Recommendations for Closer-to-Nature Forest Management Methods in Pine Forests
(Summary)

1. Purpose and Context of the Document

The purpose of this document is to provide **scientifically grounded and practically applicable recommendations** for the management of **pine forests in Latvia** using **Closer-to-Nature Forest Management (CtNFM)** approaches. The document integrates:

- European Commission policies and guidelines,
- findings from international research,
- results of studies conducted in Latvia and analyses of forestry practice,
- the existing national regulatory framework.

Special attention is given to the **highly fragmented forest ownership structure in Latvia**, which limits landscape-scale planning opportunities. Consequently, the recommendations are primarily oriented towards the **stand (compartment) level**, while maintaining conceptual links to broader ecological processes.

2. The Concept of Closer-to-Nature Forest Management (CtNFM)

Closer-to-Nature Forest Management is defined as a **conceptual framework**, rather than a single silvicultural method. Its core principles include:

- learning from **natural processes**,
- emulating **natural disturbance regimes**,
- maintaining and developing **forest structural diversity**,
- ensuring **economically viable forest use**.

CtNFM is not opposed to forestry or timber harvesting; instead, it implies a **different management logic**, characterised by:

- lower management intensity,
- longer management cycles,
- greater emphasis on **what is retained in the forest**, rather than solely on extracted timber.

3. European Commission Guidelines for Closer-to-Nature Forest Management

3.1. Core Principles

The European Commission defines five core principles of closer-to-nature forest management:

1. **Respecting and utilising natural processes** in forest management;
2. Maintaining **structural complexity** (diversity of age, species, and tree dimensions);
3. **Integrating forest functions** across different spatial scales;
4. Selecting silvicultural systems based on **region-specific natural disturbance regimes**;
5. Applying **low-impact timber harvesting**, preserving soil, microclimate, and habitats.

The principal objectives are to:

- increase **structural complexity**, and
- promote **natural forest dynamics**.

3.2. Recommended Forest Management Approaches

The document analyses several forest management approaches, including:

- **Closer-to-nature forestry** – selection harvesting, small openings, and natural regeneration;
- **Integrated forest management** – simultaneous provision of multiple ecosystem services;
- **Continuous Cover Forestry (CCF)** – avoidance of large clear-cuts and maintenance of permanent forest cover;
- **The triad principle** – spatial segregation of intensively managed, protected, and multi-purpose forest areas;
- **Retention forestry** – conservation of biologically important structures within even-aged stands.

3.3. The European Commission "Toolbox"

Key practical instruments include:

- prioritisation of natural regeneration;
- partial harvesting (single-tree and group selection);
- establishment and maintenance of buffer zones along water bodies (recommended width ~30 m);
- retention of deadwood;
- minimisation of pesticide and fertiliser use;
- protection of wet habitats and forest soils;
- setting aside areas for free natural development;
- regulation of ungulate populations.

4. Regional Guidelines

4.1. Boreal Forests (Latvia)

In Latvian boreal forests, CtNFM is based on **emulating natural disturbance regimes**, primarily:

- gap dynamics (small-scale disturbances),
- patch dynamics,
- cohort dynamics,
- and, more rarely, stand-replacing succession.

Key recommendations include:

- natural regeneration as the primary regeneration method;
- use of native tree species;
- application of continuous cover forestry methods in fertile and moist forest types;
- application of retention forestry in dry and nutrient-poor forest types;
- retention of 5–15% of standing volume as structural elements;
- consideration of biodiversity planning at the landscape scale.

5. Conceptual Framework for Pine Forest Management

The recommendations are based on four key elements:

5.1. Ecological Characteristics of Tree Species

The document provides a detailed analysis of the ecological traits of key tree species (Scots pine, Norway spruce, birch, aspen, oak, etc.), including:

- light requirements,
- longevity,
- regeneration strategies,
- sensitivity to decay, pests, and ungulate browsing.

Ecological and Ontogenetic Parameters of Tree Species (Table 2.1)

The table compiles the **ecological amplitudes and biological characteristics** of the most important tree species occurring in pine forests in Latvia (Scots pine, Norway spruce, birches, aspen, oak). These parameters determine species suitability for different silvicultural systems.

Key findings:

- **Scots pine and oak** are characterised by high longevity and structural stability, making them suitable for long rotations and structurally complex stands;
- **Birches and aspen** function as pioneer species, playing a crucial role in early successional stages and in the development of structural diversity;
- Species-specific **light requirements, moisture tolerance, and soil reaction** directly influence the choice of harvesting methods and management intensity;
- Differences in susceptibility to decay, pests, and ungulate browsing highlight the importance of **mixed-species composition and uneven-aged stand structures**.

This information forms the basis for selecting **appropriate silvicultural systems**.

5.2. Linkage Between Forest Types and Natural Disturbance Regimes

Forest types are grouped according to their **dominant natural disturbance regime**, which serves as a model for selecting harvesting methods and management intensity.
Particular emphasis is placed on the fact that **drained forest types represent novel ecosystems**, requiring deliberate management decisions regarding their trajectory towards more natural conditions.

5.3. Forest Management Intensity Levels

Five forest management intensity classes are distinguished:

- unmanaged forest,
- closer-to-nature forest management,
- multi-objective forest management,
- intensive even-aged forest management,
- short-rotation forestry.

CtNFM primarily corresponds to **low and medium intensity management**, although its elements can be integrated into more intensive systems.

Forest management approaches are structured into **three principal intensity classes**:

1. Low-intensity management (Closer-to-Nature Forest Management)

- Natural regeneration as the primary regeneration method,
- Minimal machine operations,
- No fertilisation or chemical treatments,
- High level of retention of ecological trees and deadwood (≥ 10–15%).

2. Medium-intensity management (Multi-objective forestry)

- Natural regeneration supplemented by planting,
- Limited soil preparation,
- Retention of ecological trees in accordance with, or exceeding, regulatory requirements,
- Structural elements retained temporarily.

3. High-intensity management (Even-aged forestry)

- Regeneration dominated by planting,
- Intensive machine operations,
- Possible use of fertilisers and chemical treatments,
- Minimal retention of ecological structures.

5.4. Silvicultural Systems

The document describes various silvicultural systems, including:

- clear-cutting systems,
- shelterwood systems,
- selection systems,
- group-based harvesting systems,
- systems incorporating retention of ecological trees.

It is emphasised that a silvicultural system represents a **long-term management programme**, rather than a single harvesting operation.

6. Regulatory Framework in Latvia

The document analyses:

- the Forest Law,
- Cabinet of Ministers regulations on tree harvesting,
- nature conservation requirements,
- buffer zone regulations.

It concludes that:

- the regulatory framework remains largely oriented towards even-aged forest management;
- however, it allows for selection and shelterwood harvesting systems;

- closer-to-nature forest management is feasible when regulatory provisions are applied skillfully and flexibly.

Particular attention is given to:

- retention of ecological trees,
- deadwood requirements,
- restrictions in buffer zones.

7. Management Recommendations for Pine Stands in Different Forest Types (Tables 2.3– 2.5)

The tables provide **stand-specific recommendations** for pine forest management based on:

- forest type (e.g. dry pine forests, mesic pine forests, bog-influenced (wet peat soils) sites),
- dominant **natural disturbance regime** (cohort dynamics or successional dynamics),
- selected management intensity.

Main conclusions:

- In **dry and nutrient-poor forest types**, preference should be given to cohort dynamics, group-based openings, and long rotation periods.
- In **more fertile and moist forest types**, both selection forestry and shelterwood systems are applicable.
- The **size of canopy openings** (approximately 0.2–0.5 ha) is critical for successful natural regeneration of Scots pine.
- Retention of **successional elements**, particularly admixture of broadleaved species, enhances stand resilience and ecological stability.

Classification of Silvicultural Systems and Harvesting Methods

The tables systematically link:

- regeneration methods (natural, combined, planting),
- harvesting systems (selection, group selection, shelterwood, clear-cutting),
- rotation lengths (long, medium, short),
- maturity criteria (maximum mean annual increment, target diameter, financial optimum).

A key principle emphasised is that:

A silvicultural system represents a **long-term management programme**, rather than a single harvesting operation.

Role of Nature Conservation Elements

Across all tables, consistent emphasis is placed on:

- retention of ecological trees,
- maintenance of deadwood,
- balancing biodiversity objectives with fire risk, pest outbreaks, and safety considerations.

Recommended retention levels include:

- at least **5–10%**, preferably **10–15% of the initial standing volume**,
- on average **20–30 m^3 ha^{-1}** of deadwood or potential deadwood.
- **management**.