ways. These are:

✓ 1- Overgrazing prevention

✓ 2- Undergrazing prevention

✓ 3- Disturbed rangeland management

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2.2- Managing Grasslands More Sustainably (Cont'd)

- ✓ 1- Overgrazing:

- o too many animals graze for too long → exceeding the carrying capacity of the grassland.

- o disadvantages:
- reduces grass cover
- exposes the soil to erosion & compacts the soil
- enhances invasion of exposed land by species that cattle won't or can't eat

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2.2- Managing Grasslands More Sustainably (Cont'd)

- ✓ 2- Undergrazing:
  - o no grazing for long periods (at least 5 years)
  - o disadvantages:
    - dense grass

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3- Ecological Restoration: Definition & Operations

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3- Ecological Restoration: Definition & Operations

- Ecological Restoration → repairing damage caused by humans (to the biodiversity & dynamics of natural ecosystems)

  (ex: replanting forests, restoring grasslands, reintroducing native species…).

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3- Ecological Restoration: Definition & Operations (Cont'd)

- Some main repair operations are:

✓ 1- Restoration: trying to return a particular degraded habitat or ecosystem to a condition as similar as possible to its natural state.

✓ 2- Rehabilitation: attempting to turn a degraded ecosystem back into a functional or useful ecosystem without trying to restore it to its original condition.

✓ 3- Replacement: replacing a degraded ecosystem with another type of ecosystem.

✓ 4- Creating Artificial Ecosystems: ex: creation of artificial wetlands to treat sewage.

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Reference Book

Reference Book:

Miller, T. & Spoolman, S (2009). *Living in the Environment* (16th ed.) Canada: Cengage Learning – Brooks/Cole

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n.b: All the material in this presentation is taken from the previously mentioned reference book.

(for educational purposes)