What is Alternative Forest Management? – A Systematic Literature Review of a Scientific Concept, its Motivations and Usages

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Independent degree project • 15 credits
Swedish University of Agricultural Sciences
Faculty of Forest sciences - Southern Swedish Forest Research Centre
Forest and Landscape - Bachelor's program
Alnarp 2025

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Credits:	15 credits
Level:	First cycle, G2E
Course title:	Independent project in Forestry science
Course code:	EX1012
Programme/education:	Forest and Landscape
Course coordinating dept:	Southern Swedish Forest Research Centre
Place of publication:	Alnarp
Year of publication:	2025
Keywords:	forestry science, forest management, alternative forest management, AFM, systematic literature review, continuous cover forestry

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Forest Policy and Planning

Abstract

Forests are facing an increasing number of challenges from human activities, including projected increases in wood consumption. Growing demands for forest-based products are driven by technological advances and the conceptualisation of forests as a sustainable resource. In response, novel approaches to forest management have emerged in recent decades, often based on divergent rationales and ideologies. Among these, Alternative Forest Management (AFM) is frequently mentioned in both scientific literature and practice. Its meaning and application remain inconsistent and therefore difficult to apply in science and policy. The central objective of this study is to scrutinise AFM, in a conceptual sense, by examining its utilisation and underlying motivations in scientific publications. The study addresses four research questions: (1) Is Alternative Forest Management (AFM) understood and used as a concept in scientific literature, (2) What forest management practices are categorized under AFM in scientific literature over the past decades, (3) How is AFM associated with different scientific disciplines, and what is its geographic distribution in global research, and (4) What are the motivations influencing the introduction of AFM? To answer these questions, a systematic literature review was conducted using two major bibliographic databases. The investigation applies different theoretical entry points to dissect AFM. The results demonstrate that, while the term 'AFM' is frequently mentioned in the literature, approximately only 10% of the literature refer to AFM as concept. AFM functions as an umbrella term for different forest management practices, especially Continuous Cover Forestry (CCF). AFM appears mainly in studies focusing on the boreal regions with some mentions in the global south. The motivations behind the use of AFM are consistently linked to addressing a plurality of forest-related goals, needs and values. This study shows that AFM is not only a practical term, but also an evolving scientific concept that reflects the complexity of contemporary needs addressing forest management and the necessity for multi-dimensional approaches.

Keywords: forestry science, forest management, alternative forest management, AFM, systematic literature review, continuous cover forestry

A concept is a brick. It can be used to build a courthouse of reason. Or it can be thrown through the window.

Deleuze & Guattari, A Thousand Plateaus – 1987

Vem ska förklara för blommorna
att de måste vänta på våren
när vi är borta

Who will explain to the flowers
that they must wait for spring
when we are gone

Jonathan Johansson – 2025

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Abbreviations

AFM	Alternative Forest Management
ANT	Actor-Network Theory
CCF	Continuous Cover Forestry
CDA	Critical Discourse Analysis
CTNF	Close-To-Nature Forestry
FAO	Food and Agriculture Organisation of the United Nations
FM	Forest Management
JFM	Joint Forest Management
NTFP	Non-Timber Forest Products
PFM	Participatory Forest Management
RQ	Research Question
SES	Socio-Ecological System
SFL	Systemic Functional Linguistics
SLR	Systematic Literature Review
SLU	Swedish University of Agricultural Sciences
STS	Science and Technology Studies
WoS	Web of Science

1. Introduction

Global forests account for over one third of the habitable land area with around four billion hectares (Ritchie 2021), with approximately 40% of this area under some form of management (Lesiv et al. 2022). Today's forests are increasingly subject to a wide range of human-induced challenges. The Food and Agricultural Organisation of the United Nations projects that the demand for timber will increase in the coming decades (FAO n.d.b). Demands on forests are also growing due to technical advancement and the conceptualisation of forest as a sustainable resource. These demands often have mutual influence, like biofuel extraction, increasing need for sustainable labelled construction timber, carbon storage, and conservation or restoration of biodiverse ecosystems in the landscape (Rosa et al. 2023).

In response to these demands, new forest management approaches have emerged both in professional practice and in the scientific sphere over the recent decades. Some of these approaches prioritise industrial values, some seek to redefine forestry through the lenses of sustainability (Sayer & Maginnis 2005), adaptability (Reinhold et al. 2025) and resilience (Hagerman & Pelai 2018), or socio-ecological tailoring (Hallberg Sramek 2023). This is to emphasise not solely economic outputs, but a plurality of values (e.g. cultural, ecological, social and community-centred). The concept of forest management has thus become even more complex and contentious.

There are different ways how concepts can evolve in forest management discourse(s). This can be e.g. scientific refinement, as rhetorical device, or as flexible/adaptive frame that makes re-interpretation possible to fit changing values, environmental conditions and/or a political agenda. Concepts, often used as buzzwords, are versatile and thus potentially vague. This is because the concepts are used for and adapted to new applications by a variety of disciplines and actors. This can be that e.g. scientific communities co-opt a concept adding meaning to it making it fit the context of this specific scientific community. As previous investigations have shown, concepts in forestry science can be misnomered as in the case of *intensive forest management* (Bell et al. 2006) or work in a double-function manner as in *integrative multifunctional forest management* (Borrass et al. 2017). Park (2011:337) declares that the sphere of forest management "is awash in buzzwords and acronyms". Park (Park 2011) demonstrates how some terms and concepts in forestry, exemplified with the term *resilience* and the concept *sustainable development*, are used as buzzwords mutating into deformed (or as Park says, creeped) paradigms and pushing these close to meaninglessness. In this, the latter concept has become to be understood as a philosophical guideline rather than a technical term that informs a

management. However, a concept "may still be useful as a unifying metaphor […] to promote socio-ecological landscapes […] in the face of inevitable change" (Park 2011:342). In the case of *resilience* there should be a differentiating between a strict technical definition of *resilience* and that of a *resilient approach* that should be more understood as a general mindset in managing forest (Park 2011). In the case of *intensive forest management*, it is the variation of definitions throughout time and the variation of definitions in different scales, local to regional, that make the term ambiguous (Bell et al. 2006). In the case of *integrative multifunctional forest management* in Germany, a combined notion of politics and the logics of natural science of forest management merged into an amorphous character of the concept (Borrass et al. 2017). This may be an intended outcome through a strategic narration in which its policy implementation in response to diverse and environmental demands was aimed at. Simultaneously, the concept served as a sectoral power strategy which re-legitimised the responsibility of the forest sector, thus aligning with environmental policy and strategic political needs (Borrass et al. 2017). Approaches and concepts considered and/or adopted within and outside the field of forestry over time, are reproduced, either retaining or altering their meaning.

Further, this investigation derives from my own notion that there are as many forest managements as there are forest managers. This thought has recurred in various guises throughout my education. It highlights the challenges in formulating, categorising, and defining forest management approaches. This is because forest management, the act of controlling a forest, can be performed in different ways from coercive to synthesised, depending on the incentives and values involved. This notion lead me also to the eternal question of forest management and policy; who manages what, and for whom? This question would be understood and answered differently depending on context. Already the concept of *forest* functions over multiple scales, from local to global. The understanding of the concept *forest* functions as foundation for the understanding of forest management (Chazdon et al. 2016). There are significant differences between countries, their ecological and social conditions, and institutions leading to varied conceptions of what a forest constitutes thus causing misunderstandings across borders (Côte et al. 2018). Misunderstandings of these definitions make e.g. the act of deforestation or degradation easier and a co-ordinated management beyond borders often more complicated (Côte et al. 2018).

Considering the current growing demands on forests and the uncertainty of future forests, there is expeditious need to provide clear frameworks what different forest management approaches refer to. This is crucial for understanding the status quo of forest management and a critical step in the development of future forest policies

and managements. This is because definitions of forest managements are the foundation that shape policies on all scales, from local to global (Chazdon et al. 2016) and are used as meaningful tools in forest sciences. However, there remains a persistent and under-addressed problem: forest management is not a clearly defined concept. The difficulty in defining forest management stems in part from the varying socio-ecological systems (SES) within which it is situated. SES assumes that societies and the ecological environment are inevitably interdependent consisting of multiple social actors and multiple ecological resources (Bodin & Tengö 2012). In these systems the variation of understanding and applying forest management concepts varies across the globe. This also applies for a forestry practitioner or scientist whose knowledge, needs, and wishes are part of a formulated definition of forest management. This is because, the underlying incentives of forest management are formed by different factors such as cultural background, scientific schools, national policies, varying forest structures and geographical conditions, and the ideas and structures that emerge within these SES. Crucially, different actors perceive and value forests in different ways, which leads to differing interpretations and applications of forest management concepts. This value pluralism can result in significant variation in outcomes, even when actors use similar terminology.

For policy to be applicable, and for science to produce meaningful output there is the need to understand how novel forest management systems are defined and have developed in the socio-ecological networks they are situated in. One forest management that gained attention over the last years is *alternative forest management* (AFM). It appears across scientific publications, forestry practice, and policy contexts. Within the scientific field which aims to dissect and reflect on ecological and social phenomena, the definition and usage of AFM seems to be ambiguous. AFM is inconsistently characterised in scientific publications, raising questions about its role and application. In order for AFM to serve a scientific and practical purpose, there is need for a better understanding what AFM is and what the rationales of its usage are.

To tackle this problem requires an expanded awareness of the motivations and values that underpin forest management, of the actors who argue for these, and of the discourses they are embedded in. The following investigation is an initial exploration of how the underlying values of forest management, here in the case of AFM, can be critically examined. By uncovering motivations and discursive contexts in which AFM is situated, it becomes possible to better evaluate if AFM is a concept that can contribute to better forest management.

1.1 Aim and research questions

The aim is here to investigate how the term *alternative forest management* is used and understood in the scientific sphere. This will be done by examining its relationship to other forest management approaches and the scientific disciplines it is associated with, and by analysing the underlying ideas and motivations for its introduction. The following research questions are derived from these objectives:

1) Is Alternative Forest Management (AFM) understood and used as a concept in scientific literature?
2) What forest management practices are categorized under AFM in scientific literature over the past decades?
3) How is AFM associated with different scientific disciplines, and what is its geographic distribution in global research?
4) What are the motivations influencing the introduction of AFM?

1.2 Delimitations and positioning

This investigation is a first step in deconstructing the meanings and scientific links of AFM. This study should be understood as interdisciplinary in which forest science, linguistics, science and technology studies, and discourse analysis are synthesised. This approach has been continuously developed throughout the time period I have conducted this thesis, by creating a theoretical framework that is applicable in a systematic manner adapting to the data while collecting and analysing it.

Forestry as science and as practice are multi-disciplinary fields, within which pluralistic knowledge production processes exist. I understand this discourse(s) not as two fields cross-fertilising each other, but rather as gradient from theoretical perspectives towards physical interventions in the landscape. Forestry practice, including science, management, and education is a multi-disciplinary field where there should be focus on the social actors and factors that in the end define and execute forest management. However, forestry requires increased interdisciplinarity and a pluralistic understanding among practitioners of how socio-ecological structures, and the values arising from these structures, influence forest management and practices (Innes 2011). I am a student in a hybrid education with nature- and social science input writing this thesis. The deriving point and knowledge base for this investigation is forest science. I will also include previously gained knowledge and perspectives from previous studies into it. These include a three-year training in contemporary arts at the State Academy of Fine Arts in Stuttgart where much of my time was spent exploring discourse and its analysis with language itself serving as material, one year of linguistic studies in Lund, and

courses in the subject of history of ideas. I myself understand this thesis as a first exploration into how scientific concepts in forestry can be dissected. This is to take a holistic and transparent approach that brings together as many lenses as possible, to shape a more comprehensive understanding that does justice to the complexity of the socio-ecological system a concept is embedded in.

A further comment on this investigation; The choice of using *I* in writing up this thesis is to underline that a human actor cannot be understood as an isolated subject. This is to show awareness that I as an investigator influence the choice of theories and methods, and how I understand and use these as tools to analyse (Gunnarsson & Bodén 2021). "A researcher is not distanced from what is studied, but is involved and intertwined with it" (Gunnarsson & Bodén 2021:38).

2. Theoretical underpinnings

In this thesis, I dissect *alternative forest management* (AFM) from different perspectives. This is reflected in the four research questions (RQ) in which each is thought to have a certain theoretical frame as backbone. The first question is how AFM as phrase is linguistically used in scientific text examined through systemic functional linguistics (SFL). Here a selection is made, only including publications to this investigation that refer to AFM as a concept. With the second RQ, I dissect the included scientific publications from a forest science perspective, finding relations to other forest management practices and/or social practices. The third RQ leans on Science and Technology studies (STS) through which I illustrate in which scientific spheres AFM is found. Here the actor-network theory lays the foundation for an overview of scientific fields and disciplinary links. Through the fourth RQ, I provide a critical discourse analysis (CDA) to understand with what underlying motivations authors justify the implementation of AFM. I draw on several theoretical frameworks here, utilizing both their central ideas and selected components, to construct a comprehensive approach for analysing a scientific concept. How these theories are thought to synthetise and conceptually complement each other, is presented in Figure 1.

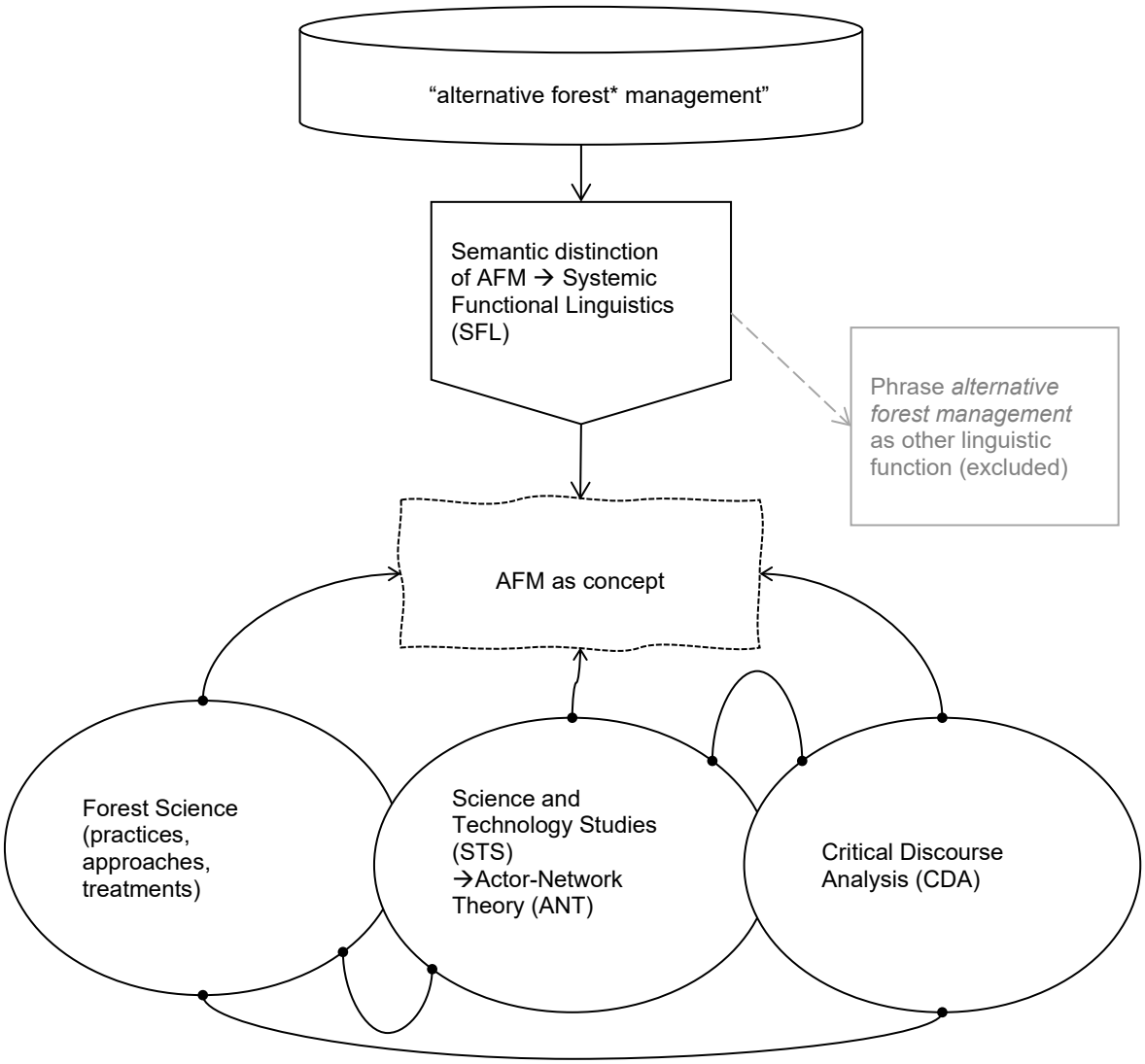

Figure 1. Graphic representation of how the different applied theories are thought to complement each other. Data derived from search string "alternative forest management". SFL functions as a filter to come forth with scientific publications that understand AFM as a concept. Forest science functions as knowledge base, STS and ANT are understood as a lens, CDA as an analysing tool.

2.1 Systemic Functional Linguistics (SFL)

I understand language as in the foundational semiologist perspective developed by Ferdinand de Saussure (2011), later laying the foundation for structuralist thinking. The core understanding is that language through words, terms, and phrases builds meaning units through their relation and the differences between each other. This includes the syntax in a sentence but also that of a text unit. Meaning making in these structures reaches from non-physical abstract references to concrete and physical references (Saussure 2011). Further, the field of terminology studies examines how specialised vocabulary in science is created and structured. For phrases referring to concepts being cognitively accessible and communicable,

multi-term concepts are typically composed in a head-modifier structure. This is that one unit, the head, indicates the general class in which a concept can be allocated, whereas the resting terms can be understood as modifiers which specify properties or indicate a relation to the head term (Temperley & Gildea 2018).

To identify how the phrase alternative forest management is used and functions in scientific literature, I draw on Systemic Functional Linguistics (SFL), (Halliday & Matthiessen 2014). This is to establish a distinction between the usage of the phrase as either a concept or another category. SFL is about how grammar serves meaning in a context. The argumentation is that the "study of discourse cannot properly be separated from the study of the grammar that lies behind it" (Halliday & Matthiessen 2014:731). The idea of the SFL framework is: in order to understand and explain language we need to model it. This is through linking the eco-social environmental surrounding to non-random disturbances in the air (the sound) through different strata. In SFL, stratification refers to the understanding that language is a complex semiotic system with several levels, or strata. These four language strata are depicted in Figure 2, where one can see the organisation of language and where this system is embedded in context. Context is the eco-social environment. Content exists in two strata, the lexicogrammar (vocabulary and grammar) and the semantic one.

Halliday & Matthiessen (2014) introduce ideational metaphors and nominalisation as the result of the semantic and lexicogrammar strata influenced by its surrounding context. Nominalisation is when processes, normally expressed through verbs, and properties, normally expressed through adjectives, are reworded metaphorically as noun or noun-phrase. This is that these are not functioning as a process or attribute anymore, but rather as a nominal group, or as Halliday & Matthiessen say: a thing.

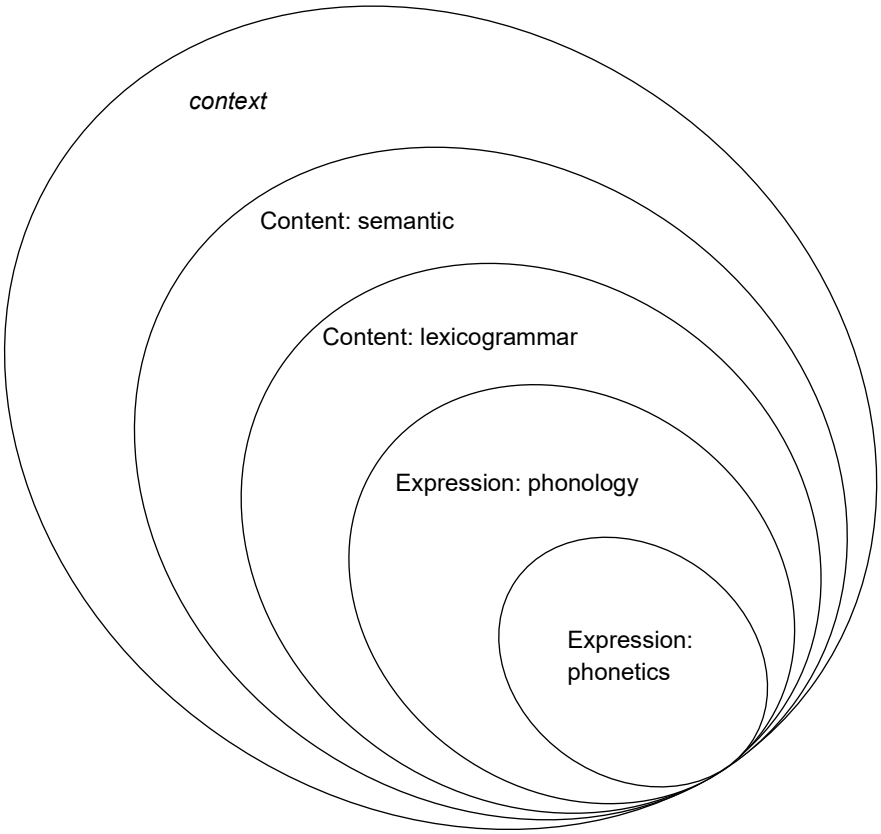

Figure 2. Stratification of a language system according to (Halliday & Matthiessen 2014). (Illustration inspired by Halliday & Matthiessen 2014, page 26).

Halliday & Matthiessen (2014) also stress that this phenomenon derives from scientific and technical registers, where constructing hierarchies of technical terms and/or a packaging of complex ideas into nominal forms is the case. In this way a phrase or package becomes a metaphor in the discourse which can become ambiguous over time. "[A] writer presumably knows exactly what it means [she refers to]; but the reader may not, and so this kind of highly metaphorical discourse tends to mark off the expert from those who are uninitiated" (Halliday & Matthiessen 2014:730). This separation between expert and non-expert can be understood as a factor of power (Ottinger 2017). Crucial here is to note that metaphorical wording carries an extra layer of meaning—it simultaneously conveys both its metaphorical interpretation and its more literal, or congruent, meaning (Halliday & Matthiessen 2014). This means a similar looking phrase can be used in different ways and therefore has different semantic meanings. This is when a term functions as an abstract concept, or in a descriptive way, when it qualifies something more concrete. To apply this, identifying if a text refers to alternative forest management as a concept or not, I developed a table with test questions pointing out the differences, see Table 1 below:

Table 1. Test questions to help identifying if AFM is referred to as concept or descriptive use.

Test question	Explanation	Interpretation
Is AFM defined, theorised or discussed abstractly?	The phrase AFM followed by "refers to", "is defined as", etc.	Strong indicator of conceptual use
Phrase AFM a subject or object in clause?	e.g. "Alternative forest management is needed."	Suggests conceptual use
AFM nominalised?	Is it used like a 'thing' (noun phrase), rather than a process?	Nominalized, more likely conceptual
Is it part of a modifier Phrase?	e.g. "Five alternative forest management methods..."	Suggests descriptive use (not a concept)
Is it the phrase alternative forest management pluralised or varied?	e.g. "several alternative forest management scenarios"	Often indicates descriptive use (not a concept)

The questions in Tabel 1 should be seen as a starting point when examining in what syntax and context the phrase alternative forest management is situated. As mentioned above, there are always several variables that characterise how something is understood and used.

An example of a descriptive use could be a sentence in which an author wants to describe that, for example, several different scenarios have been simulated, as in the sentence *Several alternative forest management scenarios were simulated to identify…* Here, the phrase is more descriptive to its surrounding, the situational context and refers to the possibility of choice between two or more options. An example for a conceptual usage of AFM could be is an author states a sentence as e.g. *alternative forest management is a way forward*, here the phrase is nominalised and used as a subject in the clause.

2.2 Re-visiting alternative, forest, and management

In this section I re-visit the terms alternative, forest, management, and the concept forest management. This is to give an idea of the problematics behind each term isolated.

Alternative

The word alternative as a noun refers to "something that is different, especially from what is usual; a choice" (Cambridge Dictionary n.d.). Alternative as an adjective is defined as "offering a choice between two or more things" (Cambridge

Dictionary n.d.). Notice, in both definitions the word *choice* transcribes *alternative*. A first derivation that the word alternative could have to do with reaching a decision through choice.

Forest

To define what is a *forest* is difficult in a global context. I do not aim to solve this problem here but rather draw attention to the problematic that is associated with the term. In a global perspective where there are significant differences between countries, their ecological and social conditions, and institutions having varied conceptions of what forest constitutes, misunderstandings can arise (Côte et al. 2018). These misunderstandings of definitions make the act of e.g. deforestation or degradation easier since variance opens up for grey zones without well-defined boundaries. On the other hand, these misunderstandings and/or disagreements of definitions often makes a co-ordinated management beyond borders more complicated. A further consideration when referring to the term forest is the difference in values and cultural perceptions, and the semantic concepts that are formed in different parts of the world (Côte et al. 2018).

My aim is to provide an idea of what alternative forest management could mean around the globe through a scientific literature review. I (a democratically raised citizen living in the global north) passively agree that when an author refers to forest, it is forest. However, to get an idea of what forest could mean in a global context, the Food and Agriculture Organization of the United Nations refers to the concept *forest* as follows:

> "Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use". (FAO 2015 in Côte et al. 2018:255)

Management

The definition of the word management in the Cambridge dictionary (n.d) is "the control and organization of something" and "the group of people who control […]". The verb to manage refers to control or organize someone or something (Cambridge Dictionary n.d.). Here the term to control is considered as foundation to understand management. I understand the term in a neutral way, since control can be practiced in a coercive or synthesised way. With coercive I mean e.g. that a formulated goal is set as value, and the forest is controlled disregarding other values or actors. With a synthesised way of management, I mean the act of accounting for what actors are present in a socio-ecological system, and that the control of forest includes and aligns to this plurality of actors and values.

Forest management

As mentioned in the introduction, there are multiple factors that shape the perception of what forest management is. This makes it difficult to pinpoint a definition of forest management (FM), especially when investigating forest management globally. However, I introduce here several perspectives on FM in order to give some background.

FM is argued to be reflected in the definitions of forest. This is because FM objectives are responses to changes in societal values and needs (Chazdon et al. 2016). Over the past decades FM has evolved over time in response to the changes in values and needs. In the 18th century in Germany, FM focus was on the sustaining of timber yield. This was theory-based FM. After the second world war the FAO introduced a forest definition, mentioned above, that is centred on timber production and the assessment of productivity, which is still widely used today. In the 1960s environmental movements widened the focus integrating biodiversity and conservation into management objectives. More recently, concerns on climate change have led to the recognition of forest as carbon sinks. This resulted in new definitions related to carbon accounting. Today, FM is embracing a landscape approach in which forests are seen as complex socio-ecological systems. In these there is need to provide a balance of diverse objectives of multiple stakeholders (Chazdon et al. 2016).

The Food and Agricultural Organisation of the United Nations (FAO) refers to FM as follows:

> "Forest management is the process of planning and implementing practices for the stewardship and use of forests to meet specific environmental, economic, social and cultural objectives. It deals with the administrative, economic, legal, social, technical and scientific aspects of managing natural and planted forests". (FAO n.d.a)

FM approaches lead to practical interventions and treatments that influence forest structures and ecosystems, but it is not solely the forests that alternate from its management. It is also a forestry practitioner, theoretical and practical, who continuously relates to her practices and other practices in the world that surrounds her. One's practice is shaped through values that derive from culture, industrial networks and markets, one's education, the existing knowledge in a field, policies and legislation, technology and the from these factors arising incentives and goals (Hertog et al. 2022). The incentive to manage forest can also be constructed from an inner personal value as the relation to nature, forest, and ecological environment itself. FM can thus be understood as a reciprocal process. By this I mean the mutual relationship between forest and a manager acting as co-actors. This is not to understand as dualistic system between human and nature, between social and

ecological, but rather as processes of relations that continuously are emerging in a wider network (West et al. 2020). These relations are difficult to uncover but lay the foundation for the variation of existing FM concepts.

Examples of contemporary FM concepts frequently discussed in science include e.g. fast-growing tree species for increased biomass production in a shorter time frame for energy conversion into pellets (Alaejos et al. 2023), closer-to-nature forest management as a way to keep forest ecosystems intact and nuance its development to formulated goals (Bauhaus et al. 2013), and multiple-use forestry where e.g. recreation, production, and biodiversity conservation are sought to be balanced (Hoogstra-Klein et al. 2017). In the case of multiple-use forestry to be said having an abstract and vague meaning, it nonetheless is a "powerful and enduring […] concept […] providing a common ideological denominator and social glue […]" (Hoogstra-Klein et al. 2017).

Further, the concept of FM as such is in an ongoing crisis of legitimating, especially its sustainability aspect thought to provide services in a continuous manner. Its dilemma(s) lies in the ongoing re-evaluation of what forestry could and should be (von Detten 2011). The problem is that long-term and target-oriented steering of forests is criticised because of the increment of unpredictability of future natural changes, hazards, and decision-making behaviour in the Anthropocene. There exists an argument that with more demands, but especially with increasing future uncertainties, risks, and indeterminacy the current paradigm of forest management of anticipation and steering is and should be oriented towards a management paradigm of incrementalism and adaptation (von Detten 2011). By this is meant a move away from rigid long-term forest management plans towards more flexible and adaptive approaches. Flexible and adaptive refers here to incremental changes, reflexive learning along the way, and feedback mechanisms incorporated (von Detten 2011).

Synthesising the above perspectives in this section, it becomes evident that aligning these varied factors that define forest management with coherent, evidence-based policy remains challenging (Chazdon et al. 2016). Comprehensively, FM "refers to the practical application of scientific, economic, and social principles to the administration and working of a forest for specific objectives" (Bell et al. 2006).

2.3 Science and Technology Studies (STS)

This is a brief introduction to the field of Science and Technology Studies (STS) and why it is contributing here as a lens to understand the scientific sphere in my analysis. The field of STS stresses that science, technology, and social structures stand in an inseparable relationship. STS understands that language (to produce

meaning), science and technology (understanding, categorising, and specialising), and discourse (the eco-social experience through language) are indivisible related. STS suggests that science is not a neutral arbiter of facts; it is that scientific knowledge is not discovered but constructed within a particular social context reflecting values of its creator (Ottinger 2017). Furthermore, STS is not solely thought as an inward-directed lens to dissect science itself, its practice is also thought to identify alternative ways of practicing science (Ottinger 2017).

2.3.1 Actor-Network Theory (ANT)

In the field of STS, Bruno Latour (2005) had a significant impact with his Actor-Network Theory (ANT). ANT offers an approach to understanding how actors are not independent in science, but rather defined by the network these actors are situated in. Here the importance lies in that an actor can be human as well as non-human. An actor is understood as everything that modifies a state of affairs, and thus other actors (Latour 2005). This can be a researcher, journal, a publication, or keywords of a scientific article. Networks are the sphere in which actors are moving in, in which the interactions and associations with other actors happens (Latour 2005). The focus lies on how the path of an actor is circulating or moving and thereby modifying the path of other actors. The point here is that not only one actor is moving, producing meaning, alternating and influencing other actors. It is that all actors are moving simultaneously, carrying on discourse within a network.

In science, a paradigm is a time period or a phase that favours certain theories, used methods, and scientific facts that are widely accepted. This also defines what is considered to be legitimate scientific output within scientific disciplines. On the other hand, this functions also vice versa, a paradigm shapes the way scientists understand problems, interpret data, and conduct their research. Latour (1999) understands scientific facts as constructs that circulate. This circulation produces, stabilises, and maintains through the network of actors.

There are five circulating and interrelated loops that influence each other continuously and that should be taken into account when rendering science (Latour 1999). The first loop is (1) the mobilisation of the world and can be understood as perspective a scientist has of the world. Scientist practice cartographical observations and thus mediate the phenomenon, materials, and elements of the world into what is often referred to as data. This data is then how these phenomena are made logical accessible, making it possible for that fact to circulate and be compared. But as Latour underlines, this translation has a side effect; “instead of moving around the object, scientists make the objects move around them” (Latour 1999:101).

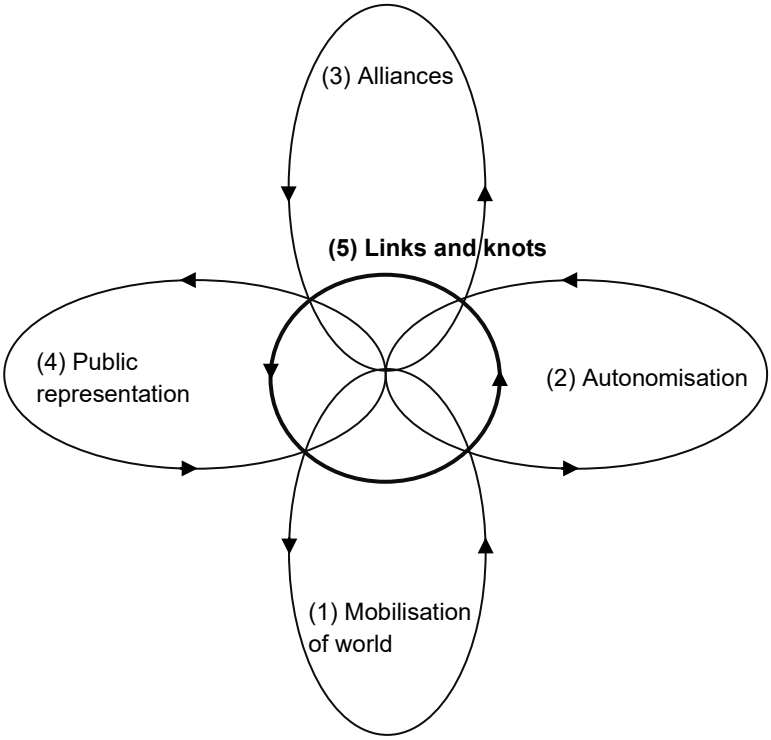

Figure 3. Five loops that form and determine scientific facts according to Latour (1999). (Illustration inspired by Bruno Latour 1999, ch.3 Science's blood flow, page 100).

The second loop is (2) autonomisation which can be understood as the scientific community that has developed around a certain field, a scientific discipline. In this field scientific facts are peer-reviewed and so verified or criticised. This means that a scientist needs this discipline, or her colleagues within it, for her scientific outcomes to be meaningful. Also, Latour understands the diversity of scientific disciplines and their conflicts as a motor for science, bringing forward new disciplines with new questions and methods. The third loop (3) refers to alliances, briefly meaning the connection to external actors in society, policy, profession sectors, and especially funding institutions. This is because these lay the ground for science to continue to sustain. It also includes the labour of making people in these spheres interested; both to create funding possibilities but also new colleagues enduring the discipline. The fourth loop is (4) public representation, referring to the reciprocal relation to society. Science has to be engaged with society. This is to produce meaningful outcomes and handle question that regard the interest of the collective. It is about the skill to carry or communicate the produced scientific facts into a wider social sphere. This includes the ability as well to understand how the wider discourse happens and how the own scientific practice is influenced by that. The fifth loop (5) are the links and knots, or as Latour metaphorical suggests, the "pumping heart" that hold the four other loops alive. It is about holding a collective of thoughts and scientific facts together. If we e.g. think of a certain scientific outcome of concept, we tend to define it as well through the discourses happening

in the other loops. Latour (1999) places the idea of concept in this loop's core, and it is the other loops that give meaning to it through their context.

According to Latour, changes in scientific facts and within practices, whether it is a new method of investigating something or a paradigm shift, follow these five loops. Where the (1) mobilisation could be the introduction of a new concept, followed by the (2) autonomisation where the concept is more nuanced defined and can be so recognised in science. For this concept then to be recognised outside of science within a sector or policy body, (3) alliance building is a necessary circulation. Then this leads to (4) the translation of the concept into the public discourse where it is further legitimised. Finally, this concept is nuanced and integrated into the wider existing scientific and discursive knowledge through (5) links and knots that are continuously practiced and thus re-considered and maintained. Therefore, ANT and the five loops holding scientific facts circulating can be understood as a tool to investigate a scientific concept. To implement an STS (and ANT) approach with its mean to dissect the meta-data of the different scientific publications.

2.4 Critical Discourse Analysis (CDA)

Critical discourse analysis (CDA) is the approach to inspect language usage by dissecting how discourse reflects power relations, ideologies, and social structures. In this investigation I lean on Fairclough's three dimensional model of CDA (Fairclough 2009). I follow the description of the model and analysis approach formulated by Bergström & Boréus (2012). This model provides a framework to analyse language, power, and society. According to Fairclough discourse is social practice through the use of language. To analyse discourse is to investigate how texts are produced, distributed, and function in a sociocultural practice (Fairclough 1995 in Bergström & Boréus 2012). Science is a sociocultural practice; therefore, I see this model as a way to analyse scientific literature as appropriate. In the model with its three dimensions the central part is (1) text as a linguistic deriving point as meaning producing entity including a text's grammatical structure. Text is here understood as a meaning making sequence of words, phrases, and sentences in various formats (speech, written etc.). (2) The discursive practice relates to how this text is produced, distributed, and consumed. The interplay of text with its surrounding, it is situated into a broader context, namely (3) sociocultural structures and practices in which motivations to produce or utter text often are motivated by ideology. These three dimension should not be understood as isolated but rather as interconnected (Fig.1). How would meaning of a text be discursive if there is no receiver.

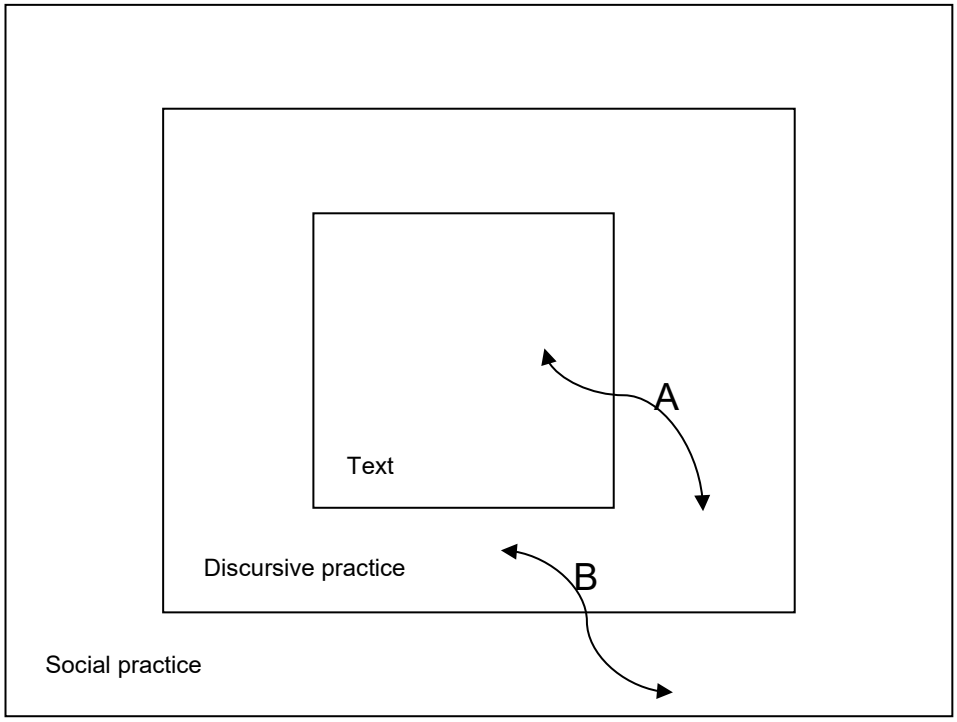

Figure 4. Conceptual representation inspired by Fairclough's (1992 s.73) three-dimensional analysis model. I included the arrows; A represents the process how text constructs meaning through discursive practice and its reception, and vice versa. B represents how discursive practices shape and are shaped by social practices including social structures, power relations, and ideologies.

Considering a (1) text for analysis should include analyses for transitivity meaning: who is acting as agent, what acting is done, and who is the receiver of the action and/or affected. Nominalisation, the act of transforming active or describing words as verbs and adjectives to nouns. This can make that a receiver of a text is distracted and lead away from the process in some sort of passive-making. And modality, meaning how a sender of a text is related to the content of the text. The (2) discursive practice in this case is the science sphere which does here not need any more clarification here. The (3) social practice on the other hand is to be considered, since text and discursive practice are in need to be related to its wider surrounding, namely social discourses and practices. This in order to be able to formulate a wholistic picture of the conducted analysis (Bergström & Boréus 2012). Overall, this CDA approach stresses that text, in this case scientific knowledge production, is shaped by underlying social and ideological functions manifested in language. This language then is part of the construction of a reality of social spheres.

3. Method

In this thesis I use quantitative and qualitative methods in a combined approach to draw a picture of what AFM is and its usage in science.

3.1 Data collection: Systematic Literature Review

To find answers to my research questions, I conducted a systematic literature review in the Web of Science (WoS, All databases) and Scopus databases, following the PRISMA workflow (Page et al. 2021). PRISMA stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses and is a protocol and flowchart that visually shows how records are included or excluded (Figure 5). It depicts how many records were identified through database search, screened after removing duplicates, assessed for eligibility based on full-text reading, and finally included to answer the research questions. With the usage of PRIMSA I wanted to make this investigation as transparent as possible and ensure reproducibility, and to help a reader to understand how the records used, were selected. The investigated search string was "alternative forest* management" and limited to topic in WoS and title, abstract, and keywords in Scopus. From this record-pool, duplicates were removed. All peer-reviewed, available in English and full-text, free accessible, and indexed records (article, dissertation thesis, book-chapters, review article etc.) throughout time to the time of writing (April 2025) were screened. 19 records were excluded because they were not available in English or were not peer-reviewed. In the screening phase I removed records that did not refer to the concept of Alternative Forest Management (AFM) but rather used the word sequence alternative forest management in another semantic context. This was when the phrase alternative forest management was followed by terms that clearly indicated a descriptive usage as e.g. scenarios, simulations, models, etcetera. If the phrase alternative forest management was followed by a term like practice(s), method(s), strategies, or solely alone standing, I declared the records eligible to be screened fully. One could say this was a first sorting for inclusion or exclusion of the records.

This first screening resulted in 39 records that seemed eligible for further investigation, screening the full article. The selected records were imported to the qualitative data analysis software NVivo, read, and coded. In the full-text screening, the most important criteria for a record to be included to this study was that the context of the whole text suggested that the author or authors refer to AFM as a conceptual idea, following test questions (Table 1), a levelling of certainty (Table 2) for each scientific publication, as the other described criterion (section 3.2). While full text screening the scientific articles, 17 records were excluded because in these I considered AFM not to refer conceptually to AFM. Further, one scientific

article was excluded due to it being an intern and complex project understanding of alternative forest management models in the ALTERFOR (Alternative models and robust decision-making for future forest management) project which would not contribute to this investigation (European Commission n.d.), rather complicated it unnecessarily.

The process of inclusion or exclusion criteria of scientific literature through the PRISMA workflow can be found in Figure 5 below.

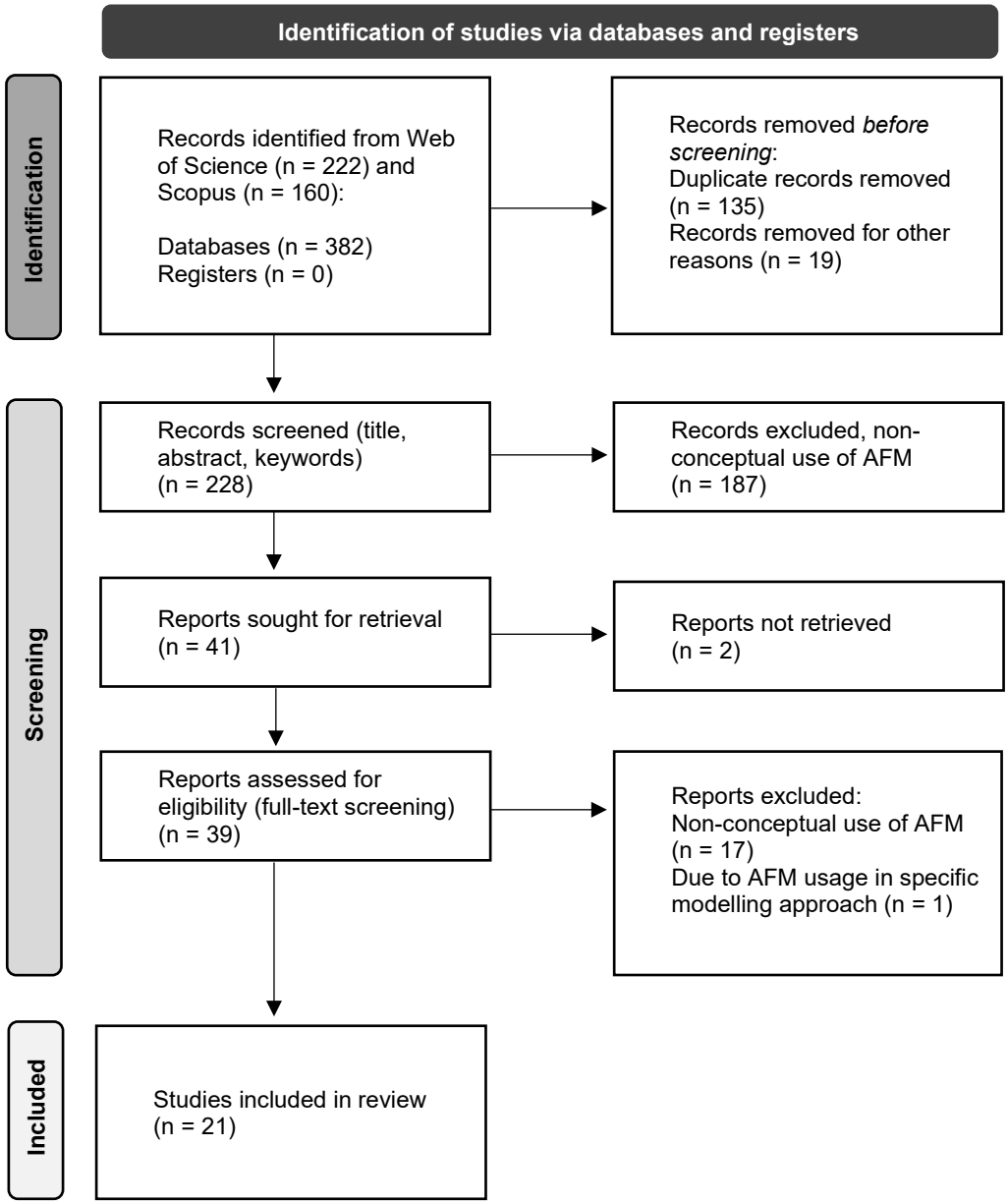

Figure 5. PRISMA workflow diagram showing phases of review process. Identification of peer-reviewed, free-accessible, and provided full-text in English records, otherwise removed. First screening performed on title, abstract, and keywords; if not relating to AFM

as a concept, records were excluded. Second screening included full text reading. (Source: Page MJ, et al. BMJ 2021;372:n71. doi:10.1136/bmj.n71.)

3.2 Analysis

Throughout this investigation I reflected on the data while I was handling it in an abductive approach. This is because to seek answers in a pre-defined way to a delimited problem can bear the risk of excluding unexpected information or knowledge which might have been of interest for the overall understanding (Nordstrom 2018). An abductive approach understands that there is a constant exposure and interaction between a formulated problem, collected material, previous research, a constructed theoretical framework, in which none of these blocks is seen as superior to the other ones (Nordstrom 2018 in Gunnarsson & Bodén 2021). I understand these parts as interplaying with each other in order to come forward with a result that is easy to follow that has not been unnecessarily restrained through a pre-defined methodology. After the first screening of titles, abstract, and keywords of the broad mass of records in the first exclusion phase, I got a vague idea what the data I am handling consisted of. I formulated and adjusted some RQ, the method, and the theoretical framework after the screening phase to my best knowledge in order to analyse and make sense of the data. An incentive for intertwining multiple theory frameworks, is that forestry science is a multi-disciplinary subject itself. To have several lenses dissecting a phenomenon in a structured way I understand as a contributing factor here. To have an approach where these lenses are applied each in a framed way, I hope makes this investigation accessible to a wide range of readers. Some of the theories are overlapping, as I try to communicate in Figure 1. This is that language as a meaning vehicle is analysed, thus from different perspectives. SFL is used as a filter to include only scientific records that refer to AFM in a conceptual way. STS and ANT are a lens of meta-analysis asking who the ones are that produce text and how are these actors connected. With a CDA I analyse formulations that indicate motivations and references to scientific discourses, of these actors which are situated in a discursive (their scientific field) and a social practice (the country an institution is situated and/or an author is situated). In the discussion I try to intertwine the compiled results.

3.2.1 Systematic Literature Review

To answer parts of the first research question, the screening process is part of the result. This is that I screened title, abstract, and keywords of 228 records and decided if a record is included for further investigation or excluded. From this process I could identify that there are different ways of how the phrase alternative forest management is semantically used in the literature. This process is part of the

result section even though some of the records were excluded along the selection steps following the PRISMA workflow.

3.2.2 Systemic Functional Linguistics

With systemic functional linguistics (SFL), I aim to differentiate the phrase alternative forest management when used as a concept. This is when processes are converted into abstract concepts, often nominalised. To implement this as a selection criterion, I used the test questions developed (see Table 1) in the full-text screening process, in which I assessed records for eligibility. Besides the questions in Table 1 to differentiate between usages, I dissected if the word phrase alternative forest management is used to oppose to e.g. current/traditional/conventional etc. forest management approaches. If this was the case it was as well a strong indicator that AFM is used in a dichotomic way to express an opposition to something that is argued to be altered, conceptually. A further indicator for a record to be included was that, if alternative forest management was part of the records keywords suggesting AFM to be understood as concept by an author. The full-text papers screened referred to and used AFM in a variety of ways, making it difficult to understand and draw clear lines between what is clearly conceptually AFM and what is not. Therefore, I systematically applied the above specified criterion and the overall impression I got from the publication into categories. This categorisation can be seen below in Table 2 in which the level of certainty of a record referencing AFM as a concept is provided. In the first full text screening I only focused on if AFM is referred to as a concept or not. This was to analyse systematically and avoid being distracted by other coding.

Table 2. Description and characterisation of level of certainty if AFM is referred to as concept.

Level	Certainty of Conceptual Reference	Description
1	Certain – clear, direct reference to AFM as concept	AFM as concept is explicitly named, defined, or clearly central to the text AND phrase AFM is nominalised in text AND/OR mentioning alternatives to current management in dichotomic way
2	Plausible – likely reference to AFM as concept, though indirect	Strong alignment with conceptual idea AND mentioning alternatives to current management in dichotomic way AND/OR named with an extra head-term (e.g. alternative forest management approaches).
3	Possible – uncertain reference to AFM as concept, but not ruled out	Alignment with conceptual idea AND mentioning alternatives to current management in dichotomic way but not clearly AND/OR named only with an extra

head-term (e.g. alternative forest management strategies).

3.2.3 Critical Discourse Analysis

To adapt the critical discourse analysis (CDA) into a design that fits the purpose in this investigation and to have a deriving point for the qualitative data analysis, I created an initial coding handbook that served as leading guide when systematically reading the publications. While coding I considered for RQ3, forest management approaches and their definitions, and for RQ4 motivations and discourses that can be linked to AFM. As an orientation for my coding, the way I systematically approached each paper, I leaned on a qualitative content analysis to find and describe variations in the data (Lindgren et al. 2020). The overall way to code was that the names of the categories and sub-categories of codes should answer the aim (Lindgren et al. 2020). Along the way of the analysis, I added and/or alternated codes. This open and reflexive coding procedure allowed to have a structure to begin with, but still having an openness to adapt to the data throughout the coding process. While reading and coding the different publications, identifying motivations and scientific discourses, I looked for several indicators and signals. These included (1) normative language using terms as should, need to, must, ensure etc. that indicates a need for something to happen, in relation to (2) keywords that continuously are discussed and used in scientific discourses indicating value statements as sustainability, biodiversity conservation or preservation, social justice, etc., (3) critiques of current or prior practices, references to broader ideologies or ideological anchors as anthropocentric, relational, or biocentric thinking, resilience thinking, future generation thinking etc., (4) and if and how a publication discusses nature-society relations as in how ecology is seen, as e.g. a resource, co-producer, or as part of the self. The code-hand book can be found in the Appendix in Table 6.

3.2.4 Meta-analysis

For the 21 records included in this investigation, I examined and extended the bibliometric metadata by coding for continent, institutional country, number of authors per record, and an authors' institutional affiliation and main field of research. In the meta-analysis of scientific publications only the main authors' scientific knowledge and discipline is considered. The exclusion of subordinated authors is due to two criteria. Firstly, some included records are multi-author papers with up to 17 authors, complicating and diffusing a simple representation. Secondly, there would be the need of a more complex approach in which authors' relative intellectual contribution (Rahman et al. 2017) is considered in a nuanced way which lays outside the scope of this thesis. However, this investigation is not

about which author has contributed in what way, it is to get an idea what scientific fields are thinking within the context and formulation of AFM. I understand the approach, to represent a scientific field through the first author, in the way that a first author is (often) the one taking initiative in developing a frame for an investigation and later in the process coordinates the work and is a large factor in data analysis and decision making. This is in line with what large studies on author contribution have shown (Corrêa Jr. et al. 2017). When investigating the first author's main field of research and thus their main expertise, I considered the institution and department of the respective university, and the description of the person on the university page. In some cases, e.g. a PhD student or post-doc at a larger institute, the author's disciplines are defined by the discipline of the most recent graduation.

The software VOSviewer was used to illustrate how actors, in this case keywords and authors, are networked within the included 21 publications. For this I exported a plain text file from Web of science (WoS) with the data attached, imported it to VOSviewer in order to create network-illustrations for re-occurring keywords and authors. Figure 7 to 9 were made with the software RStudio and code assistance provided by ChatGPT.

4. Results

In this section the results are presented following the structure of the four research questions.

4.1 Usage of AFM in scientific literature

The phrase alternative forest management is used in scientific literature in different meaning producing ways. How the distribution of its usage can be viewed in Table 3.

Table 3. Usage of AFM in scientific publications in numbers.

Usage/understanding	Total no. of publications (=228)	Degree of certainty		
		Certain	Plausible	Possible
AFM referred to as concept	*21*	*11*	*9*	*1*
Term alternative forest management used in descriptive or other non-conceptual way	*207*	*207*		

Of the total 228 screened records found with the search string "alternative forest* management" 21 refer to it as a concept, approximately 10% of the total usage of the term. In these cases, the term *alternative forest management* referred to as conceptual reference, i.e. it conveys an abstract idea independent of a particular situation. This is often in a nominalised setting in which the phrase functions as a subject or object in a sentence. In this case, its idiomaticity can refer to more than what its three term units (alternative, forest, and management) in relation produce for meaning, a concept with multiple layers of meaning. However, this depends on a recipient's depth of knowledge of e.g. forest management. The 207 excluded publications do not refer to AFM as a concept but mention or used the phrase alternative forest management in a descriptive or another way. In these cases, the phrase can often be found in scientific literature in combination with another noun at the end of the phrase that is described through the previous modifiers, including the term alternative. The phrase is referred to in a contextual sentence structure, where its meaning is derived from the surrounding information and situational syntax.

4.2 Forest management approaches included in AFM

In the 21 included scientific publications, nine of the in total 24 mentioned forest management approaches mention Continuous cover forestry (CCF) as an AFM which is approx. 37% of the mentioned approaches. The second most occurring approach is uneven-aged management with three mentions. The characteristics of

uneven-aged management strongly correlated with CCF characteristics as can be seen in Tabel 4. If both these would be understood as either CCF or uneven-aged management and categorised into one group these would be 50% of all mentioned forest management approaches. Both these AFM have in common that a canopy is continuously present. There are two papers mentioning uniform shelterwood, one of these that understands it as a CCF approach (Tabel 4). Shortened rotation management, which is an adaption to rotation forestry just with shortened time periods of growth, is as well mentioned as AFM with 2 mentions. The remaining approaches are mentioned once including a variety of approaches. Five approaches refer to social forest management with different names and definitions. These practices and management approaches consider throughout people and communities living close to forests. All these managements regarding social concerns within a forested landscape have in common to attempt or argue for a decentralisation of decision making or acknowledgment of needs of these near-by communities, or both. Another common thread is that there should be a shared decision making, this is in joint- and co-management. Other approaches referring to AFM and mentioned once are Close-to-nature forestry (CTNF) and adaptive forest management. One publication refers to AFM as such to oppose to current practice in Sweden, mainly concerning regeneration with other tree species than Norway spruce (Table 4).

How these different AFMs are mentioned throughout time can be seen in Figure 6. Forest management addressing social practices are spanning over the whole 30-year period records were found referring to AFM as a concept. The first time AFM is mentioned conceptually is in 1995 as practice that should also consider social values, community forestry. The first mention to have an AFM approach referring to an intervention considering ecological values in the forest is gap cutting in 2005. CCF is mentioned nine times, beginning in 2007 until the point writing this thesis (Figure 6).

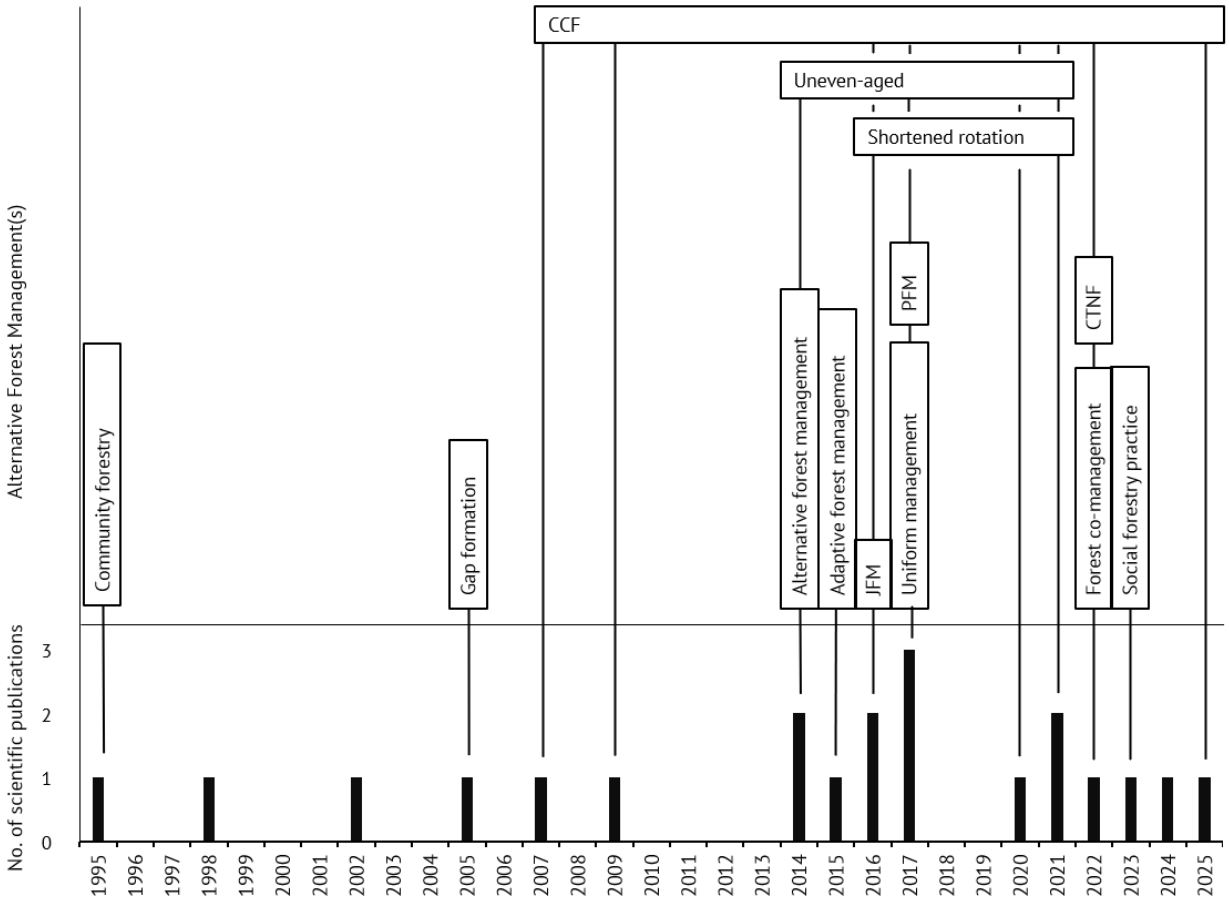

Figure 6. Publications per year of the included scientific publications referring to different AFMs. Lines extending from the boxes represent the frequency of mentions.

Table 4, starting on the next page, is the summary of extracted forest management practices and their characteristics understood as AFM in scientific literature. Each AFM comes with detailed description how different authors characterise each approach.

Table 4. Approaches and practices identified as AFM, along with their definitions and descriptions as presented in the included scientific publications.

Alternative forest management, (acronym if used in paper), [Number of papers referring to concept]	Characteristics		Source(s) considering various AFM, (Year)
	Description(s) and/or definition (s)	Associated practice(s), intervention(s), and treatment(s). [Number of referring papers]	
Continuous cover forestry (CCF) [8]	▪ Management involving continuous and uninterrupted maintenance of forest cover without clearcutting + stand structure can be uneven-aged, or the trees can be grown in two or more stories [1] ▪ Generating complex stand structure with numerous canopy layers, mimicking natural old-growth forests with wider range of tree diameters and age classes [5] ▪ Retention of some canopy cover and the occurrence of natural regeneration [6] ▪ Uneven-aged stands that are harvested by selective cutting [7] ▪ Usage of silvicultural systems whereby the forest canopy is maintained at one	▪ Group selection systems [2] → Periodic felling of small groups of old crop trees gives rise to clearings within which natural regeneration occurs ▪ Single tree selection [1] ▪ Selection cutting [1] → System referring to felling of scattered single trees and/or small groups of trees selected over a whole area. Size and age of remaining trees should be maintained in a proper proportion where all age classes should be represented. Suitable mixture of species should be maintained if needed. Young saplings should be freed from suppression. [9] ▪ Uniform shelterwood [1] → Method whereby young regenerating crop of trees is established under the canopy of older crop of trees, whilst at same time older crop of trees provides shelter to the regenerating layer. This is achieved by initially uniformly thinning old crop of trees within a stand, which opens the upper canopy up allowing natural regeneration to occur, followed by subsequent thinning and gradual removal of the old crop trees. [6] ▪ Shelterwood [1] ▪ Varying harvesting intensity along a gradient from single tree selection to patches or groups of trees of different sizes with gaps as large as 0.5 ha [5]	[1]Laitila et al. (2025) [2]Gresh & Courter (2022) [3]Huuskonen et al. (2021) [4]Juutinen et al. (2021) [5]Versluijs et al. (2020) [6]Williams et al. (2017) [7]Klapwijk et al. (2016) [8]Bertin (2009) [9]Axelsson et al. (2007)

	or more levels without clear-felling [8]		
Uneven-aged silviculture/forestry/ management [3]	Maintaining continuity of forest canopy, mimicking small-scale disturbances.	Overall strong affiliation with CCF descriptions ▪ Selection cutting [1] ▪ Provide stratified forest structure similar to that of old-growth forests	[1]Juutinen et al. (2021) [2]Joelsson et al. (2017) [3]Moen et al. (2014)
Shortened rotation [2]	Traditional rotation forestry with shortened rotation period	▪ Aiming for forest with low tree diversity, even-aged age structure, high tree density, high harvesting residuals, and low understory.	Juutinen et al. (2021) Klapwijk et al. (2016)
Forest co-management [1]	Umbrella term referring to variety of agreements for sharing of power and responsibility between the government and local resource users in close proximity to the resource	▪ Advocating for institutional and long-term process in which fundamental involvement of first nations through co-management together with forest industries and provincial governments is thriving ▪ Synthesizing legal state bureaucratic scientific management (industrial model) with local consensus-based management characterized by customary tradition and enforced by social sanctioning	Treseder & Krogman (2002)
Uniform Shelterwood [1]	Rotational forest system with period of 100 to 120 years	▪ Application of 2 to 3 shelter cuts ▪ Regeneration period 30 – 40 years	Roessiger et al. (2017)
Close-to-nature forestry (CTNF) [1]	Close-to-nature forestry systems avoiding clear-cutting and chemical application. Generally, with continuously protected forest canopy. This is to improve biodiversity, soil quality and climate adaptation. Associated with Europe.	▪ Strict canopy protection	Gresh & Courter (2022)
Gap formation [1]	-	▪ Harvesting trees group-wise thus creating small gaps	Ritter (2005)
Adaptive forest management [1]	Consciousness to be responsive in landscape/regional scale in management	▪ Continuous improvement and re-planning ▪ Considering variations in local + regional conditions and expected impacts	Schelhaas et al. (2015)

		▪ Assessing consequences at larger scales and how they interact with other demands for forest services	
Community forestry [1]	Goal is to reclaim degraded and misused land. Umbrella term including social forestry, homestead forestry, forest farming, agroforestry etc. → Different names reflect institutional infrastructure	▪ Intensive agro-horti-silviculture (in developing countries) ▪ Ecosystem approach of natural management with equal emphasis on community benefits and ecosystem stability ▪ Going beyond short-term considerations → Sustainability of forest is priority ▪ Character of management depends upon what a community needs and what a forest can offer ▪ Relation with industry is subsidiary	Mallik et al. (1995)
Social forestry practice [1]	Focusing on exploration and incorporation of communities-based ecotourism (CBET) as new strategy in sustainably managing forest reserved	▪ Balancing of forest conservation, and economic and social development of communities → social sustainability ▪ Application in forest reserves	Abdullah et al. (2023)
Participatory forest management (PFM) [1]	Approach linking objectives of conservation with local development needs.	▪ Acknowledging ethical issues of burdening and imposing variation of costs on local communities, and the practical challenge of their resistance to conservation groups practicing fortress conservation. ▪ Inclusion of communities in vicinity of protected area with property rights through participation in the conservation process ▪ Combining both biocentrism anthropocentric arguments in conservation practice ▪ Communities manage their environment based on ecological principles and benefit economically through being stewards of forests close to them	Tesfaye (2017)
Joint forest management (JFM) [1]	Management of forests through sharing of roles, responsibilities and benefits between government and local communities.	▪ Community forestry management → individually manages the forest plantation either through elected management committee or traditional leadership	Munyanduki et al. (2016)

		▪ Community user group management → forest owned and managed by specific group of people from the community ▪ Company-community partnerships → formal or informal relationships established between companies and local communities with sharing of benefits and costs	
Alternative forest management [1]	Alternative forest management as such, not further defined or exemplified	▪ As opposition to current practice in Sweden, mainly concerning regeneration with other tree species than spruce	Lidskog & Sjodin (2014)

4.3 Meta-analysis of included scientific literature

Following the PRISMA workflow (Page et al. 2021), in total 21 peer-reviewed scientific publications are included. The thirty-year publication period of these publications reaches from 1995 to 2025, with a higher publication rate in the last eleven years (Figure 6). Most of the publications have multiple authors. The number of authors per publication ranges from four single-author papers to 17 multi-author papers. The multi-author publications are produced by two to 17 authors with higher frequency between two and six authors (Table 4).

The distribution of countries where all authors' institutions of the 21 included scientific publications are situated, can be seen in Figure 7. Two publications from Africa, one from Asia, four from North America, and two publications in which authors' institutions collaborate within Europe, North America, and Oceania. As can be seen in Figure 7, most publications come from Sweden (7), Canada (5), and Finland (4) in the boreal zone.

Figure 7. World map highlighting mention frequency of countries associated with all authors' institution(s) of the 21 scientific publications.

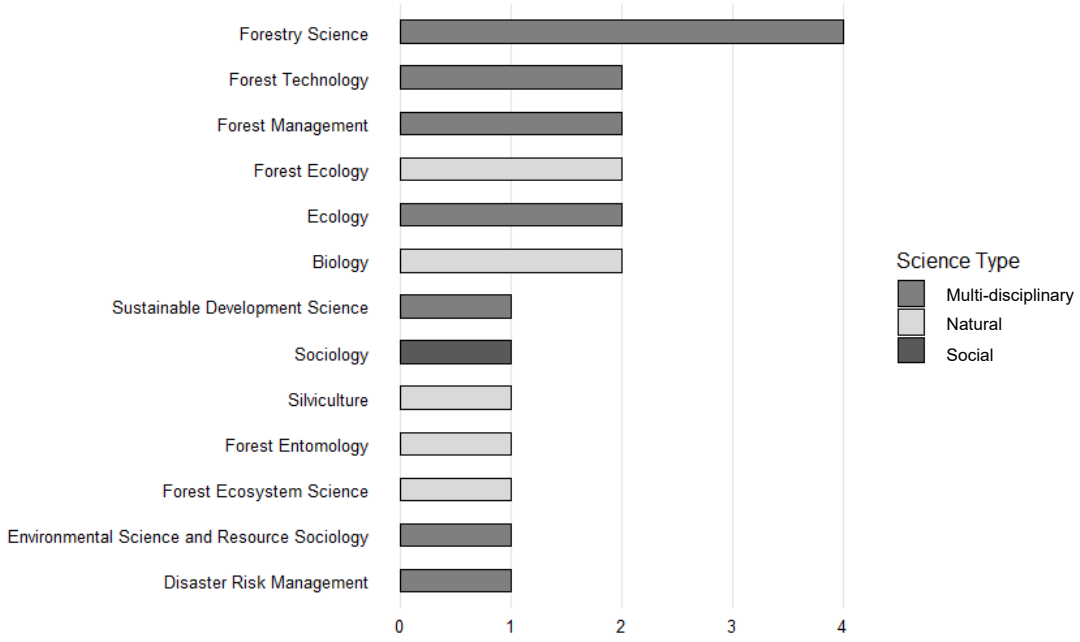

Figure 8. Frequency of the 1st author's scientific discipline of each included scientific publication.

AFM is predominantly referred to in natural and multi-disciplinary science spheres, in 10 of 21 cases (Figure 8). One solely social science article discusses AFM. Four publications are published in the journal Forest ecology and management and two in Scandinavian Journal of forest research, while the rest are published in other non-recurring journals. Half of the articles' mentioning AFM is in journals that are forestry related, eight of the in total 16 journals (Figure 9). Other journals that the included scientific publications are found in, can be seen in Figure 9.

To understand how the keywords of the 21 included scientific publications are re-occurring and building a network of repeating keywords (van Eck & Waltman 2010) can be seen in Figure 10. However, there are two publications that use AFM as a keyword. These are not in Figure 10 represented because the keywords are varying, *alternative forest management regimes* (Munyanduki et al. 2016) and *alternative forest management* (Treseder & Krogman 2002). Furthermore, there is only one author that occurs twice among the included publications, all other authors are occurring once along the 21 included scientific publications (Figure 11).

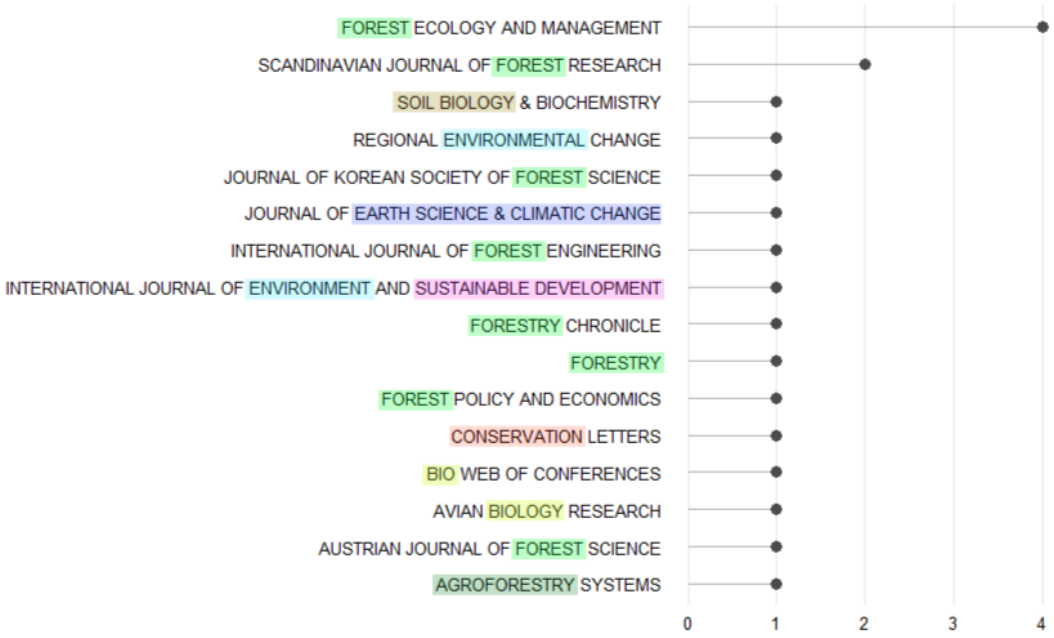

Figure 9. Journals in which the 21 scientific publications are published. Colour coding of terms suggesting main scientific discipline(s) discussed in each journal.

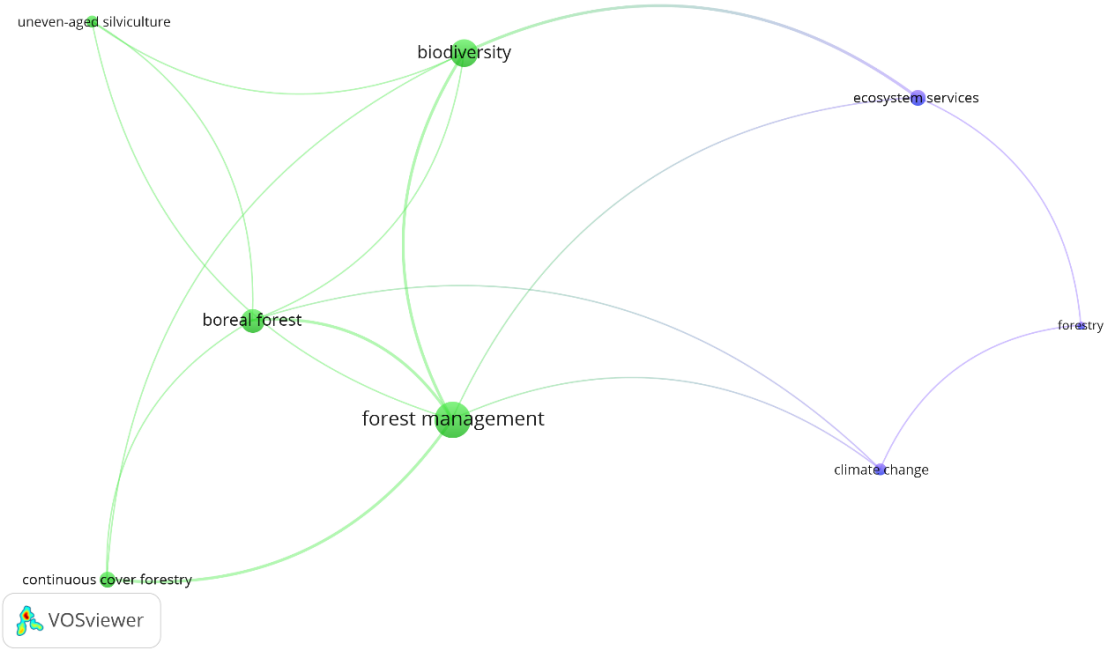

Figure 10. Illustrating re-occurring keywords, minimum two times mentioned, of the 21 included scientific publications. (Graph created with VOSviewer (van Eck & Waltman 2010)).

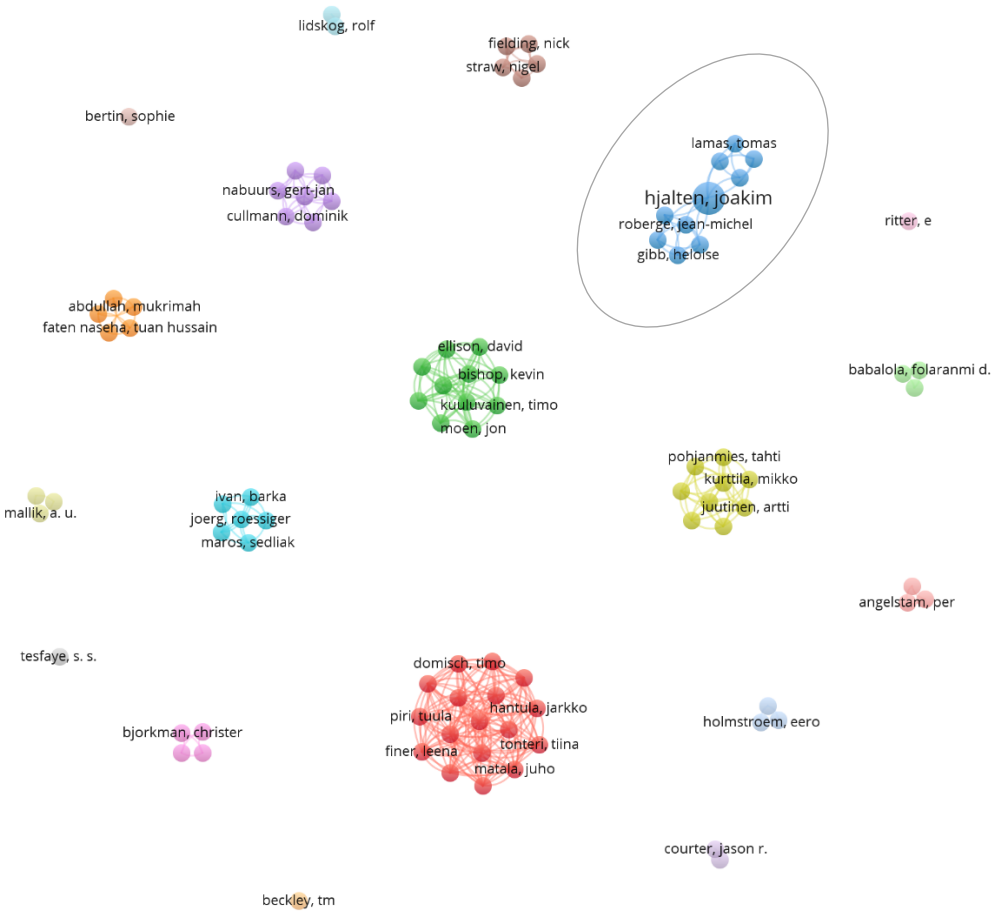

Figure 11. VOSviewer illustration showing that most of the included scientific publication's authors do not co-occur. There is only one author who appears twice, indicated in this figure by the larger bubble in the top right-hand corner. (Graph created with VOSviewer (van Eck & Waltman 2010)).

4.4 Motivations introducing AFM

All mentioned forest management approaches that are understood under AFM have one thing in common; author(s) stress that it is essential for forest management to address a plurality of values. There is a necessity to investigate, acknowledge, and integrate values, needs, and/or goals, mentioned by the authors in various strengths. Some of the publications discuss a balancing of these values, needs or goals, others solely notice that there is a plurality of values that needs to be considered. This balancing can be between socio-economical, socio-ecological, and/or eco-ecological considerations and benefits.

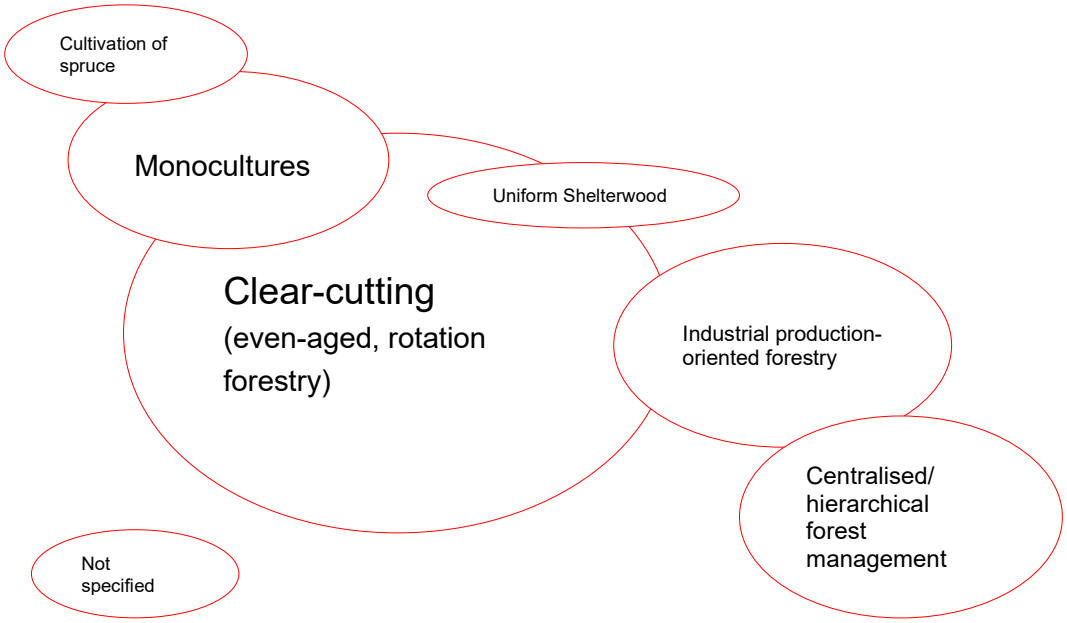

Figure 12. Bubble illustration showing criticised forest management practices, where bubble size represents the relative frequency of mentions. Overlapping of the bubbles indicates how the publications understand their interconnection.

18 of the 21 scientific publications suggest AFM to a prior management or approach to be not sufficient any longer or in need to be re-thought. The motivation in these is that the proposed AFMs contrast the prior management. The various criticised forest management(s) can be viewed in Figure 12. One article suggests AFM (in this case CCF) as a complementary management to even-aged management (Laitila et al. 2025). Two articles do not specify what AFM is thought to oppose (Schelhaas et al. 2015; Abdullah et al. 2023). Of the 18 that suggest that a prior management is not sufficient anymore, 12 publications criticise monoculture forest management with clearcutting, whereas two of these publications specify especially coniferous monocultures (Huuskonen et al. 2021), and one publication criticises rotational shelterwood systems with clear cutting at the end of a rotation (Gresh & Courter 2022). Further, one publication suggests AFM to oppose a wood production-oriented management of both industry and non-industrial private forestry (Beckley 1998). The AFM associated with social management focus suggest opposing a state centralised approach. These argue for a more governed process and decentralised management in which local people near to forests should co-manage their values and needs are minded and finally integrated into a management (e.g. Mallik et al. 1995; Treseder & Krogman 2002; Abdullah et al. 2023). One publication criticises hierarchical decision making argued to result in industrial wood production management (Mallik et al. 1995).

In Figure 13 the identified motivations of each publication to suggest or argue for an AFM are presented. Table 5 can be read that every row is a brief narrative on when what author(s) introduce an AFM to what prior management, and what

motivation lies behind it. The last column in Table 5 is a subjective characterisation (partly due to the stated motivations and the criteria described in the method) of how certain the publication understands and refers to AFM as a concept (see Table 2 for definition of the three classes).

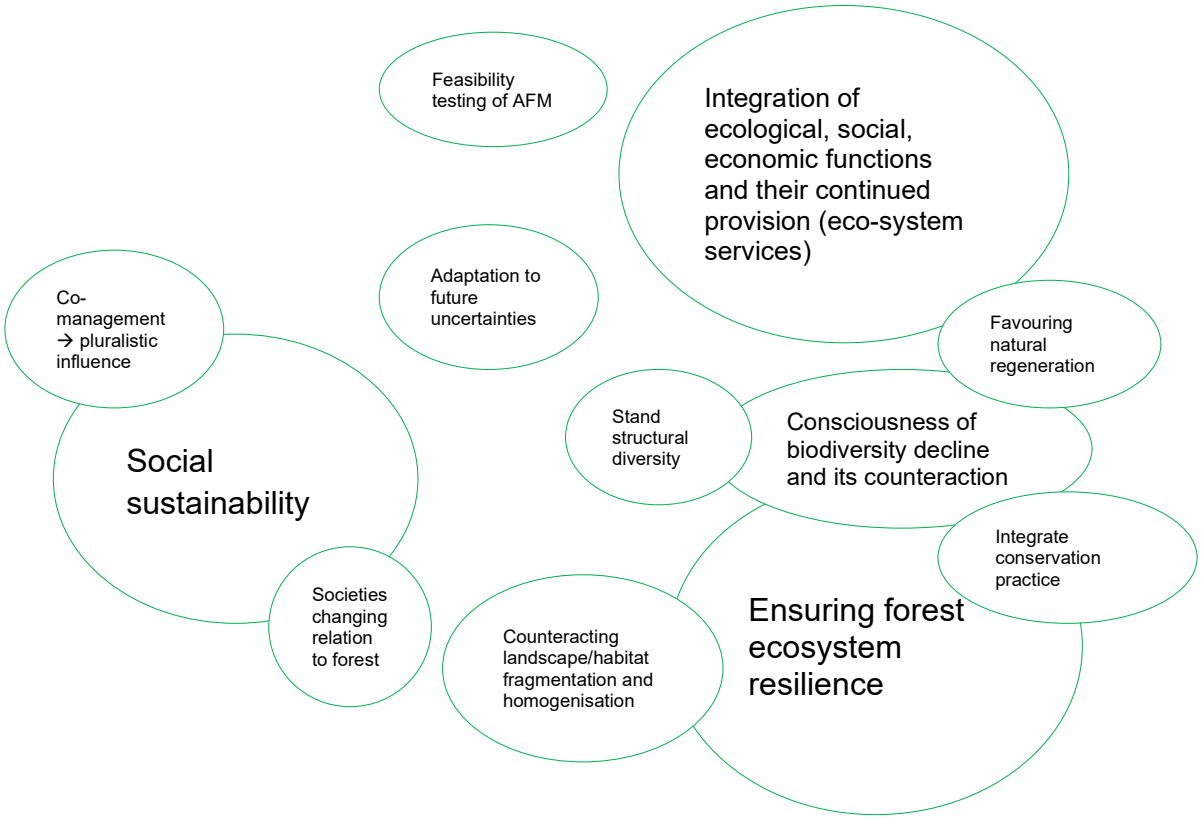

Figure 13. Bubble illustration showing motivations for the introduction of AFM, where bubble size represents the relative frequency of mentions. Overlapping of the bubbles indicates their relatedness. In this case the relatedness to each other is based on my interpretation.

Table 5. Identified motivations of each scientific publication to introduce and discuss AFM. Sorted by publication date, from most recent to oldest.

Source/ Scientific publication (Year)	Country/Region in focus OR case study site	Alternative Forest Management	Alternative to what?	Motivation(s) for introduction of AFM	Certainty AFM referred to as concept
Laitila et al. (2025)	Finland	CCF	Complementary to dominant even-aged forest management	Effects of alternative management method on harvesting productivity, costs, and quality should be known to comprehensively evaluate the feasibility. Compiling productivity models and harvesting quality parameters.	2
Abdullah et al. (2023)	Malaysia	Social forestry	Not specified	Preventing increased poverty, ensuring conservation and development and provision of forest goods to forest-dependent communities. Value: Forest goods and services benefiting local non-timber forest products (NTFP), are employment opportunities, recreation/ecotourism and forest ecosystem services. NTFPs may be used for subsistence or income. Some NTFPs have medicinal value contributing to community's health and well-being.	1
Gresh & Courter (2022)	USA	Close-to-nature forestry, Continuous-cover forestry	Alternative to current clear-cut forestry and shelterwood system with clear cut at end of rotation	Improving bird habitat and counteracting landscape and habitat fragmentation. Lower severity forestry studies needed to understand forest management impact on US avian ecosystems.	1

Juutinen et al. (2021)	Finland	CCF, Uneven-aged management, Shortened rotation period	Alternative to clearcutting forestry	Provisioning of plurality of ecosystem services. Beneficial from the perspective of the whole of society. "Biodiversity also has its own intrinsic value."	2
Huuskonen et al. (2021)	Fennoscandia	Mixed forests	Alternative to coniferous monocultures	Integration of ecological, economic and social functions of forests in practice in need of more effort.	2
Versluijs et al. (2020)	Sweden	CCF (Irregular forestry)	Alternative to clearcutting deriving from natural disturbance emulation hypothesis: large-scale stand-replacing disturbances resulting in even-aged stand structure imitating large stand replacing fires.	Global biodiversity declines as result of human-induced habitat loss, fragmentation and structural homogenization at multiple spatial scales. CCF maintains mature or late-successional forest characteristics and species assemblages better than even-aged silviculture.	1
Tesfaye (2017)	Ethiopia	Participatory Forest Management (PFM)	Alternative to state centralised forest management promoting exclusion of forest dependent societies.	Need to integrate views and aspirations of local people in conservation practices. Intellectual anchor referred to: Ostrom 1999 → *Revisiting the Commons: Local Lessons, Global Challenges*	1
Roessiger et al. (2017)	Slovakia	Special management (Shelterwood + selection cutting)	Alternative to conventional wood production-oriented forestry (reforestation, thinning, harvesting, wood transport)	Need of compensation payments for nature conservation and protection might resolve conflicts over optimal forest management regarding ecological and socioeconomic aspects.	1
Williams et al. (2017)	England	CCF	Alternatives to monocultures, clear-cut system	Ensuring forest ecosystem's resilience to potential negative effects of climate change particularly	1

		(Uniform shelterwood, group selection systems)		drought, flooding, and extreme events such as storms and windblow events. Drought events in particular are likely to stress forest trees making them more susceptible to attack by insect pests such as bark beetles	
Joelsson et al. (2017)	Sweden	Uneven-aged silviculture	Alternative to even-aged silviculture with clear-felling	Balancing maintenance of structures and processes important for biodiversity while meeting timber management goals. Evaluating how uneven-aged silviculture methods affect forest species assemblages.	1
Munyanduki et al. (2016)	South Africa	Joint forest management (JFM)	Alternative to state managed forest plantations	Ensuring long term social sustainability of state forest plantations in South Africa	1
Klapwijk et al. (2016)	Sweden	Shortened rotation (clearcutting), Mixed forest, CCF (selective cutting)	Alternatives to monocultures and Clearcutting	Increased uncertainty about future growing conditions and the potential threat of invasive species. Adopting new forest management regimes will have economic as well as ecological effects.	2
Schelhaas et al. (2015)	Europe	Adaptive forest management	Not specified	Ensure continued provision of forest resources in the face of climate change. Adapting to signals of a trend increment in increased disturbance damage due to climate change.	2
Moen et al. (2014)	Boreal region	Mixed forest, Uneven-aged forestry	Alternatives to intensive monoculture forestry	Increasing resilience by enhancing a response diversity toward disturbances in more diverse forest communities. Shift away from focus on stability and simplicity that is underlying the current management regime. Necessity of use of deliberative and collaborative management methods	3

Lidskog & Sjodin (2014)	Sweden	AFM as such (no approaches further defined or exemplified)	Alternative to cultivation of conifers (especially spruce) and clear cutting as the dominant approach	84% of forest owners are aware of risk of wind damage and that more than 95% of the replantation in the area consisted of spruce. Variation in ways of reasoning of management practices. Very strong general pattern that needs to be explained.	2
Bertin (2009)	Scotland	CCF	Alternative to clear-felling	Need of changes in silvicultural practices, yet there is little experience in the UK in transforming even-aged coniferous plantations to continuous cover management. Enhancing stand structural diversity and favouring natural regeneration.	2
Axelsson et al. (2007)	Sweden	CCF	Alternative to clear-felling, an economically efficient silvicultural simple to practise using mechanized methods encouraging removal of deciduous trees	Provisioning of multiple values; Production, ecological integrity, sociocultural demands	1
Ritter (2005)	Danmark	Gap formation	Alternative to forest management removing majority of mature trees in a large area which may change forest microclimate drastically	Microclimatic changes in small canopy gaps are less pronounced than in large areas of open space. Less severe impact on forest ecosystems than traditional management practices.	2
Treseder & Krogman (2002)	Canada	Forest co-management	Alternative to industrial model and singular value of timber production hierarchical decision making with highest decision-making authority located in metropolitan areas.	Enabling pluralistic influence over forest management allowing for immediate attention to several values (wildlife populations, biodiversity, water quality, community well-being). Limiting trend of globalisation of forest resources. Co-existence with indigenisation of natural resource management. Improving local participation in resource management decision making.	1

Beckley (1998)	Canada	Co-managed forestry (science emphasis), Community forestry (local knowledge)	Alternative to industrial forestry with main objective of wood mass production and non-industrial private forestry	Addresses society's changing relationship with forest where new and latent forest values are articulated.	2
Mallik et al. (1995)	Canada	Community forestry	Alternative to modern forestry practices with large-scale clear cuttings and plantations as ecological degraders	Concern about fast environmental degradation rate of forest ecosystems through non-sustainable industrial forestry. Need for ecologically sound alternatives. Industrial forestry cannot meet needs of common people in developing countries which must implement sustainable forestry policy for averting further social and ecological degradation.	1

5. Discussion

This thesis is an initial deconstruction of AFM, offering a preliminary exploration of its complexities. In the present discussion I offer a foundational examination of AFM, acknowledging that a comprehensive analysis lies beyond the scope of this degree project. A majority of scientific publications use the term alternative forest management in a non-conceptual way, descriptively used to help authors to differentiate between a number of scenarios or models. However, AFM is also used in a conceptual understanding in science. How functional this concept is, if it serves a delimited scientific and policy purpose, that is questionable according to my results. The following sections delve into some of the intricacies of AFM.

The scientific publications referring to AFM as a concept aim to oppose a prior management option and simultaneously suggest a management that seems superior in a certain context. The point with AFM is not only about suggesting a good forest management for a certain purpose, but with the intent to contrast it to another management which is criticised. In all publications included, it is this distinction of improvement to something prior underlining the possibility of choice. This situates almost all mentioned AFM in the result section at a similar deriving point; to argue for a management that considers a wider socio-ecological environment a managed forest is situated in. However, a reoccurring reasoning is to control forest through management due to a plurality of values, needs, or goals. The underlying incentives and motivations are varying in scale, from forest stand to regional scale, and its holisticness, from the consideration of conversation of a species taxon to the inclusion of a socio-ecological integrity. Considering the critiques of current management (Figure 12), it can be said that solely technical and industrial forest management are criticised. An industrial and technical approach is thus associated with monocultures, rotational forestry, clearcutting, and/or centralised and hierarchical decision making where decisions are taken far away of the forests in question. Under AFM are more conscious management approaches discussed in which a management action or intervention is situated in a layered socio-ecological environment. It seems that a greater consideration of what a management action alternates within the socio-ecological network, is taken. These can be of social, ecological, and/or economical character. Repeating themes that are considered interventions against biodiversity loss, to ensure resilience of forests, counteract landscape fragmentation and homogenisation, be adaptive to future climate challenges, and enhance a social sustainable situation for communities surrounding forests. To integrate these objectives, it is predominantly argued to maintain forest canopies in varying degrees and to decentralise decision making. This is discussed in various ways; in a sustainable way of thinking in which a future provision of

service(s) by a forest are aimed at, and in an adaptable manner where the focus is on creating a presence of adaptiveness to future uncertainties. AFM is predominantly understood existing within the idea of sustainable forestry, meaning to focus on the uninterrupted provision of services (e.g. Axelsson et al. 2007; Munyanduki et al. 2016), and occasionally associated with the idea of adaption to future uncertainties (Schelhaas et al. 2015). This brings friction into AFM being understood both as adaptive approach and within the sustainability aspect. The question is how well can an uninterrupted provision of ecosystem services be assured when there is an uncertain future in which the forest sector should think adaptable (von Detten 2011). This ambiguity of varied thinkings of what AFM contains and is, makes it a vague or even contradicting concept that is not coherent and thus not having relevance in a policy context.

Most publications introducing AFM are case studies on a specific problem in a delimited site. Consequential, the criticised managements are as follows condemned in their respective context. Predominantly a narrowed incentive is formulated under AFM. An example of argumentation under AFM is that of enhancing bird habitat in a forest landscape through the promotion of continuous cover forestry or close-to-nature forest management (Gresh & Courter 2022). These are distinct forest management systems, but in the context of adopting to a more conscious approach to bird habitats, the focus is on improving upon current practices. Here two alternative forest management strategies are proposed. In this case AFM is both understood as a concept and used in a descriptive way. This shows that there is also no clear line between AFM understood as a concept and/or in a descriptive way. Therefore, the distinction between AFM as concept and descriptive unit is to be understood as a gradient. For practice and policy, this means that AFM can be a confusing factor due to its different linguistic applications. Different actors understand and associate different things when referring to AFM due to their varying contexts. This is for both the conceptual/non-conceptual use of AFM, and the varying management systems associated as AFM. A further example of contradiction in AFM is the management system uniform shelterwood (at the end of a rotation some shelter-/seed trees are left and serve as shelter/seed source for regeneration). After some years, the shelter layer is cut. Once it is mentioned as AFM and understood as a sub-set of CCF (Williams et al. 2017). The other time it is criticised and categorised as a rotation forest management (Gresh & Courter 2022). This shows that there are also contradicting understandings what AFM entails when it comes to sub-understood treatments and approaches. This should also be seen also as an obstacle AFM being used as a practical and well-defined tool in policy and/or scientific contexts.

The scientific actors using AFM was meta-analysed. This was to shape an understanding of the scientific spheres in which AFM is used. It seems, following the origin of the first three published papers from 1995 to 2002, AFM was first mentioned and referred to as concept in Canada. Then appearing in Denmark (Ritter 2005), Sweden (Axelsson et al. 2007), and Scotland (Bertin 2009). In the global south AFM is firstly mentioned by Munyanduki et al. (2016). A further geographical pattern is that there is a greater mention frequency of AFM in the northern arboreal regions, especially in Sweden, Finland, and Canada. These nations have all an extensive industrial forest sector. In the global north the main concern is environmental and biodiversity degradation and interventions to counteract these. The degradation is argued to originate from anthropogenic activity which is also the reason for climate change and thus landscape change and biodiversity loss. This is derived from the motivations (Table 5) and the used keywords (Figure 10) in the different publications. In the global south the main concern is socially oriented sustainability. It is argued that local perspectives need to be integrated leading to better surviving/thriving situations for communities (of depending on forest resources or work opportunities. Social actors are, partly, understood as the gate to exist in relation with the environment. The argument is that local communities, the ones living in and with forest are integrated stewards producing benefits for themselves and the environment. This is argued to be better than a centralised management body delegating from distance. This also shows that there are varying incentives for using AFM in different regions in the world. In the global north, the focus is on the ecological degradation, attempting to tackle it through direct interventions such as a changed forest management, species preservation, conservation, stewardship, etcetera. In the global south AFM is social oriented to e.g. provide resources for livelihood (Tesfaye 2017; e.g. Abdullah et al. 2023). Further, it seems that AFM is predominantly discussed in forest science related discourses (Figure 8 + 9). Considering this, I argue that AFM has developed from within the multi-disciplinary field of forest science, but is also used from outside forest science, where environmental change, disaster risk management, and biology and conservation-oriented fields discuss and form the concept AFM.

AFM leaves room for interpretation. AFM could also derive from another source of need; many publications are written by several authors, often within a multi-disciplinary sphere. In these publications, AFM could also be used as a way of packaging uncertainties when referring to forest managements. AFM could serve as a problem solver in which authors may agree on that there is need for an alternative management and criticising another one but are not certain which forest management could do the job. This is a thought that occurred while analysing the motivations for using AFM in a conceptual way and the fact that the author's publications independently mention AFM (Figure 11). Here an examination of

cross-referencing among the publications using VOSviewer, could have been an insightful addition to the wholeness to this thesis. Instead of referring to a concrete forest management concept, referring to an umbrella concept such as AFM, could provide a sufficient argumentation for some scientists. This is, that in some cases the critique towards a forest management regime is the main point that is stated, supported by scientific evidence in e.g. a case study.

One thing to consider is that AFM has a dichotomic nature, as shown in this investigation. To suggest an alternative implies that there is a prior condition, in AFM this prior is actively criticised. For scientific articles, which are contributing to the social discourse through discursive practice, to support a strict implementation of a novel forest management alternative and the strict critique of a current/prior management contributes to a social discursive outcome that polarises. This is for example the case in Sweden, where there is a polarised discussion about what climate positive forest management is; is it a coercive management where production captures carbon or is it an ecological management that saves carbon in a longer perspective (*Debatten om skogen alltmer polariserad – forskare söker vägar framåt för klimatnyttigt skogsbruk - Sveriges Radio, Studio Ett* 2024). Only one of 21 publications, suggests AFM as a complementary forest management besides a conventional one (Laitila et al. 2025). This is a strong indicator that the scientists motivating the use of AFM, through the text production of their publications, only focus on a specific frame, e.g. their case-studies. Since science is partly foundation of policy making, a nuanced argumentation for AFM or other novel forest management approaches and a nuanced critique towards prior management could be more productive for a concept being useful in policy making, and for science to have a constructive output.

Considering the points above in this discussion, I argue that AFM nevertheless is a sign of a shift or as Latour (1999) describes it, the mobilisation of the world (the first circulating loop) where underlying scientific procedures but also the in it anchored knowledge(s) are deriving point for new understandings and concepts. By this I mean the overall increasing consideration of the world, its landscapes, and its forests as interconnected socio-ecological networks. AFM can be seen as an autonomisation in the scientific sphere where systematically a current/prior forest management, most often monocultures followed by a clear-cut, are criticised and argued to be replaced by AFM. Around this thematic, as this investigation shows, have started to build a scientific community, yet independently mentioning AFM. However, the two publications that have AFM as a keyword, could be understood as sign of the first links and knots of AFM (Treseder & Krogman 2002; Munyanduki et al. 2016). One of the publications from Finland (Juutinen et al. 2021), published in a Forest Policy and Economics, underlines that biodiversity has

its own intrinsic value. A publication from Ethiopia refers to the intellectual anchor Ostrom's re-visitation of the commons, discussing that "impacts of forest centralization is the loss of local control over forest resources and the reduced role of local institutions" (Tesfaye 2017:83). These two references in association with the aim to argue for AFM can be seen as an indicator for a wider range of objectives and values considered. I see this as indicator for attempting to integrate and display a consciousness that considers the complexity of a socio-ecological system. To recognise a plurality of actors and their rights and thriving, biodiversity and the maintenance of local control over forest, is what Latour (1999) refers to as a representation of society in science, the fourth loop. This is when science understands the necessity that scientific outcomes need to be anchorable within the real world, being a socio-ecological system. Biodiversity and its relational value are a concern of many in society, as is the right to be able to govern and utilise nearby forest. Ultimately, AFM in the scientific sphere should be seen as an indicator or even a meaning producing vehicle that points out the complexity of values and objectives existing around forested landscapes that need to be considered to satisfy contemporary needs.

Rethinking forest management paradigms

The question is what to do with this information on AFM, an umbrella concept that intends to oppose industrial, intensive, and monocultural forest management. Its conceptual ambiguity poses challenges. Much like other terms and concepts in forest management that are used as buzzwords (Park 2011), AFM functions more as a rhetorical device than a clearly defined management concept. For instance, intensive forest management is associated with rotation forestry and monocultures, even this term lacks consistent definition (Bell et al. 2006). This illustrates the broader problem of conceptual vagueness of forest management in itself and that there is no simple way to label forest management approaches. AFM is used as buzzword that opposes, the question is to whom the critique is addressed inherent to AFM. The embedded critique in AFM often is directed inward emerging from within forest science, particularly in countries with extensive forestry sectors in the global north. The question that occurs here is, is the forestry sector contributing to the narration of AFM in order to be an actor shaping future forest management paradigms, just as in the case of *integrative multifunctional forest management* in Germany (Borrass et al. 2017). However, the growing use of the term AFM suggests that forest management itself is under negotiation, where forests are increasingly viewed not just as resource to exploit but as complex socio-ecological systems requiring context dependent and pluralistic approaches. The challenge lies in harnessing the energy of those advocating for AFM to develop more holistically formulated frameworks or guidance for future forest management paradigms. This investigation nonetheless makes visible that there is the intend in science to make

forest management better under the unifying metaphor of AFM. Therefore, in an era of growing uncertainties, how reasonable and suitable is it to adhere to the idea of sustainable forest management that relies on fixed plans and predefined rigid targets designing forests that resist pressures we think can be predicted, rather than to be actively adaptive in the process of managing forests (Reinhold et al. 2025). It is about unleashing from the obligation trying to eliminate uncertainties of social and ecological future conditions, but to exist within and acknowledge uncertainty by focusing on "continuous learning" and "permanent adaption" in managing forests (2025:5). For this to function there is the need for "institutional conditions within which an advanced view of forests and novel concepts for decision-making and action actually enable a different approach towards forest ecosystems" (2025:7). Then there would not be the need for rigorous definitions of forest management concepts and approaches, but rather need for guidelines in how to approach forest management through monitoring and evaluating forest ecosystem dynamics, a continuous process (Reinhold et al. 2025).

5.1 Reflection on methods and limitations

The approach developed throughout this thesis, the conceptual framework in which I chose to have four theoretical lenses, is already in itself a result. A first act in exploring a methodology to observe (systematically), to describe (bottom up) and characterise forest management approaches and practices. This could be expanded to several layers, science, practitioners, policy, grey literature, and other sources. In the case of this investigation, this is a first exploration in how to dissect (novel) forest management concepts that are discussed in science; firstly it tries to show how a forest management concept is linguistically and contextually understood and used (in this case systemic functional linguistics helped to categorise its semantic uses), then it scrutinizes which silvicultural or social interventions/practices it is characterised through (in this case reviewing and synthesising sources), it examines the scientific landscape it circulates in (using a science and technology (STS) lens), and finally it critically analyses the motivations that have led to the concepts' introduction (this is to analyse how authors formulate and argue its case). Overall, this is to give a multi-dimensional perspective on a forest management and its embeddedness in a wider discursive and social context. It would be intriguing to use this frame and/or lens(es) to dissect other forest management concepts and test how applicable it is.

Limitations of this investigation are as follows. To decide which paper refers to AFM as a concept or as a syntactical phrase in the screening phase only through title, abstract, and keywords is subjectively and difficult to define how selection has happened in this step, and thus difficult to follow and reproduce. To collect data without not yet having a clear picture what the investigated concept contains, could

have led to exclusion of scientific publications that refer to AFM as a concept. The differentiation if AFM is understood conceptually or rather in a descriptive way, should not be seen as a two-sided coin but rather as a gradient. In this thesis, I tried to find a way to systematically analyse if AFM is understood conceptually or not. Since this was the first step in the process, there might be cases that were overseen or misunderstood in the screening phase and thus not included. For this investigation to be less biased, at least one more person (preferably several) could have taken part in the screening phase. This could have been a sufficient way to have further perspectives and options for discussion with someone being also involved with the data. Alos, to enlarge the collection of data through a snowballing approach during the screening phase could have contributed for more records to be included, making the investigation more thorough. Due to the time limit this was in this case not possible. However, this thesis should be seen as a first act in dissecting the concept of AFM.

A further limitation is that, when ascribing scientific fields and disciplines to authors, a more detailed description of forestry science disciplines could have been provided, given that this is the field I as an investigator derive from. There might be misunderstandings in ascribing nuanced differences of scientific expertise and fields while assigning what field(s) a scientist is practicing in. Also, the designation of a scientific discipline to be either multi-disciplinary, social, or natural science is problematic. The distinction between social and natural science, with interdisciplinarity in between, should be understood as a gradient. But to give a simplistic overview of scientific fields and their main orientation, I decided to categorise in the way it is done above.

5.2 Future research

In this investigation AFM is dissected from a forestry science perspective with several analytical lenses. This can be seen as a first step identifying how, why, by whom and for whom AFM is introduced in science. To shape a more comprehensive picture, research is needed to investigate if and how AFM is interpreted in forest governance outside of the scientific field.

A compelling follow up to this study would be to conduct interviews with the main author or authors of the included scientific publications considered in this thesis. This is to collect information on how they perceived, understood, and referred to AFM in their writing processes. This could be productive in two ways; first, one could get informed in a more nuanced way how AFM is referred to and understood, investigating insights in the decision to label something as AFM. Secondly, this could test if the in this thesis developed frame is a good starting point to be applicable. To get more insight into the discursive sphere how AFM is understood

and in which scale(s) it operates. Future research could analyse how texts discuss AFM from a socio-ecological system perspective, in which resource systems from micro (individual resource use) to macro (governance, institutions) are considered. Also, to investigate Latour's (1999) third loop, alliances that promote AFM should analyse the public institutions and private sector actors that fund research that focusing on AFM. This would further contribute to shaping a holistic understanding of the networks AFM derives from and in which scales it operates.

The question if AFM serves as a boundary object is another survey worth to investigate. This is if AFM serves as a concept, tool, or bridge in between different spheres like different scientific disciplines, or between science and society. The question is if AFM helps, through a flexible interpretation but with a shared structure, to facilitate cooperation without full consensus. Some of this has been discussed in this investigation. An example of no full consensus in the context of AFM is the adaptive versus sustainable understanding for future forests. Here the question is if AFM and its associated approaches strive for an alternative to long-term planning or just adaptations of long-term planning. I also touched upon this in discussing multi-author papers where AFM could be seen as a problem solver when several authors from different disciplines synthesise and articulate their concerns.

6. Conclusion

Of all scientific literature that uses the phrase AFM, approximately 10% refer to it conceptually, thus meaning it is understood as a scientific concept. AFM is used as an umbrella concept in scientific literature that intends to oppose industrial, intensive, and monocultural forest management. It includes social, ecological, and socio-logical forest management practices. Scientific spheres in which AFM is discussed are predominantly forestry-oriented sciences (approx. 50%) and other disciplinary fields such as environmental and conservation science, and biology. Consistently, when science authors refer to AFM, the motivations are to respond to changing demands and current needs. These are varying but always pluralistic and to some extend attempted to be balanced. AFM is an overarching concept ambiguously defined thus making it of limited use in policy. Nonetheless, AFM can be understood as a unifying idea that challenges forest as solely a resource to exploit. This investigation also addresses the need for more comprehensive descriptions of forest management concepts, outlining the factors that should be considered in future analyses. Overall, AFM is an expression that intends to underline a shift towards a more socio-ecological consciousness in forest management.

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Popular science summary

Forests are under increasing pressure from human activities such as drought, forest fires and the growing demand for wood-based products. As people look to forests as a sustainable resource, new ideas are emerging about how to manage them. One of these ideas is called Alternative Forest Management (AFM). What does that really mean? This study takes a deep dive into how scientists use the term AFM and what types of forest practices it encompasses. By reviewing hundreds of scientific articles, this research found that while AFM is often mentioned, a few papers understand it as concept and clearly define what it is. Most discussions of AFM focus on forests in northern boreal regions, with some coverage of forests in the global south. AFM turns out to be an umbrella term that covers a number of different methods, in particular Continuous Cover Forestry (CCF), a technique that involves more selective harvesting of trees to keep the forest canopy intact. What unites approaches understood under AFM is the common goal to balance the many environmental, economic and social values that circulate in science and practice. In short, this study shows that AFM is more than just a word phrase - it's a concept that reflects the growing need to manage forests in a smarter and more flexible way.

This popular science summary is partly created with the help of ChatGPT.

Acknowledgments

A heartfelt thank you, Ida Wallin, for your supervision and stimulating discussions, your continuous support throughout the period this thesis was written, and your helpful and constructive criticism. Thank you, Ida Wallin, Luis Andrés Guillén Alm, Vilis Brukas, and all the students in the social forestry group, your critical comments and engaged conversations during our meetings have been valuable and deeply appreciated. Thank you to the organisers and educators of the Forest and Landscape program at SLU for providing an education that is not only multi-perspective and interdisciplinary but also attuned to the realities of living and acting within socio-ecological systems.

Appendix A – Coding handbook

The coding handbook exported from NVivo (Table 6) has built up during the period I was reading the different scientific publications. New codes were added, some initial codes were not used and taken away.

Table 6. Codebook exported from qualitative coding software Nvivo. Bold rows are summary-codes.

Name	Description	Files	References
AFM approaches and practices	**Practices that refer to actions, techniques, or management approaches that are named explicitly as part of AFM or are described in contrast to conventional forestry**	**18**	**54**
Adaptive Management	As an own code.	1	2
CCF	Continuous cover forestry	6	11
Close-to-nature forestry		1	1
Co-management		1	1
Community forestry		1	2
Conventional forest management	Management approaches that are considered conventional, traditional etc. which the alternative managements are contrasting	3	3
Gap formation		1	1
Group selection management		1	1
Mixed forests	Tree species related, mixed refers to at least two species in a forest represented	2	6
Modelling	How alternative management is referring to modelling	2	4
Multifunctional Approaches	When there is a plurality of values or needs that is considered in a practice.	2	2
Selection cutting		1	1

Name	Description	Files	References
Selection felling system		1	1
Selective cutting		1	1
Social and Participatory Practices	Practices that have social and participatory interventions in focus as e.g. in community-based forestry, indigenous forest management, co-management	5	8
Special management	term found in literature	1	2
Sustainable forest management	related to SFM	2	2
Uneven-aged		2	2
Uniform shelterwood		1	1
Variation of clear-cutting forestry		2	2
AFM understood as concept	Coding for the section in the text where AFM is understood conceptually rather than descriptive.	18	20
Ideational motivations and discursive clues	**Ideational motivations refer to the underlying ideas, values, and worldviews that motivate changes in forest management approaches. Normative or value driven.**	**20**	**104**
AFM present in keywords		1	1
Critiques of prior management	Critiques of prior paradigms. Alternative to what? Juxtapositions	12	28
ESS	Argumentation and/or management in relation to Ecosystem Services	4	5
Ideational motivations	These refer to the underlying ideas, values, and worldviews that motivate changes in forest management approaches. Keywords & Signals: Normative language: “should,” “need to,” “must,” “important to ensure…”	18	40

Name	Description	Files	References
Intellectual anchors	Citations of influential authors/work	2	2
Scientific paradigms	Scientific paradigms or theories are referenced. Terms like “forest transitions,” “multifunctionality,” or “resilience” can signal discourse communities. Including Epistemological shifts (e.g., from technocratic to holistic views, or from anthropocentric to biocentric or relational)	8	18
Time perspective	Coding for mentioning of time perspective, e.g. future generations	3	4
Value statements	Worth assigned. This can include a natural resource, a social concern, etc. based on its use, option, or non-use. e.g. “Sustainability,” “biodiversity preservation,” “ecological integrity,” “social justice,” “intergenerational equity”	4	6

Appendix B – Included scientific publications

The included scientific publications that serve as quantitative and qualitative data in this investigation can be found in Table 7, starting on the next page.

Table 7. Included scientific publications serving as data.

Publication label used	Full author list	Year	Title of publication	Type of scientific document
Laitila et al. (2025)	Laitila, Juha; Repola, Jaakko; Holmstroem, Eero	2025	Time consumption models for predicting harvester productivity when selection cutting, thinning from below, and clearcutting Scots pine-dominated stands in Finnish Lapland	Journal article
Abdullah et al. (2023)	Abdullah, Mukrimah; Mamat, Mohd Parid; Faten Naseha, Tuan Hussain; Huda Farhana, Mohamad Muslim; Wan Radzi, Wan Abdullah	2023	Assessing well-being in forest dependent communities: a case study of Gunung Tebu Forest Reserve, Terengganu.	Journal article
Gresh & Courter (2022)	Gresh, James M.; Courter, Jason R.	2022	Assessing the effects of Close-to-Nature Forestry on forest birds in the eastern United States: A case study and way forward	Journal article
Juutinen et al. (2021)	Juutinen, Artti; Kurttila, Mikko; Pohjanmies, Tahti; Tolvanen, Anne; Kuhlmey, Katharina; Skudnik, Mitja; Triplat, Matevz; Westin, Kerstin; Makipaa, Raisa	2021	Forest owners' preferences for contract-based management to enhance environmental values versus timber production	Journal article
Huuskonen et al. (2021)	Huuskonen, Saija; Domisch, Timo; Finer, Leena; Hantula, Jarkko; Hynynen, Jari; Matala, Juho; Miina, Jari; Neuvonen, Seppo; Nevalainen, Seppo; Niemisto, Pentti; Nikula, Ari; Piri, Tuula; Siitonen, Juha; Smolander, Aino; Tonteri, Tiina; Uotila, Karri; Viiri, Heli	2021	What is the potential for replacing monocultures with mixed-species stands to enhance ecosystem services in boreal forests in Fennoscandia?	Journal article
Versluijs et al. (2020)	Versluijs, Martijn; Hekkala, Anne-Maarit; Lindberg, Eva; Lamas, Tomas; Hjalten, Joakim	2020	Comparing the effects of even-aged thinning and selective felling on boreal forest birds	Journal article
Tesfaye (2017)	Tesfaye, S. S.	2017	Assessment of local community perception of and attitude towards Participatory Forest Management (PFM) system and its implications for sustainability of forest condition and	Journal article

			livelihoods: the case of Chilimo-Gaji Forest in Dendi district, West Shewa zone, Oromia, Ethiopia.	
Roessiger et al. (2017)	Joerg, Roessiger; Ladislav, Kulla; Maros, Sedliak; Miroslav, Kovalcik; Ivan, Barka; Marek, Fabrika	2017	Compensation payments for alternative forest management supporting nature conservation - a case study based on SIBYLA tree growth simulator and silvicultural cost model	Journal article
Williams et al. (2017)	Williams, David T.; Straw, Nigel; Fielding, Nick; Jukes, Martin; Price, John	2017	The influence of forest management systems on the abundance and diversity of bark beetles (Coleoptera: Curculionidae: Scolytinae) in commercial plantations of Sitka spruce	Journal article
Joelsson et al. (2017)	Joelsson, Klara; Hjalten, Joakim; Work, Timothy; Gibb, Heloise; Roberge, Jean-Michel; Lofroth, Therese	2017	Uneven-aged silviculture can reduce negative effects of forest management on beetles	Journal article
Munyanduki et al. (2016)	Munyanduki, Precious; Chirwa, Paxie W.; Babalola, Folaranmi D.	2016	A case study assessment of socio-economic sustainability and alternative management regimes for state forest plantations in Limpopo Province, South Africa	Journal article
Klapwijk et al. (2016)	Klapwijk, Maartje J.; Bylund, Helena; Schroeder, Martin; Bjorkman, Christer	2016	Forest management and natural biocontrol of insect pests	Journal article
Schelhaas et al. (2015)	Schelhaas, Mart-Jan; Nabuurs, Gert-Jan; Hengeveld, Geerten; Reyer, Christopher; Hanewinkel, Marc; Zimmermann, Niklaus E.; Cullmann, Dominik	2015	Alternative forest management strategies to account for climate change-induced productivity and species suitability changes in Europe	Journal article
Moen et al. (2014)	Moen, Jon; Rist, Lucy; Bishop, Kevin; Chapin, F. S., III; Ellison, David; Kuuluvainen, Timo; Petersson, Hans; Puettmann, Klaus J.; Rayner, Jeremy; Warkentin, Ian G.; Bradshaw, Corey J. A.	2014	Eye on the Taiga: Removing Global Policy Impediments to Safeguard the Boreal Forest	Journal article

Lidskog & Sjodin (2014)	Lidskog, Rolf; Sjodin, Daniel	2014	Why do forest owners fail to heed warnings? Conflicting risk evaluations made by the Swedish forest agency and forest owners	Journal article
Bertin (2009)	Bertin, Sophie	2009	Physiological ecology of understorey trees in low impact silvicultural systems	Dissertation
Axelsson et al. (2007)	Axelsson, Robert; Angelstam, Per; Svensson, Johan	2007	Natural forest and cultural woodland with continuous tree cover in Sweden: How much remains and how is it managed?	Journal article
Ritter (2005)	Ritter, E	2005	Litter decomposition and nitrogen mineralization in newly formed gaps in a Danish beech (Fagus sylvatica) forest	Journal article
Treseder & Krogman (2002)	Treseder, Leslie; Krogman, Naomi T.	2002	Forest co-management in Northern Alberta: does it challenge the industrial model?	Journal article
Beckley (1998)	Beckley, TM	1998	Moving toward consensus-based forest management: A comparison of industrial, co-managed, community and Small private forests in Canada	Journal article
Mallik et al. (1995)	Mallik, A. U.; Rahman, H.; Park, Y. G.	1995	Community forestry: revitalizing an age-old practice of sustainable development.	Journal article

Appendix C – Meta-data of scientific publications

In Table 8, starting on the next page, the compiled meta-data set of the included scientific publications can be viewed.

Table 8. Collected meta-data of included scientific publications.

Publication	No. of authors	Type of scientific document	Journal Name	Science IS, NS, SS	1st author's discipline	Geographical scope of authors (1st country = 1st author)
Laitila et al. (2025)	3	Journal article	INTERNATIONAL JOURNAL OF FOREST ENGINEERING	IS	Forest Technology	Finland
Abdullah et al. (2023)	5	Journal article	BIO Web of Conferences	IS	Forestry Science	Malaysia
Gresh & Courter (2022)	2	Journal article	AVIAN BIOLOGY RESEARCH	NS	Biology	USA
Juutinen et al. (2021)	9	Journal article	FOREST POLICY AND ECONOMICS	IS	Forestry Science	Finland Sweden Germany Slovenia
Huuskonen et al. (2021)	17	Journal article	FOREST ECOLOGY AND MANAGEMENT	IS	Silviculture	Finland
Versluijs et al. (2020)	5	Journal article	FOREST ECOLOGY AND MANAGEMENT	IS	Ecology	Sweden
Tesfaye (2017)	1	Journal article	Journal of Earth Science & Climatic Change	IS	Disaster Risk Management	Ethiopia
Roessiger et al. (2017)	6	Journal article	AUSTRIAN JOURNAL OF FOREST SCIENCE	IS	Forest Management	Slovakia Czech Rep.
Williams et al. (2017)	5	Journal article	FOREST ECOLOGY AND MANAGEMENT	IS	Forest Ecology	England
Joelsson et al. (2017)	6	Journal article	FOREST ECOLOGY AND MANAGEMENT	IS	Forestry Science	Sweden Canada Australia

Munyanduki et al. (2016)	3	Journal article	AGROFORESTRY SYSTEMS	IS	Forest Technology	Sth. Africa Nigeria
Klapwijk et al. (2016)	4	Journal article	FORESTRY	NS	Forest Entomology	Sweden
Schelhaas et al. (2015)	7	Journal article	REGIONAL ENVIRONMENTAL CHANGE	IS	Forest Ecosystem Science	Netherlands Germany Switzerland
Moen et al. (2014)	11	Journal article	CONSERVATION LETTERS	IS	Ecology	Sweden USA Finland Canada Australia
Lidskog & Sjodin (2014)	2	Journal article	SCANDINAVIAN JOURNAL OF FOREST RESEARCH	SS	Sociology	Sweden
Bertin (2009)	1	Dissertation	-	IS	Forestry Science	Scotland
Axelsson et al. (2007)	3	Journal article	SCANDINAVIAN JOURNAL OF FOREST RESEARCH	IS	Sustainable Development Science	Sweden
Ritter (2005)	1	Journal article	SOIL BIOLOGY & BIOCHEMISTRY	NS	Forest Ecology	Iceland Danmark
Treseder & Krogman (2002)	2	Journal article	International Journal of Environment and Sustainable Development	IS	Environmental Science and Resource Sociology	Canada USA
Beckley (1998)	1	Journal article	FORESTRY CHRONICLE	IS	Forest Management	Canada
Mallik et al. (1995)	3	Journal article	Journal of Korean Society of Forest Science	IS	Biology	Canada

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