Impacts of Plants on Earthen Dams

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Module 1: Introduction

Learning Objectives

By the end of this module, you will be able to:

- **Identify** the primary detrimental impacts of tree and woody vegetation on earthen dam embankments.
- **Evaluate** the professional responsibilities of different stakeholders in maintaining dam safety regarding vegetative growth.

Executive Summary: Trees and woody vegetation have no place on the embankment of an earthen dam. Professional Engineers must possess the technical knowledge to overcome sentimental or ecological resistance and prioritize the structural safety of these critical assets.

Professional Perspective on Vegetative Growth

While trees are often viewed through an aesthetic or ecological lens, dam safety professionals—including **owners**, **operators**, **inspectors**, **dam safety regulators**, **engineers**, and **consultants**—must recognize that woody growth on an earthen embankment is a direct threat to safety. Engineering professionals frequently encounter "grass roots" resistance to vegetation removal based on cultural, environmental, or financial concerns. Addressing these challenges requires a fundamental technical understanding of how such growth compromises dam integrity.

Program Purpose and Scope

The primary objective of this course is to equip the engineering community with the technical knowledge required to manage the safety risks associated with tree and woody vegetation on earthen dams. This includes understanding detrimental effects and applying proper methods for establishing **desirable ground cover**.

The course content is structured sequentially to facilitate application:

- **Problem Identification**: Analysis of problems caused by woody growth and common misconceptions regarding root development.
- **Inspection Protocol**: Procedures for determining the specific impacts of vegetation on dam safety.
- **Vegetation Management**: Methods for controlling undesirable growth while maintaining beneficial ground cover.
- **Remediation Design**: Design considerations for removing existing vegetation and implementing phased-remediation plans.
- **Economic Analysis**: A factual presentation of maintenance costs versus long-term remediation expenses.

Professional Implementation

This course synthesizes **sixty-five years** of research and engineering practice. It serves as a specialized reference for different roles within the dam safety community:

- **Engineers and Consultants**: Use this material as a reference for **remediation dam design** and maintenance recommendations.
- **Regulators and Inspectors**: Utilize these modules as a **guideline for inspections** and for directing owners toward proper maintenance procedures.
- **Owners and Operators**: Apply these concepts to establish **O&M programs** that promote desirable vegetation and control risky woody growth.

💡 **Design Tip:** While technical study continues, the current industry consensus is definitive: trees and woody vegetation have no place on the embankment slopes of an earthen dam.

Checkpoint Quiz

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1. **According to the course content, why is technical knowledge essential for engineers when dealing with vegetation removal?**
   a) To minimize the environmental impact of the dam.
   b) To overcome resistance from stakeholders based on sentimental, cultural, or financial issues.
   c) To justify the planting of ornamental trees on the crest.
   d) To eliminate the need for regular mowing.

Answer: (b). Professionals must have technical knowledge of detrimental impacts to address resistance from stakeholders who may prioritize aesthetics or costs over safety.

2. **Which professional group should use this course specifically as a guideline for directing owners in proper O&M procedures?**
   a) Environmental scientists.
   b) Dam safety regulators and inspectors.
   c) Financial auditors.
   d) Local landscaping contractors.

Answer: (b). Regulators and inspectors are tasked with directing owners and operators toward methods that maintain dams without detrimental growth.

3. **What is the industry consensus regarding trees on earthen dam embankment slopes?**
   a) They are acceptable if they are less than 4 inches in diameter.
   b) They provide necessary stabilization for steep slopes.
   c) They have no place on the embankment slopes of an earthen dam.
   d) They should only be removed if they are dead or decaying.

Answer: (c). The text explicitly states there is no doubt that trees and woody vegetation have no place on the embankment slopes of an earthen dam.

Module 2: Problems with Tree and Woody Vegetation Growth

Learning Objectives

By the end of this module, you will be able to:

- **Identify** the primary safety risks and structural deficiencies caused by woody vegetation on earthen dams.
- **Evaluate** the legal, financial, and environmental constraints that impact vegetation removal programs.
- **Select** appropriate policy frameworks for managing trees on existing and new dam structures based on current state and federal consensus.

Executive Summary: Approximately 50% of state-regulated dams in the U.S. exhibit excessive tree growth, which compromises structural integrity through root-induced internal erosion, hinders safety inspections, and attracts burrowing animals.

Current Scope of the Vegetation Problem

Data from the 1998-99 National Inventory of Dams (NID) indicates approximately 76,700 dams of significant size and hazard category across 50 states. However, because many states use lower size definitions, the actual number of state-regulated dams is approximately 94,000.

A survey by the Association of State Dam Safety Officials (ASDSO) revealed that all responding state officials consider trees and woody plant growth a safety problem. Complacency is a major risk factor, as owners may not recognize slow-growing trees as an evolving threat to structural safety.

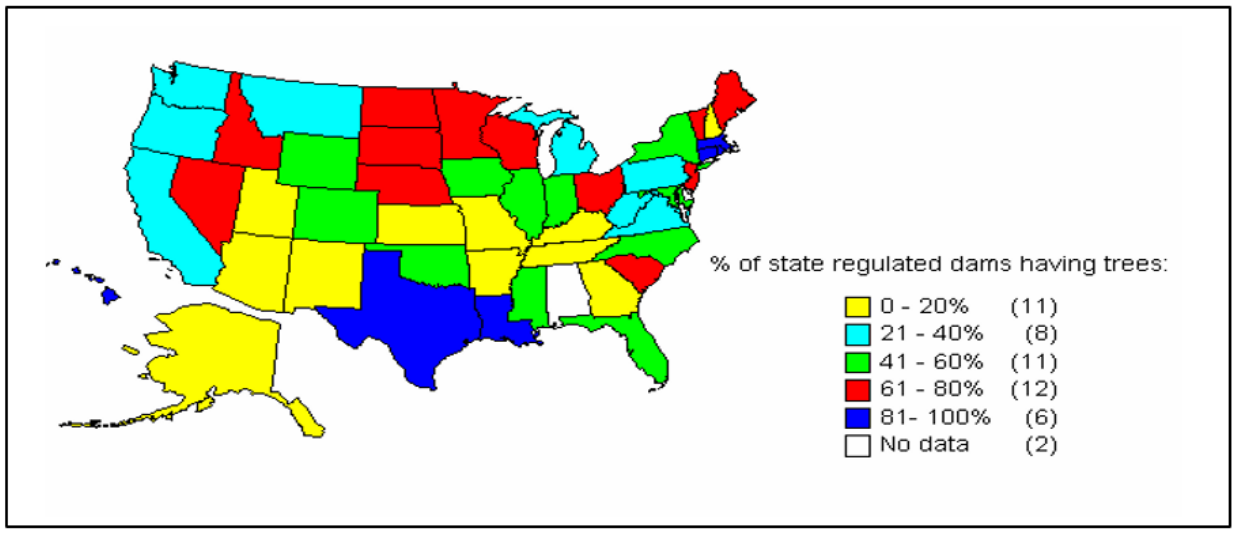

Figure 1. Estimated percentages of state-regulated dams having trees.

Primary Hazards and Structural Deficiencies

Woody vegetation creates a range of hazards that can lead to catastrophic failure. All major federal agencies (USACE, USBR, TVA) strictly prohibit tree growth on their structures due to these known risks.

Inspection and Monitoring Obstructions

Vegetation on an estimated 30,000 state-regulated dams (nearly one-third) obstructs effective safety inspections.

- **Hinderance**: Trees, vines, and briars mask signs of seepage, cracking, sinkholes, and slumping.
- **Deterrence**: Significant vegetation prevents inspectors from accessing and monitoring critical areas of the embankment.

Figure 2. Example dam with problematic trees in Nebraska.

Figure 3. Example dam with inspection- hindering trees in Tennessee.

Purchase this course to see the remainder of the technical materials.