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Frame analysis of attitudes towards forest-based bioenergy in Europe: Exploring the criticism to improved dialogue

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ABSTRACT

The objective of this study is to investigate the criticism against forest-based bioenergy. It is based on a qualitative study and provides a comprehensive understanding of critical attitudes towards forest-based bioenergy among environmental non-governmental organizations (ENGOs) in Europe. Through semi-structured interviews with 12 representatives from Swedish and European ENGOs a frame analysis was done. The analysis shows how these respondents conceptualize challenges related to forest-based bioenergy, what processes that underpin these views and what concrete solutions the respondents suggest to the risks they perceive. Frames refer to what arguments the respondents use to justify their opinions and conclusions, whereas framing is the process of applying their frames to situations. The analysis also accounts for system boundaries set among the respondents, since that influences their problem definitions and conclusions. The ENGO representatives reported rigorous and profound criticism of forest-based bioenergy and, not the least, of current forestry practices in general. Also, respondents within the same ENGO differed in approach to forest-based bioenergy, which suggests that individual characteristics need consideration for dialogue to be constructive. Lack of trust was identified as one major obstacle for constructive dialogue. Understanding the socio-personal factors and diversity in perspectives behind forest-based bioenergy criticism is crucial for development that is socially acceptable. To this end, policy processes need to involve facilitation and well-designed dialogue processes oriented towards mutual learning, where actors are invited early and allowed to engage in the very problem definition. Crucial is also to maintain continuity among the participants. To get a complete picture of the discourse on forest-based bioenergy a similar analysis of proponents would complement this study.

1. Introduction

Climate change is currently a strong driver for decarbonising the global energy system by means of renewable energy sources such as solar, wind, hydro and biomass. IPCCs latest synthesis report states that limiting warming to 1.5–2 °C will "involve rapid and deep and, in most cases, immediate greenhouse gas emissions reductions in all sectors this decade" (IPCC, 2023). Considering that fossil fuels currently (2022) account for 85 % of the global direct primary energy consumption, with no decreasing trend in sight, and the fact that biomass still is the largest renewable energy source (*Our World in Data*, 2023), with most of the biomass originating from forests (WBA, 2024), increasing pressure on forests may be expected, and is a central issue to resolve in the energy and forestry sectors alike. In the Nordic countries, forest-based biomass for energy is primarily used in district heating (often combined with electricity production) and as process energy in the forest industry i.e. pulp and paper, and sawmill industries (Ericsson et al., 2004). Industrial residues are already fully utilised, and focus is now on primary sources such as logging residues, small-diameter trees, and even stumps - all of them with their sustainability issues (de Jong et al., 2017). This potential increased pressure comes during a time when the sustainability of current production-oriented forest practices is already debated (Garcia et al., 2025; Nayha and Wallius, 2024; Takala et al., 2023).

All energy systems include negative environmental or cultural impacts, and different actors prioritize differently among these, such as mitigating climate change by using wood versus biodiversity, or forestry versus conservation (Eriksson and Klapwijk, 2019; Söderberg and Eckerberg, 2013). Mather-Gratton et al. (2021) argue that much of this controversy depends on actors' different views on "what relationship we as humans should have with forests" (p. 25). Claims on how forests

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should best be managed and used by society encompass a multitude of alternative uses and competing views, ranging from forests as existing carbon stocks and future carbon capture and storage (Favero et al., 2020), to conventional lumber, pulp and paper production (Bryngemark, 2020), and more recently applications such as the production of biochar (Phounglamcheik et al., 2022), bio-based substitutes for plastics (Coppola et al., 2021), petrochemicals (Roddy, 2013), and concrete (Gustavsson et al., 2006). The extraction of forest biomass for energy purposes hence competes with many other uses of forest resources and consequently has triggered substantial debate both in public discourse (Logmani et al., 2016) and science (Cowie et al., 2021; Kallio et al., 2018; Norton et al., 2019; Schulze et al., 2012).

Apart from competing uses of wood from forests, also the way in which forests are managed and harvested is of importance and contested. The additional extraction of wood for bioenergy purposes can be considered an intensification of ongoing forestry practices and may have impacts on several environmental factors (de Jong et al., 2017; Repo et al., 2020). Many studies have therefore focused on identifying consequences and suggesting measures to avoid negative impacts (Repo et al., 2020). On this basis, sustainability criteria for mitigating negative effects of forest biomass have been developed (Fritsche et al., 2014; Mai-Moulin et al., 2021). However, many ENGOs remain critical, although some also acknowledge a role for forest-based bioenergy in society (Mather-Gratton et al., 2021). Arguably this is a consequence of humans developing their opinions out of facts, as well as beliefs and values. Whereas facts may differ between different sources of data and methodologies, sense-making of those facts is also done in a process of social interaction. This renders a socially constructed "story" or narrative that mirrors different actors' interpretation of reality. In this context, interpretation is universal and applies to all ideologies as well as scientific paradigms. The strength of the constructed narrative once established makes people allegiant to it and unlikely to listen to opposing evidence (e.g. Dewulf et al., 2009; Muncie, 2020; Iyengar and Massey, 2019). In the discourse on forest-based bioenergy, this gives rise to differences in opinion, and consequently grounds for controversy and conflict (Garcia et al., 2025; Nousiainen and Mola-Yudego, 2022).

This paper aims to explore critical attitudes towards forest-based bioenergy among environmental non-governmental organizations (ENGOs) in Europe. The reason is a societal need to find balance between extraction and other values (Torvanger, 2021), i.e. forest-based bioenergy systems that are efficient, environmentally sustainable, and socially acceptable. Our interest in this issue stems from the high level of controversy and polarization in the public discourse on the role and potential of forests (Logmani et al., 2016; Johansson and Ranius, 2019; Andersson and Westholm, 2019; Holmgren et al., 2022); e.g. for climate change mitigation, biodiversity, forestry, and biomass extraction for energy purposes. In this paper, critical attitudes are therefore conceptualized as examples of narratives that have arisen based on the biased interpretation of facts as well as beliefs and values, a process sometimes referred to as framing (e.g. van Hulst and Yanow, 2016). Whereas framing in some literature refers to individual internal organization of thought (Rein and Schön, 1996), our notion of framing highlights its communicative or interactive component. Framing is conceptualized as a communicative device in an interactive setting, and thereby something beyond an individual internal process of organizing thought. Arguably, differing narratives resulting from such processes significantly have contributed to the conflict in the public debate on biofuels, which is why frame analysis may provide important insights and clues for more constructive dialogue and, potentially, conflict resolution (Rein and Schön, 1996).

The objective of this paper is to provide a comprehensive understanding of critical attitudes towards forest-based bioenergy. Specifically, this is done by exploring framing processes in the construction and representation of opinions held by critics, encompassing the underlying personal reasoning and interdependence among individual critics. Our use of the concept framing is rooted in a qualitative research tradition, thus corresponding more to the original, sociological understanding of frames and framing as conceptualized for example by van Hulst and Yanow, 2016; a view by which frames are imagined as windows, or glasses, applied by people to interpret the world to define situations, and formulate adequate responses. However, in the literature multiple interpretations and definitions of framing coexist, in fields ranging from sociology (Benford and Snow, 2000; Goffman, 1974) to communication studies (Entman, 1993; Matthes, 2009) and political science (van Hulst and Yanow, 2016; Barth and Bijsmans, 2018; Rein and Schön, 1996) etc. Differences and similarities in different traditions of frame analysis are therefore further elaborated upon in Section 2.2: frame analysis.

The choice to prioritize the critical voices for now, is because these actors seemed to have multiple layers of resistance and arguments, and perhaps a more heterogeneous range of opinions compared to the proponents. Also, this study serves to expand a preceding Swedish report that contained a brief account for birdwatchers' opinions on forest-based bioenergy (Ebenhard et al., 2019). Understanding the framing processes at play in the public debate on forest-based bioenergy is essential for understanding conditions for constructive dialogue, and thereby increasing the likelihood that future bioenergy policy, management practices, and extraction levels can develop towards a higher degree of ecological sustainability as well as social acceptance. More specifically we depart from the following research questions:

RQ1. How do critics conceptualize challenges related to forest-based bioenergy, and on what basis, i.e. what frames can be identified?

RQ2. What framing processes shape individual opinions on forest-based bioenergy, i.e. how are the frames applied to the specific situation of forest-based biofuels?

RQ3. From the perspective of critical individuals, under which conditions could forest-based bioenergy be socially accepted, i.e. what (if any) concrete solutions do they perceive?

Knowledge on this matter may provide important insights useful for a more constructive dialogue process, formulation of socially just policies, and future studies. This study was performed by a multidisciplinary team consisting of four researchers from distinctly separate research areas: environmental communication, systems ecology and human geography, conservation biology, and forest production.

2. Material and methods

In this study, the investigated population was delimited to representatives of environmental non-governmental organizations (ENGOs). Thematically, the focus on forest-based bioenergy was delimited to extraction of forest biomass for energy purposes. To meet the objective of the study, the following methods were applied in combination; 1) semi-structured interviews (Kvale and Brinkmann, 2009) to expose underlying factors shaping the decisions and opinions of the respondents, 2) frame analysis (van Hulst and Yanow, 2016) for understanding the social and personal processes behind the (co-) construction and representation of forest-based bioenergy criticism.

The study was done in an abductive approach (Brinkmann, 2013), which means that it was designed "for dialoguing with an evolving reality of persons in conversations rather than attempting to formulate theories that are universally true" (p. 56). An information-oriented selection of respondents was done to receive a rich content from a small sample (Brinkmann, 2013).

In the initial phase of the study, eight respondents in Sweden were interviewed, after which additionally four respondents were included from other parts of Europe. The sampling was done by 1) searching on the Internet for organizations and networks with an environmental interest that had acted or written critically about forest-based bioenergy in the last five years, and 2) by asking the policy director at the Swedish Bioenergy Association about the most dominant representatives among

ENGOs in the debate on forest forest-based bioenergy. This resulted in two lists of 31 possible ENGOs as well as 26 specific individuals. In total a comprehensive list of 49 individuals in the target group was compiled. Additionally, 6 individuals were added after snowball sampling during the interviews. Out of these 55 potential respondents, 17 were selected, and of these we managed to book 12 individuals for an interview. Our criteria were to involve a variation of 1) organizational affiliations, 2) gender and 3) recent public engagement in bioenergy issues.

2.1. Semi-structured interviews

In total this gave a sample of representatives from 11 different ENGOs: BirdLife Sweden, Citizens' Climate Lobby Sweden *(Klimatsvaret),* Climate Action Sweden, Nature and Youth Sweden *(Fältbiologerna)*, Greenpeace Sweden, WWF Sweden, Swedish Society for Nature Conservation *(Naturskyddsföreningen)*, BirdLife Latvia, BirdLife Europe, WWF Europe, and BirdLife Finland. All interviews were performed between 2022 and 11-10 and 2023-10-09. The mean length of the interviews was 62 min (range 49–98 min). Of the 12 respondents, four were women, and eight were men. Eight respondents were working mainly in a Swedish context and four were selected because of their international engagement. Interviews were held in Swedish or English.

The respondents were invited by email, and there were 1–2 reminders to follow up ten of them. Two of the respondents had critical questions to discuss before they accepted to participate, such as whether there is scientific support that conditions for better dialogue are indeed strengthened by bringing critical arguments to the fore, and that an analysis of power relations would be equally important, as it affects actors' real capacity to influence alternative development trajectories.

The interviews were held via Zoom and video recorded after consent from the participants. Respondents were assured confidentiality, including not revealing any data that could be backtracked to the individual. Each respondent was given a code number, kept in a separate document. The interviews were transcribed and a half page compilation from each transcript was sent out to the respondents to offer them the possibility to react and correct. Only two respondents chose to make minor corrections at this stage. Selected sections from the Swedish transcripts were translated into English.

The interviews followed conventional principles for holding semi-structured interviews (Kvale, 2007). An interview guide (appendix A) was constructed with themes, questions, and possible sub-questions.

2.2. Frame analysis

When people establish their reality, they observe, interact and construct meaning in what they experience (Berger and Luckmann, 1966). This constantly ongoing interpretation takes place in a social setting as an interactive, inter-subjective, process (Ödman, 2001; Eriksen and Weigård, 1999) with language having a central role (Maines, 2000; van Hulst and Yanow, 2016). One way to analyse and understand this social co-construction of meaning from the perspective of the individual is frame analysis (Westin, 2019; van Hulst and Yanow, 2016). Frames are imagined windows, or glasses of the subject in question, that assist in interpreting the world, to define the situation and formulate an adequate response (van Hulst and Yanow, 2016). This involves elements from the past (experiences), the present (context) and the future (expectations) according to the person (Dewulf et al., 2009). The dynamic nature of frames has increasingly been engaging researchers who aim for a stronger focus on the inter-subjective part of it, more often referring to framing. As Dewulf et al. (2009) put it: "framing is the process of applying cognitive frames to situations". In other words, framing is the factual rationale and/or emotional reasoning underpinning frames. For example, the opinion that forests should be conserved rather than exploited would represent a *frame*, whereas referring to emotions or the intrinsic value of nature would represent the *framing* in support of this view.

In the literature there are however other ways to conceptualize frames and framing. For example, Entman (1993) represents a notion that involves strategic purpose; people use frames to convince others about a certain problem definition and solution justification, by deliberately selecting biased descriptions and arguments. The tradition of communication studies that Entman represents applies a somewhat linear transfer model of communication with terms as "receiver" (Entman, 1993). Meanwhile, our research stems from a constructionist view that regards communication as joint construction of meaning (Fischer et al., 2024). In Entman's view, a frame is consciously constructed, with the purpose to influence, and framing is the attempt to constrain the interpretation and to connect it to certain values to justify certain solutions, i.e. as "rhetorical devices" (van Dijk, 2023, p 165). The distinction by Rein and Schön (1996) in "rhetorical frames" and "action frames" also hints at an underlying assumption of strategic involvement. Such a view contrasts with the notion applied in this paper; where a frame or framing is seen as an attribute of a narrative somebody identifies with (due to values) rather than an instrument for political strategy. In this view, framing is better described as a type of opinion formation, a less conscious way of influencing the perception of others. Central parts of framing are also the interactive and intersubjective processes that the subjects are involved in when developing frames (van Hulst and Yanow, 2016). As part of the frame analysis in this paper, a typology was therefore sought, to classify and expose the ways in which critics of forest based biofuels engage in framing this contested issue.

As frames are biased representations of the external world (Dewulf et al., 2009; Asplund, 2014) - representing what people believe is external reality - if the frames of individuals differ, the same situation will be interpreted differently, leading to different views on the same phenomenon, and potentially polarization between conflicting views. For example, specifically related to the forest-based bioenergy discourse, Söderberg and Eckerberg (2013) point out possible frame conflicts, relate these to differences between EU sector areas, and hint typical criticism argued by ENGOs. Identifying frames and framing processes at play in public discourse on contested issues, such as forest-based bioenergy, is hence essential for understanding the similarity or dissimilarity of individual frames, thereby creating better conditions for constructive dialogue and mediation of multiple and conflicting opinions. Dialogue in this sense acknowledges differences in perspectives and knowledge as socially constructed, and it aims for increased understanding (Forester and Theckethil, 2009). In this way dialogue may be a means for social change, through co-construction and mutual learning.

Since our study is limited to include a single side of a multi-part dialogue controversy, and neither the acts of communication nor the frames of other interacting parties, we chose to work with frames, rather than interactional framing. This is both an ontological and an epistemological consideration, i.e. it is related to both what is to be regarded as reality and to what we believe is possible to gain knowledge about (c. f. Dewulf et al., 2009). Our notion of frames is coloured by social constructionism and symbolic interactionism. This implies that we regard frames as frozen pictures of realities and although they may be biased, there is not a meaningful way to search for unbiased pictures of realities, since there are none. Also, we recognise that these individually held frames are products of social interaction, of social experiences, of language and acts of communication. Thereby, there are no frames that are independent of other actors, but through the study of frames, we will also grasp some information about other actors and the processes of e.g. agenda setting, problem formulation and argument formation that is done in interaction with others.

In this study, frame analysis was applied by analysing the interview transcripts in two aspects, drawing on Dewulf et al. (2009) notion of *frames*; respondents' biased representations of in this case forest-based bioenergy, and *framing*; respondents' personal process of applying their frames to situations. The results of this study thus rest on two analytical dimensions – frames (I) and framing (II).

2.2.1. Identifying frames (I)

The first part of the analysis -identifying *frames* (I) - consisted of extracting two main components; in simplified terms, what is the problem and what should be done. Each transcript was read through with these two main questions in mind and some following sub questions, guided by the literature (Westin, 2019; van Hulst and Yanow, 2016; Dewulf et al., 2009):

1) **Interpretation of the situation (problem definition).** This responds to the question "What is going on here?" from the perspective of the respondent, with attention to three specific aspects:
   a) Content, i.e. opinions towards forest-based bioenergy (substantive content, agenda items, events and problems).
   b) Identities and relations (meanings about oneself, one's previous experiences and their significances, and one's relationships with other actors).
   c) (Policy-) Process (roles, dynamics, course of events, future, action and response, and one's interpretation of the process).
2) **Bias for action (prescriptive).** This responds to the question "What should be done?", i.e. the respondents' suggestions on how to solve the problem.

In the proceeding analysis, the accounts of frames resulting from posing the above questions were then compiled following principles of meaning condensation (Brinkmann, 2013). This entails (general definition from Brinkmann), e.g. creating tables, sorting the material to identify what is most relevant, separating between diagnosis, action bias etc. This material was then used for creating maps that illustrate occurrence of the respective accounts on frames.

In the next step of the frame analysis the accounts of all the respondents were compiled following principles of meaning condensation (Brinkmann, 2013) according to the structure above (aspects 1a, 1b, 1c and 2). The material in aspect 1a (content) and 2 (bias) were regarded as the most central, and the material in aspect 1b (identity) and 1c (process) was thereafter only considered if it added substance to aspect 1a (content). Then a number of central themes were identified from the column of "diagnosis" as well as for "action bias". Similar themes were grouped together according to two maps, respectively. The maps show occurrence, but not frequency or dominance. Most respondents cover more than one theme.

2.2.2. Identifying framing (II)

The second part of the analysis – identifying framing (II) - was operationalised as a series of workshops within the interpretive team of researchers. Transcripts were read through, and attention was specifically put towards drivers, motives, logics, strategies, argumentation, and motivation styles. Significant statements were selected, and the accounts were compared across the respondents. Prior classifications in the literature were consulted (i.e. Westin, 2019; Raitio, 2008; Beland Lindahl, 2008; Niemeyer and Dryzek, 2007). This process was also guided by theory on rationalities (e.g. Eriksen and Weigård, 1999; Niemeyer and Dryzek, 2007) and human-nature relations (e.g. Flores and Clark, 2001; Kronlid and Öhman, 2013; Stenmark, 2016). This part of the frame analysis exposed variations among the respondents and patterns of argumentation to understand *how* actors form their opinions and what they regard as important and central in their way of framing forest-based bioenergy.

Consequently, the research process was hermeneutic; asking deepening questions to the material according to the expanding understanding of the material through continuous iteration (Ödman, 2001; Alvesson and Sköldberg, 2018), including components of heuristics; methodical application of acquired experience along the analysis to develop stronger analytical strategies (Mees-Buss et al., 2022). Significant statements were transferred to a large matrix with all respondents and their utterances.

The combination of analysing both frames and framing resulted in a typology to classify respondents. Developing the typology was a process of iterating cycles. Quotes from the interviews were read through. Key findings were grouped and compared. Our interpretive team looked for similarities and differences and investigated if there were patterns regarding what the respondents said. The variations manifested along a few directions, evoking a loose parallel to multivariate analysis. The development and naming of categories in this kind of qualitative analysis is a product of interpretive work and does not claim to be absolute or exclusive. Yet it did contribute useful explanatory insight into empirical findings.

In the typology developed, we identified a few positions held by our respondents. Positions is a way to understand where subjects may be placed in relation to different frames and offer a more dynamic alternative to for instance the concept of roles (Mendonça and Simões, 2022; Gordon, 2015; Niemeyer and Dryzek, 2007). Our intention by developing the typology was to understand how different frames and framings relate to each other and may be explanatory for the variation in critical stances towards the topic at hand among the respondents.

When framing contested issues such as forest-based bioenergy, the individual opinions are also shaped (RQ2) by which factors that are included or excluded, i.e. which system boundaries are established when interpreting the situation (problem definition) and prescribing appropriate actions, responses or solutions. Also, system boundaries differ among individuals and may influence both problem definitions and conclusions. Hence, an analysis of system boundaries was also an important contribution in the frame analysis.

Sweeney and Meadows (1995) have described systems thinkers as individuals who try to see the whole picture, e.g. by changing perspectives, looking specifically for interdependencies, complex cause, and effect relationships, and acknowledge that in situations of high interdependencies, solving one issue may make something else worse. Complementing this definition – which is to be seen as an ideal – we also drew on behavioural developmental theory, specifically the Model of Hierarchical Complexity (MHC) which offers a total of 14 Orders of Hierarchical Complexity (Commons, 2008). MHC has been used to score the level of complexity of tasks different people are able to solve; the respective stages build on each other, and each successive stage is more complex than that preceding it (Commons and Ross, 2008).

To simplify the analysis of system boundaries in this study, only three of the MHC orders described by Commons (2008) were used; Formal (order 10), Systematic (order 11), and Meta-systematic (order 12), though rephrased as system boundaries being either narrow, medium-wide, or wide. From this follows that a narrow system boundary is defined as the capacity to combine two abstract variables to describe a cause and effect relationship, e.g. that GHG emissions result in climate effects. The definition of medium-wide system boundaries thus includes this capacity but also acknowledges that such simple two-set variables are dependent on context, methodology, ideology, and culture. Hence, medium-wide system boundaries comprise the combination of political, economic, and ecological systems. Operating at the next order of complexity (order 12), wide system boundaries imply capacity to also identify, compare, or combine multiple ideologies and value systems, as well as elaborating on how they may differ, contradict each other and exist in parallel, i.e. meta-systematic reasoning. Worth noting, however, is that in this study respondents were not asked specifically to describe their system boundaries, but when analysing their responses, examples were looked for that indirectly hinted to the order of complexity in the arguments put forward and issues raised.

3. Results

3.1. Frame analysis (RQ1)

The empirical data collected during interviews were summarized and combined in a matrix (appendix B). The frame analysis (I) started with searching for the diagnosis, i.e. how critics conceptualize

challenges related to forest-based bioenergy, and on what basis (RQ1). The interviews included questions that allowed the respondents to set and explore their own views on the situation, i.e. their problem definition. Eight different main themes regarding the diagnosis were constructed out of the transcripts, in which 24 main frame elements were identified (Fig. 1).

A central issue turned out to be whether the respondents primarily consider the question of *how,* or *for what,* that the forest should be managed (Fig. 1). Some of the respondents clearly engaged with the how-question, which involves criticism towards clear-cut forestry, especially on natural forest sites with high biodiversity and nature conservation values. Some of the respondents were not as concerned with how, but rather discussed for what purpose(s) the forests and wood should be used, pointing towards cascading use principles and the existing financial drivers that speed biomass extraction. Sometimes the respondents engaged with both how and for what, however it seems that the respondents who were more engaged in climate issues, talked more about for what, whereas respondents with primarily a biodiversity perspective talked more about how.

The result indicated that economic as well as time aspects are central to the problem definitions of the respondents. For instance, forest-based bioenergy was regarded as important for the welfare of people and the economy of the country, and heavy criticism was directed towards the forest industry sector because of its dominance and economic power, even corruption. Timewise, several respondents stated that the climate crisis has a very short time frame which bioenergy cannot help to solve, also that the carbon dioxide emission space is already surpassed, in different wordings:

> "The climate crisis is urgent. It does not matter for the climate where the carbon dioxide molecules come from. All emissions count. Therefore, burning biofuels is not a solution. We are talking about a carbon dioxide budget, but there is no budget because it is already overdrawn."
>
> (R2)

> "People are fighting over how many decades it is before it has become net zero again before other trees have taken it up, we don't have time to wait that time now."
>
> (R2)

> "All the stuff from Bioenergy Europe, the biggest bioenergy lobby in Brussels, it is not based on science. It's based on defending their interest, which is making money."
>
> (R10)

There was also a line of argumentation dealing with how realistic a continuous or increased biomass extraction for energy is, ranging from the statement that bioenergy has always existed and will always remain, to the concern that large-scale forest-based bioenergy will not cover the global energy demand even if all forest is extracted and burnt:

> "We have biofuels that have been stored for millions of years and turned into fossil fuels. We can't replace it with the biomass produced on the globe during a year and burn it up."
>
> (R4)

> "Even if we cut down all the forest, it would not cover the energy needs. The risk is that we lose the forest and its ecosystem on which we depend, at the same time as the biofuels run out."
>
> (R3)

Some of these themes and elements confirm the results by Mather-Gratton et al. (2021), especially their analysis of their "climate focussed" and "critical" storylines. However, our study also provides deeper insight into those critical positions, as well as complimentary data that expands to additional aspects and elaborates the variants of standpoints in more detail.

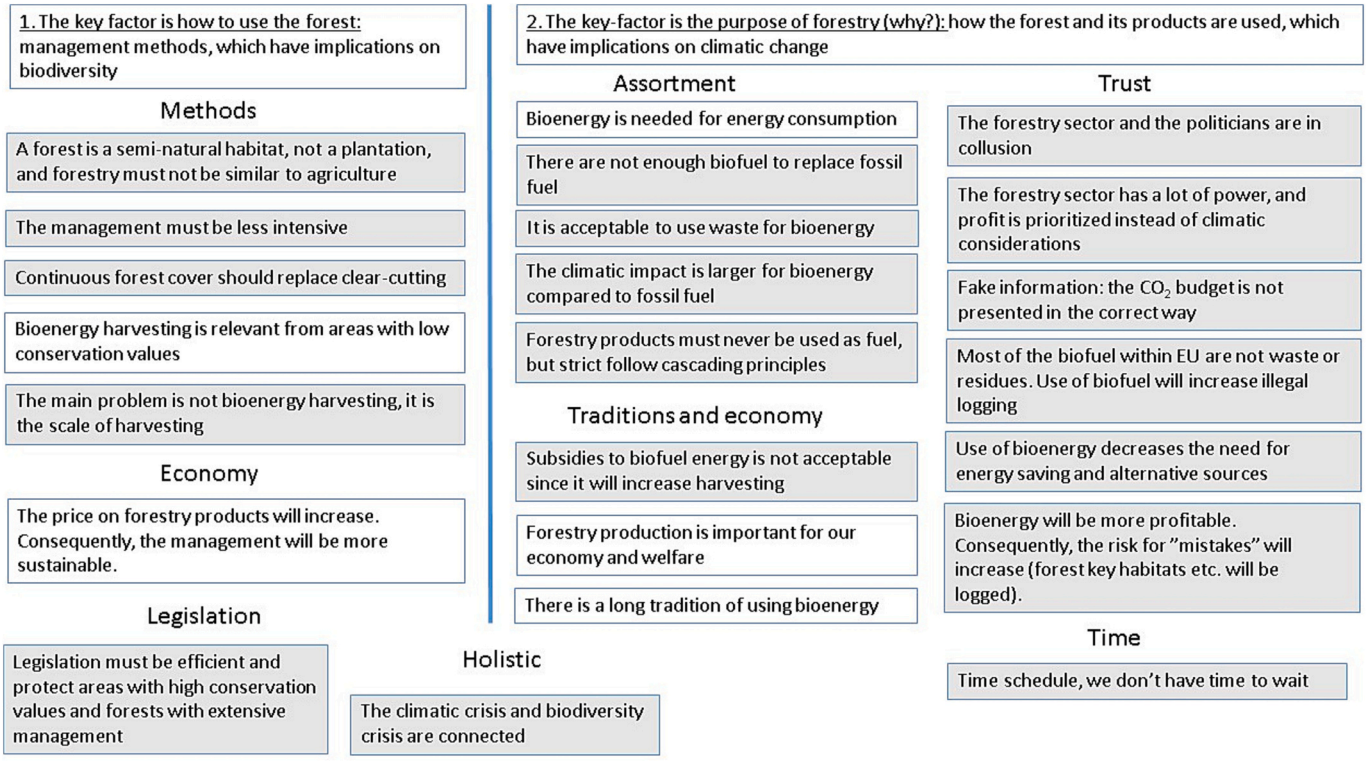

Fig. 1. In total, 24 main frame elements were identified with positive (white boxes) and negative (grey boxes) attitudes. These were sorted under 8 main themes and divided into two groups based on "How to use the forest" and "The purpose of forestry" (why).

3.2. The framing process (RQ2)

In terms of the framing processes (II), primarily two "dimensions" were identified; the 'degree of emotional engagement', ranging from (highly) emotional to formal, and the 'type of reasoning', ranging from idealism to pragmatism. These dimensions – emerging from the hermeneutic process - distinguish between orientation towards values vs. more practical concerns. The quotes provided in the matrix (appendix B) were conceptually categorized using two by two cross tabulation; plotting responses in relation to each other along the different dimensions (Fig. 2), hence representing differences in ***how*** respondents think about forest-based bioenergy, i.e. how the frames are applied to the specific situation of forest-based biofuels (RQ2).

When interpreting the interview transcripts, this was achieved by screening statements searching for language signifiers that hinted at the underlying dimensions (positions) that form the basis for the framing process. Initially this entailed judging the degree of emotion and type of rationale and then classifying the statements according to the opposing ends of those dimensions. As such, judgements were made in terms of placing the specific ways respondents expressed themselves on a sliding scale between dimensional poles, or opposite extremes. Through the hermeneutic process of asking deepening questions to the material in iteration, four recurring ways to do framing emerged, that could be identified as the extremes of two underlying dimensions forming the basis of the framing process; emotional -pragmatist and idealist -formal. These four distinctions were thus generated as responses to what dimensions were most prevailing in the interview transcripts, and interestingly to some extent manifest a parallel to Max Weber's four ideal types of social action: instrumental, value-rational, affectual and traditional (Weber, 1978, p 24–25). Subsequently, these classifications were combined to form pairs, resulting in a typology with a total set of four positions (Table 1), used to distinguish between the different "types" of respondents. Below, the results from this sequence and reflections on the respective positions are provided.

Emotional pragmatists (respondents: 1, 12) typically referred to a personal history and connection to forests, to justify its protection, though at the same time acknowledging the need to compromise to meet energy needs of society. Emotional attachment to the forest is central to these respondents:" I like to be in the forest. For me the forest is a safe place. A place for experience, relaxation", which is connected to an environmental imperative, however in a flexible sense:" I feel that in some way we need to protect the forest. […] I am not negative towards forestry. We need to use the forests. But there are different ways to do it" (R1). Similarly, another respondent states: "And for me it has been really important to protect nature and animals and living beings. To give a voice to nature and the animals who can't speak for themselves" and suggests that: "if you could combine forest-based bioenergy production and keeping biodiversity at the same time, that would be the best way forward" (R12). Hence, the emotional pragmatist typically takes a pragmatic approach to combining extraction of forest-based biomass for energy with other values.

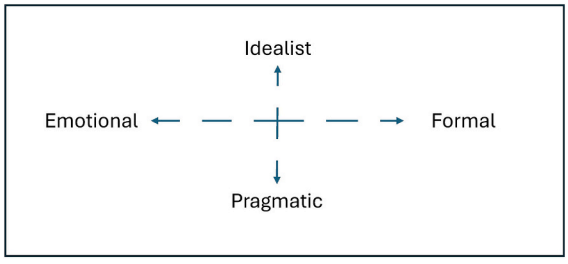

Fig. 2. The two dimensions that developed throughout the analysis. These four categories partly correspond to Weber's (1978) ideal types of social action. The vertical dimension shows normative orientation from idealist (value oriented) to pragmatist (practical or instrumental orientation) and the horizontal dimension shows a scale from emotional to formal.

Table 1
A typology with four distinct positions.

	1. Emotional pragmatist	2. Emotional idealist	3. Formal pragmatist	4. Formal idealist
Diagnosis	The forest is a safe place and we need to protect it. We need to use the forests. But there are different ways to do it.	Promises from the industry turned out to be bullshit. We must realize that we cannot consume our way out of this crisis.	There is a lot of talk about carbon budgets, but in reality, it's already full. Ideally there should be a fee on everything that is emitted.	I have been going through all the available data. Logging of forests in a clear-cut is destruction of forests.
Action bias	Encourage large-scale forestry to embrace environmentally friendly methods, rather than protecting limited forest areas. We need to look for solutions that solve multiple problems simultaneously or at least do not generate new problems.	EU legislation, economic incentives and renewable energy targets have to account for the carbon emissions from bioenergy. Talk more about general reduction of production and consumption.	Aim for carbon emission free energy solutions rather than fossil free ones. Force legislative demands on nature protection, and strict follow-up. Cascading use principle is a key for sustainable biomass use.	In a circular economy, burning resources should be avoided. Holism is needed, a key question is whether we want to save the climate or not. Create economic incentives for forest owners to let their forest grow older, and for forestry to set high biodiversity targets above yield or monetary targets.

Emotional idealists (respondents: 3, 4, 8, 10, 11), the most common typology, expressed themselves using strong emotional language, e.g. in terms of rage, fear or frustration. For example: "The catastrophe became clearer and clearer. All the bullshit promises from the industry and so on turned out to be bullshit" (R10). In comparison to the emotional pragmatists, they are less optimistic in terms of finding solutions and primarily base their arguments on either their own political ideals or ecocentric values. For example, one respondent expressed:

> "a concern that biofuels are used as an excuse to justify continued high energy use in society, which will not work in the long run. And that we lose our forest along the way. […] a lot of people don't have the energy to do anything. You may be sad. You may complain in social media, at a maximum. It's not like people turn to the media or the authorities if your forest has been clear-cut, if you are very sad about it. Why would they? There is no one who cares and it's fully legal to do so. Like, what should one do about it? It's a big frustration."
>
> (R3)

Another respondent raised a similar critique, and in a similar phrasing: "The reality is that the policies that the Finnish and the Swedish governments have been imposing are destroying land […] we don't have enough wood in Europe" (R10). One respondent also spoke emotionally about societal challenges, e.g.: "I'm afraid that the entire society will collapse soon. I give it perhaps ten years." (R3).

For emotional idealists, joining an ENGO may be a choice based on emotions:

> "In middle school I signed petitions and tried to make my family change. When I was 15, I joined an environmental organization, because I felt very lonely in my convictions. [...] I had quite a lot of climate anxiety when I joined, and it decreased when I organized. [...] I found a sense of community there that I hadn't found elsewhere."
>
> (R4)

The personal attachment may also be social: "In peace- and environmental networks I have many friends" (R3). While these are examples of emotional or personal reasons for joining ENGOs, another reason may be distrust and even rage: "It's a terrible industry. I mean, the forest industry is rotten to the bone, and it just has a very strong propaganda machine" (R10).

This suggests that for the emotional idealists, emotions as well as personal history and ties to other environmentalists play a significant role for their engagement in ENGOs. It enables them to find ways to channel their emotions by expressing their concerns and working together with likeminded people: "Our responsibility is not to come up with solutions to the problem, […] it is to bring attention to the fact that there is a problem, to raise awareness and make more people engage" (R3) and: "We must realize that we cannot consume our way out of this crisis" (R8).

When talking about venues for dialogue, forestry conferences were specifically mentioned, where different opposing actors come together in places where:

> "One should have coffee together and a nice time, to agree on different issues. They [the conference organizers] try to gather the forest industry, forest owners and their organizations, and the environmental movement. To reach some sort of consensus, they appear to believe. But that doesn't happen. You cannot transcend your differences in opinion when they are so deeply rooted, just by having some coffee. It's an enormous difference in values"
>
> (R4)

Apart from being critical towards current dialogue practice, the emotional idealist also expressed different levels of distrust in government, industry as well as the public:

> "The longer I've been engaged, the more disappointed I became in both society and the state. [...] It's just going in the wrong direction. And the societal debate is going in the wrong direction. And the companies make up new ways to make money and call it climate friendly. It's a gradual process of the confidence in companies, state and institutions deteriorating"
>
> (R8)

In this kind of reasoning there is a clear sense of we against them: "Foresters are trained to think that clear-cuts are the best. They have lived like that all their lives. Then it's difficult to have another opinion. They believe in what they do. And if you are stuck in your conviction that this is good, then it's probably difficult to change perspective" (R3).

Based on this type of critique, the same respondent further explained that:" I am also in an informal forest network […] where there are foresters, who themselves have changed their opinion from thinking that clear-cuts are great, to realizing that it's not good. […] All are engaged in other organizations already, and […] we act united on different issues that may arise" (R3). Another one instead mentioned the strategic potential "if you are a forest group based locally, then you have more legitimacy. If it's possible to say that we have lived here for generations, and we also have traditions and the right to make our voices heard. One can make other claims that way" (R4).

Formal pragmatists (respondents: 2, 6) rarely used emotional arguments nor provided details on their personal connection to forests. For example, respondent 2 repeatedly framed forest-based bioenergy as primarily climate change related: "Transportation is a large source of emissions in Sweden, but when you look at the numbers you see that forestry is even larger" (R2). Another respondent instead approaches "the issue more from a biodiversity-perspective than climate benefit" (R6), framing the argumentation in a formal way, though primarily concerned with the type of forestry management practices applied today: "[forest-based bioenergy…is] based on clear-cutting. It will not be profitable to do things like that in forestry without clear-cutting. [Forest-based bioenergy] is a manifestation of a way to manage forests that presupposes that we continue with clear-cutting" (R6). While respondent 6 clearly refrained from using emotional language, respondent 2 combined formal statements with strong language: "If normal people would know, there would be panic [...]" (R2), though quickly returning to more formal language: "There is a lot of talk about carbon budgets, but in reality, it's already full. There is nothing that can be emitted safely […] It doesn't matter in the atmosphere where those molecules come from" (R2). However, respondent 2 also acknowledged that "the more you learn, the more difficult you realize that it is [...] and then this EU-layer comes in, - 'well, but they [the carbon emissions] are accounted for somewhere else, so it's ok' [sarcastically imitating biofuel proponents]".

In elaborating their arguments on how to solve the problem (energy need vs climate), this formal pragmatist had thought of an explicit strategy repeated throughout the interview:

> "Ideally there should be a fee on everything that is emitted [...] perhaps if we try to understand how large the emissions are of a particular extraction. And then we take out a fee from the one doing the extraction, which in turn leads to price increases. Perhaps one can imagine that there would be a difference between timber that results in a building that stands for a hundred years, and that which becomes pulp or is burnt very soon"
>
> (R2)

Formal idealists (respondents: 5, 7, 9) framed forest-based bioenergy leaning on more formal arguments in combination with idealist views. Though emotional justifications were used, formal idealists commonly resorted to more formal causation: "forest-based bioenergy isn't perhaps the biggest problem, but forest-based bioenergy requires logging. And because we log in ways that affect forest habitats negatively, then forest-based bioenergy becomes a problem for us" (R5). Another one who expressed similar views, repeatedly referred to reports and formal sources of data:

> "I have been going through all the available data to check what the picture is and also scientific papers and reports [... for example] it's the definition of FAO [...], and it's also in [...] many forest laws for members of the FAO. Now, the definition of sustainable forestry includes not only production, but also conservation of biodiversity and social and cultural perspectives"
>
> (R9)

The formal idealists were less concerned with the reasons why forests are cut and more with the ways in which forestry is practiced. For example, one respondent used idealist arguments by relating them formally to climate change: "The largest challenge, number one, is that it [clear-cut forestry] releases a lot of carbon dioxide. We shall not release a lot of carbon dioxide. We shall **decrease** emissions. [...] The point is to fix the climate, isn't it? Fossil fuels are the worst. But forest-based bioenergy is also really bad […]. What I am working with is not about keeping cars on the road" (R7). When criticizing the scale and management practice of forestry, respondent 9 applied biodiversity arguments:

"From a nature conservation point of view, if you log too much forest then it's bad no matter what you use the wood for. [...] I can't really live with the idea of forestry as a form of agriculture. For me logging of forests in a clear-cut is destruction of forests. That's a radical difference in our perspectives. Where foresters currently see the beginning, the new fields they will plant with trees, I see destruction [...]. Really a difference

between us" (R9)

However, there were also examples of slightly pragmatic reasoning within this group of idealists: "We have many collections of trees that are not forests, because there is no functioning ecosystem. They are plantations. Of those plantations of course one can make forest-based bioenergy, but when we make forest-based bioenergy from functional ecosystems it results in negative impacts on forests and the values I see" (R5). This reasoning may have a tone of resignation or realism: "We can't live without forest-based bioenergy for now. We have been burning wood for energy since we started burning anything and we don't have a good substitute that we can use just right now" (R9).

While there was some pragmatism, as exemplified by the quotes above, the formal idealist generally put the environment before societal needs. This is also clear in elaborating their explanations of the status quo:

"If we listen to not least our politicians, you can tell that they don't view humans as part of an ecosystem, but rather that we as humans are outside of ecosystems and have the right to use them in ways that benefit us. A lot of people in today's society have lost this relationship, and don't see that we are a part of the ecosystem" (R5).

"A broad sustainable forestry definition is conservation of biodiversity. If the way you manage forests affects biodiversity negatively, it's obviously not sustainable. We would need fewer clear-cuts" (R9).

"Biogenic emissions within the Swedish territorial boundaries are larger than the fossil [emissions]. When we started to see that pattern, it appeared to me at least personally that this is entirely damn nuts […] it's not an argument. It's in the official statistics of Sweden. [...] It's so nuts that they account and communicate in this way. That they lead us onto policy measures [forest-based bioenergy to reach net zero by 2045] that are based on something that really doesn't work. […] They have managed to tout this solution and people buy it" (R7).

As these quotes exemplify, there is a strong sense of right and wrong, and idealism colours most of the reasoning, although it is also clear that there are differences in opinion depending on the type of forest that is being discussed, as well as whether the formal idealist base their arguments on climate change and/or biodiversity.

To summarize these positions short constructs were developed (Anzul et al., 1991) to illustrate diagnosis and action bias in the form of a typology with four distinct positions (Table 1).

3.3. System boundaries affecting the framing of forest-based bioenergy (RQ2)

System boundaries were analysed as part of the frame analysis (II, framing), relating to RQ2. Narrow system boundaries were identified among three of the respondents (6, 8, 9). However, this classification is not always representative of their actual systems view but rather turned out to be a strategy to delineate, i.e. deliberately choosing a narrow system boundary to simplify the issue in communicating with others. This occurrence corresponds to Entman (1993) notion of using frames for strategic communication purposes, and was explicitly demonstrated by a respondent, who when discussing substitution of fossil fuels versus carbon sequestration in forests said that: "It's a difficult question. Because it depends on what assumptions one makes and how you define your system boundaries. So that [the issue of substitution versus sequestration] we have tried to avoid a bit in our organization" (R6). In this example, the focus was highly formal (MHC order 10), addressing one question at a time, with clear compartmentalization of issues and explicitly avoiding complexity. However, there were also examples of more unintentionally narrow system boundaries, such as respondent 8 who was very focused on politics and Swedish forestry practice, expressing distrust in politicians and industry, but never elaborating on forests per se. A similar view was expressed by respondent 9, who mostly referred to forestry as a strictly formal policy matter.

Respondents (1,2,10), whose system boundaries were classified as medium wide, acknowledged some interdependencies and externalities of forest-based bioenergy, though with little precision and elaboration, for instance:" I am a researcher by profession. Then it's difficult not to see the big picture" (R1). By comparison, another respondent went further in elaborating on forest-based bioenergy as connected to planetary boundaries and multiple crises (climate, biodiversity, pollution), referring to them systematically (MHC order 11) as one of the same: "If you look at what forms planetary boundaries, you can divide them into six or eight or ten and you can intellectualize it in all sorts of ways. But there is one crisis and it's all part of the same crisis" (R10). However, when this respondent moved on to talk about potential solutions, i.e. alternative energy sources other than forest-based bioenergy, the systems view was narrower: lacking elaboration on their limitations, such as related to scale and externalities, thus unconsciously passing on the challenge to other domains. Respondent 2 similarly lacked further elaboration but did make some connections between different domains: "Vehicle transportation also needs to be solved, but it becomes strange then not to think about forests. They [transportation and forestry] are connected by the national blending mandates, which there is a lot of fuss about, [… but] we try to be rather simplistic, speaking only about our idea with carbon pricing."This suggests that also some of these respondents intentionally narrow their system view, to keep things simple when communicating their message, i.e. when arguing for their own solutions. Conversely, when defining problems, the system boundaries were wide - to encompass multiple negative aspects as a basis for their critique. Wide system boundaries were observed among respondents (3, 4, 5, 7) who identify and talk about multiple casualties and interdependencies, also reflecting metaphysically (MHC order 12) on e.g. the importance of value systems:

"When [access to] oil decreases we will use more forest-based bioenergy because we are dependent on a certain level of energy consumption. And we will do everything to maintain it, even if we know - well, some of us know - that we destroy our own conditions to live" (R3).

A similar concern was raised by another respondent, who is doubtful about the role of biofuels:

"[Forest-based bioenergy sources] are supposed to replace fossil fuels. Or, some is supposed to come from solar energy and nuclear power and other sources too. But it is a physical impossibility. We have forest-based bioenergy that has been stored for millennia and turned into fossil fuels. We cannot replace that with the biomass that is produced on Earth in a year and burn it. It doesn't add up" (R4).

Furthermore, wide system boundaries may be demonstrated by the request of a more multi-dimensional analysis: "It sometimes strikes me that some people actually don't seem to understand [...] how complicated the connections are, but they look at a single factor when it comes to forest production for example and then you miss the full picture" (R5). Wide system boundaries may also be more geared towards social values connected to forests:

"It's some kind of national identity, lots of different values connected to who you are as an individual and what interests you have, and there are economical values and cultural values. If you look at a picture of a forest, it's a bunch of trees standing in a formation, but there's so much more connected to it" (R7).

3.4. Solutions (RQ3)

The final part of the frame analysis (I) was the action bias, i.e. what actions or forward leaning interventions that the actors argue for and, what (if any) concrete solutions they perceive (RQ3). The action bias is often an answer to their problem definition, which in turn is dependent on the basis on which challenges are conceptualized (RQ1). The proposed actions and directions, as well as the desired course of development and outcomes according to the respondents, were compiled to three themes: New management, new tools, and new perspectives (Fig. 3).

New management involves suggestions not only about what kind of forest to use or avoid but also requests to optimize forest management

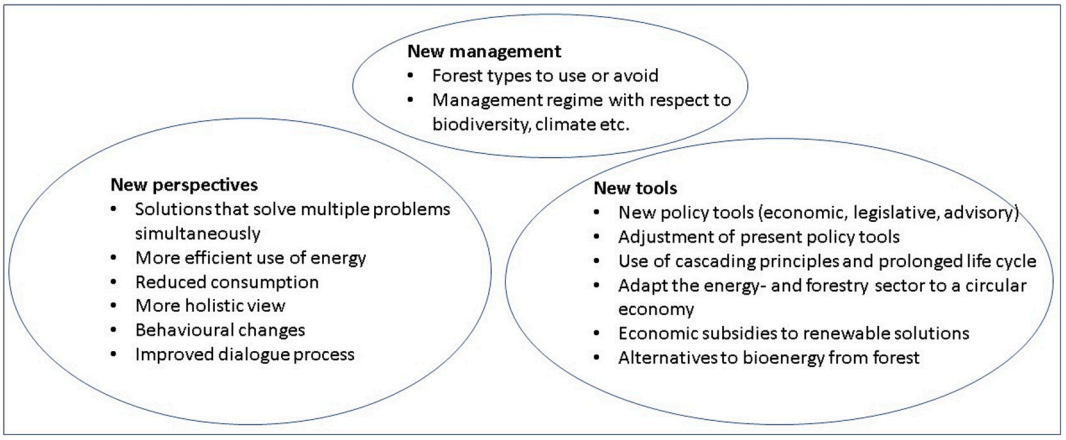

Fig. 3. The main actions proposed by respondents were divided into three themes: new management, new perspectives and new tools.

for a diverse production of long-lived forest products, including biodiversity and social values. **New perspectives** include suggestions for dialogue and collaboration, and for building trust among actors. Another important factor was behavioural changes leading to less energy consumption and more effective energy use. **New tools** gather the respondents' suggestions about new and improved economic and legislative instruments, and for instance adjust EU legislation and abolish subsidies and tax reductions regarding forest-based bioenergy. New tools also include using other energy alternatives and adaptations to a circular economy. Three respondents express this view in similar ways:

> "Basically, the [EU] Parliament wanted to cap the amount of primary woody biomass that could be counted as [contributing] towards the renewable energy target, and that was really going to be the thing that could have had an impact. Unfortunately, you know, the Member States of the Council led by Sweden, which had a really strong agenda on that point [...]. There is now no limitation on the type of forest biomass that can be counted towards the renewable energy target. [...] There is now an increased renewable energy target, which is great, but if you increase the renewable energy target, but there's no limitation on the amount of primary woody biomass I can count towards the target, then I don't see any other scenarios that doesn't increase the production of bioenergy. Because it was already a reality when the target was lower"
>
> (R11)

> "The energy transition needs to be a hundred percent wind and solar and geothermal. And maybe at a certain point we would crack things like wave power and so on, combined with good distribution grids, smart grids, obviously massive energy efficiency, storage. And we can now run an energy system without burning stuff. [...] And from my point of view, biomass is just another type of fossil fuel. It's carbon and burning carbon is a bad idea and we need to get out of it. That doesn't mean that you need to shut down everything today. You know we are not even shutting down the gas plants today. But certainly, there should be no subsidies for it"
>
> (R10)

> "The regulations don't protect the forests at all. It's nonsense. If we were to see it as a rape, we have a law that protects the perpetrator and criminalizes the victim. If you are active and engaged in trying to stop deforestation, you will be prosecuted"
>
> (R3)

The theme of **new tools** also includes suggestions for alternative sources of biomass:

> "Where we have one problem, can we solve that with some different kinds of plants? But then a mix of plants, I would say, so we don't go in for monoculture again. That we have a mix of plants. So that an ecosystem can adapt. For example, when it comes to reed, that needs to be harvested in the Baltic Sea because then we can remove nutrients like phosphorus and nitrogen, which is a huge problem in the Baltic Sea at the moment"
>
> (R12)

The quote above also indicates a request to find solutions that correspond to more than one societal problem. A more holistic perspective was asked for when formulating the problem, which is a key aspect in the theme about **new perspectives**. Some of the suggested actions prioritize climate considerations and some focus on biodiversity conservation. The respondents did not explicitly mention social or democratic aspects. The distrust towards the industry that was very dominant among the respondents, seems difficult for them to find a solution to, but they did propose that their trust in the industry would increase if there would be stronger economic and binding legislative instruments as well as improved follow-up procedures.

4. Discussion

This study contributes important insights in terms of the frames and framing processes behind critical opinions on forest-based bioenergy. This is not in order to change them, but to facilitate constructive dialogue despite an array of different and often conflicting frames. Individuals pertaining to the positions established in this study have different needs, and therefore dialogue facilitation may need to consider different process components to address the multitude of diagnoses and action bias as summarized in Table 2. In the following we reflect on particularly important aspects to consider in dialogue processes involving representatives of the respective positions.

4.1. Emotional pragmatists

With regards to the typology and respective positions identified, emotional pragmatists do not reject forest-based bioenergy per se. As such, they are potentially open for compromises in dialogue contexts. However, a prerequisite for successful dialogue is to demonstrate how to combine bioenergy harvesting with efficient tools for protection of environmental values such as biodiversity. Sustainable forestry standards need to meet biodiversity criteria.

4.2. Emotional idealists

Emotional idealists on the other hand, are concerned with broad societal challenges such as the (excessive) need for energy and the resulting environmental impacts overall. They strongly argue for

Table 2
Dialogue process components significance according to described typology.

Position	Typical needs, requests, or characteristics	Significant process components
Emotional pragmatist	-wants efficient tools for protection of biodiversity -are open for compromises	-Encourage continuous professional reflection -space to reflect on diverse values in relation to nature
Emotional idealist	-start by discussing broad societal challenges -emotions, values, and societal challenges come first	-consider cultural norms, political histories, relationships, trust, inequalities, and power asymmetries -explicit, acknowledge and validate people's (different) emotional attachment to nature -use the forest as the actual scene for deliberations
Formal idealist	-open for discussion -interested in finding constructive solutions -not easily abandon their own facts and opinions -possible to negotiate and discuss with -not interested in balancing different goals, such as economy versus biodiversity, to reach a compromise	-show trustworthy data and reports -demonstrate that/how their goals can be met -head for common agreements on definitions and shared facts -aim for meta-consensus and inter-subjective rationality -quality, reliability and interpretations of the reports and studies they refer to are
Formal pragmatist	-lean on reports and data -problem-solution-oriented	important issues to discuss (including methodology, conclusions, and problem definition)

measures to substantially decrease society's pressure on nature, before even opening up for discussion on specific activities such as forest-based bioenergy. Emotions, values and societal challenges come first, negotiation of details comes last. As one of the respondents puts it: "constructive dialogue requires more than 'having coffee', don't expect consensus, discuss value differences as a basis for understanding each other" (R4).

In dialogue contexts including emotional idealists, for conversations to be constructive, it is therefore essential to first address values and other issues much broader than the question of forest-based bioenergy itself (c.f. Niemeyer and Dryzek, 2007). This includes to problematize forestry as part of a larger issue, such as: society's overall energy and material use, and ecological overshoot; climate change; the biodiversity crisis; sociocultural values related to how humanity perceives nature; the contested right to exploit nature versus the intrinsic value of nature. Before allowing such broad critical discussions, the emotional idealist is not likely open to compromise, since narrow arguments albeit fact or research based likely will be refuted.

Inviting emotional idealists to dialogues, and negotiations also implies a need to invite and involve representatives from multiple sectors early in the process (c.f. Young et al., 2014), to provide grounds for discussing trade-offs, externalities, limitations and joint responsibilities across sectors. In other words, creating conditions for better dialogue likely requires participation by all energy dependent sectors, as well as user groups such as the transportation sector - not only actors involved in forestry for energy purposes. Being inclusive and engaging multiple sector representatives from science, policy and civic society is thus key (Brulle, 2010), as is using broader models and facilitating open-mindedness, to discuss the world as perceived differently by different stakeholders.

Facilitators should therefore be trained to enhance deliberative competence (Chilvers, 2008), e.g. to enable participants' self-reflection of values (c.f. Cornwall and Pratt, 2003; Westin, 2019; Westberg and Waldenström, 2017) and allowing for internal value reflection, before holding sessions with opposing actors and having them reflect on (value) differences together. Without acknowledging the meaning of feelings and personal experience, it is difficult to bridge and bond to other groups' perspectives. Often emotions in environmental management issues are either hidden by the actors themselves or dismissed as irrational or irrelevant (Buijs and Lawrence, 2013). However, emotions are inevitable components to human actions and dialogue facilitation requires acknowledging and considering this. One component is to explicitly acknowledge and validate people's emotional attachment to nature and use this as a common ground for shared discovery (Buijs and Lawrence, 2013). Sometimes it is a possibility to enable this sharing by using the forest as the actual scene for deliberations, to involve the material aspect and allow experiential learning on site (Buijs and Lawrence, 2013).

4.3. Formal idealists

Formal idealists are more open for discussion and interested in finding constructive solutions, but they do not easily abandon their own frames, facts, and opinions. However, by showing trustworthy data and reports, demonstrating that their goals can be met, it may be possible to negotiate and discuss possible ways forward. Constructive dialogue hence needs to start from and be based on common agreements on definitions and shared facts. However, the formal idealists are likely less interested in balancing different goals, such as economy versus biodiversity, to reach a compromise, since ideology is the primary basis shaping their views and hence what may be considered as acceptable action.

Formal idealists use formal concepts and language to give legitimacy to their argumentation. Ecosystem is such a keyword, and according to these respondents, only untouched forests – in contrast to plantations - are seen as ecosystems. These respondents also used the term ecosystem to criticize the lack of, and need for viewing human society as part of nature, thus justifying forest conservation and restoration.

One particularly challenging characteristic of formal idealists is that they seem to mask, rather unconsciously, emotional and personal experience-based framing behind their standpoints, by redressing them using more formal language. This can be explained as an attempt to ascribe their message a higher degree of authority in a policy context where instrumental rationality is recognized prior to other rationalities (Elling, 2008; Nielsen et al., 2016). Again, therefore, it is important in facilitation situations to explore the emotions and values that underpin even formal reasoning.

4.4. Formal pragmatists

Formal pragmatists base their arguments on reports and data – whether it is climate change, forest-based bioenergy, or biodiversity - in support of their views. Formal refers to their way of expressing themselves and using arguments. They are pragmatic in the sense that they have thought of potential solutions such as regulating forestry, emission caps, etc. They are problem-solution-oriented but see e.g. emissions or forestry as the main problem. The quality, reliability, and interpretations of the reports and studies they refer to are important issues for them, both in terms of methodology and conclusions, as well as the definition of the problem.

To understand formal pragmatists, as well as general framing differences, it is helpful to consider that environmental dilemmas often are handled through a "linear model" in which scientific facts are regarded as neutral and unbiased, although they are actually products of contemporary societal and scientific discourses (Young et al., 2014). This calls for two-way interaction which goes beyond "the packaging and presenting of information" (Young et al., 2014:389). Environmental dilemmas cannot be fully comprehended through a linear model, but are better understood as wicked problems containing uncertainty, complexity, diverse and deeply held values, different knowledge domains, multiple actors and multiple sectors (Young et al., 2014; Daniels and Walker, 2001). Actors may have different interests and understanding, even if the facts on the table are the same. Indeed, even which

facts that are trusted differ between the actors (van Hulst and Yanow, 2016).

4.5. Combinations of system boundaries

A recurring observation when analysing system boundaries of respondents in all positions is that where the line is drawn seems to depend on the context of the discussion. For example, some respondents keep boundaries narrow in order to simplify, but in parallel express higher complexity. Perhaps more importantly, the system boundaries changed when respondents were criticizing others, e.g. the forestry sector and politics, and when they were arguing for their own solutions. That is, when defining problems, the system boundaries were wide - to encompass multiple negative aspects as a basis for their critique. Conversely, the system boundaries were narrower when justifying their own solutions. The results thus indicate that in developing their views on forest-based bioenergy, different stakeholders may think broadly when criticizing others, and narrowly when trying to confirm their own views. This implies that how system boundaries are defined has less to do with system complexity per se but is rather determined based on preconceived notions of the system, not the least in relation to how it affects self-image and relates to worldviews and agendas. From this follows that a prerequisite for constructive dialogues is to facilitate a broadened systems view, for different actors to see arguments of others, and understand them as at least as legitimate as one's own.

4.6. General reflections on the typology and implications for constructive dialogue

Our results show that the needs of individuals representing the respective positions are highly dependent on background and personality, which has also been documented in previous research (e.g. Ernst, 2019). For instance, the three representatives from BirdLife in different countries arrive at different standpoints and forward disparate lines of arguments. They used three different frames, although their organization holds a common mission. The individuals and their personal traits thus seem to be more significant than the official policy of their ENGO. Therefore, process design for constructive dialogue calls for active consideration of participants' characteristics and their mutual relationships (Lundmark and Matti, 2015; Bennett et al., 2022). To achieve legitimacy, the participants need to experience reciprocity, i.e. a component of mutual understanding and that all participants feel that they gain from the relationships in the process (Bennett et al., 2022).

Due to project limitations this study did not focus on dialogue process design. The empirical results do not provide a complete protocol on considerations in dialogue design. However, the literature suggests some considerations that are highly relevant. Some significant components to take the participants' characteristics and relationships seriously are: early involvement; face-to-face interaction; process duration and recurring interaction; sufficient but not too extensive time; other activities complementary to plenary discussions (such as site visits and smaller meetings); and the characteristics of the venue (Ernst, 2019; Reed, 2008). The participants' different kinds of knowledge, experience, reasons to participate and their perception of the issue at hand need to be acknowledged, as well as recognizing their roles as citizens and legitimate political equals (Ernst, 2019; Hansen et al., 2022). Such considerations may foster empowerment which may in turn enable questioning of one's own standpoints, something that is often needed to achieve learning outcomes and change (Ernst, 2019). The respondents often refer to science in their argumentation, and some mention that the counterpart also refers to science, but less relevant research. When the critics use different sources of information and distrust the sources of information used by the proponents, there is a need to include moments of fact investigation and validation. Such joint fact-finding fosters shared learning, and for this new knowledge to be internalized by the participants, enough time has to be accommodated (Hansen et al., 2022). As joint knowledge generation takes place, it will also allow for collaborative reframing of the problem (c.f. Pearce and Ejderyan, 2020).

The ideal process that appeals to both pragmatic, idealist, emotional and formal positions, requires a communicative design that encourages participants to leave personal, sectoral, national, geographical interests and stakeholder perspectives behind, in favour of shared, human needs and reciprocity, in efforts of working out shared future visions (Mattila, 2016; von Essen and Hansen, 2015; Habermas, 1996; Finlayson, 2000). An optimal setting and procedure activate humans' capacity for considering alternative perspectives which allows for the strongest and wisest argument to gain acceptance in a public dispute where several arguments of different truthfulness and validity may compete (Habermas, 1984).

As indicated, facilitator capacities are crucial, however, to ensure long-term successful processes these should not be totally dependent on constant external facilitation, but also involve training of the participating actors themselves, to improve their own communicative and collaborative capacities, e.g. through tools and structures that encourage continuous professional reflection (Young et al., 2014; Caselunghe, 2018; Westberg and Waldenström, 2017).

Lack of trust is a key issue according to the respondents. Since trust is a key factor for successful collaboration (Senecah, 2004), this should be a high priority in the process design. The respondents ask for the forestry and bioenergy sector to be more attentive to follow nature conservation standards and build stricter routines, which may improve trust among ENGOs. For instance, the forestry companies should be the ones to report their possible mistakes regarding nature conservation and avoid hiding mistakes that ENGOs feel a responsibility to report. Any conspiratorial attitudes among ENGOs may decrease if the forestry sector is open with its shortcomings and planned actions to improve.

The results did not show any strong correlation between typology position and childhood experiences or forest ownership connections, which were initially assumed to affect respondents' emotional expressions. However, what turned out to be more central to their emotional motifs was fear. The type of fear that was described was fear of bird habitat loss, species extinction and fear of losing unique forests but also a more existential fear of risking future human life conditions and a strong notion of navigating between life and death. Respondents proposed that advocates for forest biofuels may also to some extent be driven by fear, but a rather limited sense of fear, such as fear of losing one's job.

Several of the frame elements regarding problem definition and action bias are consistent with previous findings by Ebenhard et al. (2019), who studied forest biofuels and birds; listing written sources from BirdLife, WWF and other ENGOs regarding the organizations' opinions on forest biomass for energy. Such statements included for instance: that bioenergy should not be counted as a carbon neutral source of energy; that bioenergy has worse climate effects than fossil fuels; that the use of industrial residues such as sawdust for energy is okay if it does not compete with other uses that may bind the carbon for longer time; that some of the logging residues should be left in the forest to provide habitat; and that EU policy on energy and climate should contain "safe guards" that limit the quantity and quality of the forest to be used (Ebenhard et al., 2019).

Although dynamic by nature, frames might become static since they sometimes are comfortable to stick with (van Hulst and Yanow, 2016), especially identity related frames which may provoke defence reactions and conflict perpetuation (Dewulf et al., 2009). However, conflict is not negative per se. Oppositely, much of contemporary research highlights conflict or agonism as inevitable and a contributing part of learning and development in environmental issues (e.g. Hallgren, 2016; Daniels and Walker, 2001), at least if constructively managed. Frames strongly affect actor conduct and reframing may thus be a way forward (Daniels and Walker, 2001).

5. Conclusions

In this study, we found rigorous and profound criticism of forest-based bioenergy among ENGOs. It is therefore of paramount ethical importance to offer a space for them to develop their assertions and jointly explore the nuances in the debate, the cautions they ask for and the futures they aim for. Identifying and mitigating environmental impacts, and understanding the socio-personal factors behind forest-based bioenergy criticism, is crucial for developing energy systems that are both sustainable and socially acceptable.

In summary, the frame analysis documented in this paper enabled us to identify crucial aspects and contribute deeper understanding of the multiple perspectives that co-exist in forest-based bioenergy criticism today. Hence, we have provided an empirical basis for unpacking what constitutes the social threshold necessarily reconciled with industry aspirations for a biomass extraction in forests that is socially just and acceptable. This information will be crucial for more constructive dialogue on the role and potential of forest-based bioenergy in the transition towards sustainable and socially legitimate bioenergy systems.

CRediT authorship contribution statement

Daniel Bergquist: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Elvira Caselunghe:** Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Gustaf Egnell:** Writing – review & editing, Funding acquisition, Conceptualization. **Johnny de Jong:** Writing – review & editing, Resources, Project administration, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.forpol.2025.103657.

Data availability

The data that has been used is confidential.

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