

## Instructions

Welcome back to continue the interactive query!

This round focuses on weak signals of change. Weak signals are disconnected pieces of information that at first appear to be background noise but can be recognized as part of a significant future change by viewing them through a different frame or connecting them with other pieces of information. The theme of this round is to examine how weak signals of change can be identified and interpreted in the broad environment in which the forest bioeconomy operates.

Please read the following instructions carefully:

There are 6 open-ended questions in this query, 3 general questions about weak signals (Questions 1, 3, and 5) and 3 questions applicable to the forest bioeconomy (Questions 2, 4, and 6). Questions 1, 3, and 5 are general level questions while questions 2, 4, and 6 take a stand on what the previous questions mean in the broad environment in which the forest bioeconomy operates. Before each question, the summary of the results of the corresponding question from the previous round (*Changes*) are presented.

You have 10 days (Sep 21 – Sep 30) for giving your answers and comments. Once you have submitted your answers, please return to the query later to review the discussions and add your comments on what others have said. In this round, I underline the importance of discussion. If you agree or disagree or would like to elaborate, extend, or deepen the previous comments, you can give your opinion and its justification/reasoning by commenting on the answers.

Please answer each question if possible. If there are questions which are hard for you to answer, you can skip the question. Still, I encourage you to think through the question from the perspective of your own field of expertise. Every answer is valuable, every answer can promote discussion.

Please note that eDelphi.org may operate slowly and a new query page may take a few seconds to load. In these situations, please wait patiently. However, if for any reason the pages do not load or you have any other questions regarding the query, please contact me by email.

Thank you in advance for your time and answers!

Best regards, Tuomas Mauno (tuomas.mauno@uef.fi)

## Question 1/6: Signs of weak signals in general

Answers of the first round question 1/6 (*What criteria could be used for identifying possible future changes? What kind of signs or signals of change would capture your attention when exploring information?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below.

	sustainable development	sustainability	strategies and policies	technology	trends
number of references	6	7	5	2	3

Considering this summary and other information, how can weak signals of change be identified through indicators or evidence we have in present?

Second round Question 1: In general, what evidence or indicators could be used for identifying possible weak signals of change? What kind of signs or

pieces of evidence of weak signals would capture your attention when exploring information?

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

## COMMENTS

*Comment date Sep 22, 2022, 8:44:44 AM*

From the perspective of my country i would say that landowners behavior and opinions are generally important. Their willingness to invest in land, silviculture and to harvest wood is important for the entire bioeconomy.

*Comment date Oct 3, 2022, 11:46:40 AM*

yes, also in my cpuntry this is very relevant

*Comment date Sep 23, 2022, 5:21:58 AM*

I think that I am not very fluent in noticing weak signals. I follow the EU decision making and the drafts of the different programs and strategies etc, are important that I think that they are already quite strong signals. The different project ideas from the different stakeholder groups are perhaps closest to the weak signals in my job.

*Comment date Sep 26, 2022, 10:34:18 AM*

If someone could collect the lobbying organisations in BRU to give their view on coming issues of interest, that would be interesting though this might not bring into light really WEAK signals.

*Comment date Sep 26, 2022, 10:31:56 AM*

Our organisation trains and educates forest owners and professionals. They meet thousands of individuals per year and have a good view on the changes in opinions, values and attitudes of these groups.

*Comment date Sep 27, 2022, 7:13:03 AM*

And how are these views communicated to someone trying to perceive the weak signals?

*Comment date Sep 29, 2022, 12:03:42 PM*

We are developing reporting of these observations, to be able to share the silent information captured.

*Comment date Oct 3, 2022, 1:10:34 PM*

This good point. The training and education has a long history, well-established, institutionalized framework. Additionally, forestry itself is a really long term operation /phenomenon. These strengthens the keeping things as they are, slowing down the observation and reaction to weak signals.

*Comment date Sep 26, 2022, 1:27:13 PM*

Our changing values, the relative significance/emphasis on some and not other values

*Comment date Sep 27, 2022, 10:39:34 AM*

MODERATOR'S COMMENT: Thank you, good commenting! Please note that weak signals are information that at first appear to be background noise but can be recognized as part of a significant future change. -Tuomas

*Comment date Sep 27, 2022, 10:52:11 AM*

Weak signals are commonly global, i.e. they appear first "somewhere", beyond the "normal observation environment". They appear in NGO discussions, ordinary people's local level observations on some very local, minor phenomenon at the time, but that phenomenon may increase to the general phenomenon that will be institutionalized later on as a part of routines and every day practice.

=> to recognize this, one must observe global media debate, talk and follow actors beyond the traditional, dominating operation environment.

=> the combination of observations from various sources provides evidences of weak signals.

*Comment date Oct 3, 2022, 11:42:17 AM*

I fully agree

*Comment date Sep 27, 2022, 12:09:25 PM*

Consumer behaviour is interesting to follow too. What kind of products are favored/banned by customers. From forestry point of view it is also interesting that citizens that do not own forests do have more and more opinions how forests are managed and which are acceptable practices and which not in the future.

*Comment date Sep 29, 2022, 8:37:15 AM*

Citizens/consumers views are to a large extent affected by NGOs, industry information and media, so there it begins. How does the public adopt the differing views from the industry and the NGOs.

*Comment date Sep 29, 2022, 12:01:53 PM*

Young people represent the consumers of the future - how they behave, what they see, what they imagine - maybe these are the current weak signals?

*Comment date Sep 30, 2022, 2:22:29 PM*

Behaviors and politics... I think plenty of the decisions made in EU may impact on the „future of forests“.

*Comment date Sep 27, 2022, 9:05:08 PM*

We would use the potential of a weak signal to be disruptive to existing systems as an identifying marker. In speaking to forest sector audiences, my typical after-the-fact example of this is the rise of the internet and its effect on paper demand. Is this development likely to break a normally functioning system (whether, social, natural, economic, or other)? Is it going to affect the ability of existing companies to continue profitable operations? Is it going to create a new market, product, behaviour, or ecological niche that did not exist before that we may not be easily able to understand, model, or predict?

*Comment date Sep 29, 2022, 12:00:20 PM*

Nice idea to be able beforehand to identify disruptive technologies (Internet, mobile phone), but how likely this is? Rather, they are easy o notice afterwords.

*Comment date Sep 29, 2022, 12:43:04 PM*

I would say that the goal here ought to be to identify the risks that they could pose early. Maybe an analyst will understand the value of a weak signal instantly and flag it immediately, but you're right that that is unlikely. The goal ought to be to grow an awareness of all of the potential threats and opportunities and be able to monitor them as they grow (or not).

The goal can't be to have that awareness immediately, but rather to have it earlier than it would have otherwise appeared.

*Comment date Sep 30, 2022, 2:21:07 PM*

Perhaps this goes towards analyzing the population who can access these disruptive technologies and could benefit from their usages, to draw predictions on the impact to elsewhere.

*Comment date Oct 3, 2022, 2:12:02 PM*

Good point. It is also worth following up on populations that aren't able to access these technologies and to see how they are affected.

*Comment date Sep 29, 2022, 5:15:25 AM*

From technology standpoint, weak signals could be captured from other industrial areas having bigger manufacturing and R&D resources.

*Comment date Sep 29, 2022, 7:24:45 AM*

I Follow the media - and discussions in the newspapers. There the messages are more well formulated than in social media, witch contains more emotional noise. I try to understand, what the discussion tells about cultural readiness and values of life. Activists have the role of speeding the rising of new ideas and belief structures.

*Comment date Oct 3, 2022, 11:02:33 AM*

I think that the role of activists is relevant and, as you say ,they speed the rising of new ideas. However, their beliefs (core beliefs and secondary beliefs) must be analysed looking for the scientific evidence they are based on.

*Comment date Oct 3, 2022, 1:01:45 PM*

In this analysis, it would be relevant to understand multidisiplinary approaches. I.e. not to interpret activists's observation directly through "forestry lenses". In this there is risk of a straight forwarding interpretation and losing some valuable/weak signals.

*Comment date Sep 30, 2022, 2:18:05 PM*

Trustworth media is obviously one source. There are also plenty of data, which can be utilized to model the trends, some of the qualitative data could be utilized to explain it. Behavioral science is also good when predicting potential future trends, especially when it comes to sustainability.

*Comment date Oct 3, 2022, 1:05:58 PM*

What is trustworth media? Recently, e.g. A-Studio, Yle, and Helsingin Sanomat has been criticized in the public debate on one way or another emphasized perspective towards various issues. The public has even less trust towards large media house in US, UK, not to mention hazardous areas (Ukrain, Iran). Who is cabable to define "trusthworth media".

*Comment date Oct 3, 2022, 11:41:25 AM*

map of actors and beliefs (core and secondary) .  
some possible actors:  
consumers (maybe by age range)  
policy decison makers

firms (SME local, global value chains, landowners)  
trade unions  
ONGs  
academia  
professors and school teachers

## Question 2/6: Signs of weak signals affecting the future forest bioeconomy

Answers of the first round question 2/6 (*What criteria could be used for identifying possible future changes that may affect the forest bioeconomy?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below.

	carbon	climate change	forest resources	technology	use of forests
number of references	4	3	3	2	8

Considering this summary and other information, how can weak signals that may affect the future forest bioeconomy be identified?

Second round Question 2: What evidence or indicators could be used for identifying possible weak signals of change that may affect the future forest bioeconomy?

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

## COMMENTS

*Comment date Sep 22, 2022, 8:46:30 AM*

Much the same answer as the previous question but more focus of the willingness for long term investments in silviculture

*Comment date Sep 23, 2022, 5:25:12 AM*

Perhaps the number of public news in the field of forest bioeconomy? What is in the news and how many times some issue is mentioned? Difficult question...

*Comment date Sep 26, 2022, 10:36:28 AM*

Like said earlier: Our organisation trains and educates forest owners and professionals. They meet thousands of individuals per year and have a good view on the changes in opinions, values and attitudes of these groups. In addition, following and media analysis of non-forestry news could raise topics not seen otherwise.

*Comment date Oct 3, 2022, 1:12:54 PM*

The risk here is too well established institutions and, consequent, slow reaction on the surrounding environment. Some weak signals can be lost due to "too good" framework.

*Comment date Sep 26, 2022, 1:29:03 PM*

Again, changing values, more emphasis on the economic valuation of forest ecosystem services, changes in energy supply and prices,

*Comment date Sep 28, 2022, 3:59:41 PM*

Ecosystem services are a big deal. Clean air and water are not cheap to produce artificially. Once those services are adequately valued, there is going to be a different balance between the value of felled trees and the value of standing ones. (And this is maybe likely to make things difficult for bioeconomy businesses, depending on how they acquire raw materials.)

*Comment date Oct 3, 2022, 1:14:59 PM*

Agree. The role of "ecosystem service business" is likely to increase. Especially in areas which are not commercially dependent on timber business. This may lead to new type of business and influence on raw material flows.

*Comment date Sep 27, 2022, 10:56:21 AM*

Related to the previous comment: "Weak signals are commonly global, i.e. they appear first "somewhere"..."

In the same way, also considering the future forest bioeconomy, one should expand the observations beyond the institutionalized operation environment in order to be able to observe weak signals from the science (e.g. planetary boundaries => impact on ff bioeconomy) and NGO debate, global media and local micro comments from various local people.

*Comment date Sep 27, 2022, 12:14:32 PM*

The sustainability of forest bioeconomy will be/is already questioned. This is demonstrated in the development of the EU legal framework. Therefore, it is important to be able to prove that FBE can provide credible sustainable solutions for climate change and nature loss.

*Comment date Sep 27, 2022, 1:20:56 PM*

The number of people taking part in and benefiting of the forest bioeconomy value chain is getting smaller, and the number of people who have other than straight economic interest on forests is growing. At the same time the emotional narratives have a bigger role in individual thinking values and belief structures. These structural changes have developed to a degree, that they have actual effects. For example EU environmental policy has taken over Eu bioeconomy and forest policy. This is the new normal. I anticipate and wait for Weak signals on the arising of a new synthesis paradigm. The synthesis paradigm should consist both the old Brundtland AND the present environmental emphasis (systemic change) paradigms. The research community should question the usefulness of the present paradigm in solving SD problems, but so far the research community seems to be very homogeneous.

*Comment date Sep 29, 2022, 12:09:06 PM*

For long I have thought that the term sustainability (with famous 4 corners) should be rewritten that it is only ecological sustainability that matters, and the other corners (economic, social and cultural) have a descending importance. Today, after the start and expansion of the Ukraine war, I believe, that the pressing emphasis on ecological aspects will decline in the future, as the economies of the world try to survive and keep welfare. Also in the EU.

*Comment date Oct 3, 2022, 1:17:07 PM*

This is a big risk during the coming decades. The growing global population, and their rights to basics (food, energy, education) strengthens even more economic-socio-cultural dimensions of sustainability.

*Comment date Sep 27, 2022, 9:09:12 PM*

Changing product flows within the forest economy is a key indicator. Does this develop alter silvicultural practices, milling, pulp and paper operations, or consumer products?

For natural signals, how is this development going to affect its ecosystem? Will it change in size, move to a different location, change in diversity or species mix? How will it affect the ability of bioeconomy companies to acquire resources that they had expected to be reliable?

*Comment date Sep 29, 2022, 5:17:01 AM*

Exploring people's willingness to pay and changes in the willingness...

*Comment date Sep 30, 2022, 2:24:50 PM*

Sustainability goals and the requirements and timelines to fulfill them. I also then any requirements for any certifications impact on potential signals on change. One needs to understand what these requirements practically mean to a forest owner and how they incentivize to a certain behavior.

*Comment date Oct 3, 2022, 11:48:55 AM*



weak signals of change that may affect the future forest bioeconomy, in my view, can be detected by interviews not only to the forest sector. all the actors mentioned in question 1 and other sectors related to forest.

### Question 3/6: Sources of weak signals in general

Answers of the first round question 3/6 (*Where do the possible future changes appear in the present? What are some channels, platforms, or sources of information where possible future changes may be identified?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below

	media	political debate	research	social media	web discussion
number of references	7	3	4	5	2

Considering this summary and other information, what sources are likely to be useful for identification of weak signals?

Second round Question 3: In general, where do weak signals of change appear first? What are some channels, platforms, or sources of information where weak signals of change can be identified?

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

### COMMENTS

*Comment date Sep 22, 2022, 8:50:53 AM*

National statistics of areas regenerated with different intensities, trends in volumes harvested and prices on timber and forest estates and the relationships between these. Another source of information is interviews and questionnaires among forest owners and to follow social media.

*Comment date Sep 30, 2022, 2:40:21 PM*

Statistics showing for example inflation trends, other economics indicators, will help to understand the potential impact on the forests and their usage.

*Comment date Sep 23, 2022, 5:26:23 AM*

The above table is good. For me the political debate, media and research are the first options.

*Comment date Sep 26, 2022, 10:38:16 AM*

In the meetings, seminars and papers of those who do not share similar (professional) background. In my opinion a good way is to stop and think if something happens that make you ask yourself What? and Why?

*Comment date Oct 3, 2022, 1:21:46 PM*

Definetely. Multidisciplinary discussion in science and practice may help oneself to open his /her eyes towards new type, beyond the tradition coming weak signals.

*Comment date Sep 26, 2022, 1:30:33 PM*

They appear within related organizations and institutions, and among other key stakeholder groups-- published pieces (both peer- and non peer-reviewed).

*Comment date Sep 27, 2022, 10:45:25 AM*

MODERATOR'S COMMENT: Good commenting! When identifying weak signals, are channels, platforms, or sources of information same as in the previous round (Changes)? What do you think? - Tuomas

*Comment date Sep 29, 2022, 7:36:05 AM*

I agree

*Comment date Sep 27, 2022, 10:57:08 AM*

Again the two previous questions:

Observations beyond the institutionalized operation environment in order to be able to observe weak signals form the science (e.g. planetary boundaries => impact on ff bioeconomy) and NGO debate, global media (professional ff media, but most of all, all kind of media debate on environmental, resource issues) and local micro comments from various local people.

It is essential to recognize the potential connect of some totally different phenomena to ff bioeconomy: women's education and capacity to use energy efficient technology in Africa -> impact on ff bioeconomy there, discussion on the opening of wild trout pathways around hydro power plant - > potential LULUCF impact elsewhere, etc.

To be able to observe this, one needs to conserve really open minded attitude to all kind of information sources.

*Comment date Sep 28, 2022, 4:03:48 PM*

If I understand this correctly, then you are looking at niche (rather than mass) media, particularly among marginal social groups. And, if so, I entirely agree. Those are often going to be the first groups exposed to, and seeking solutions for, a problem... and often the first to look for unorthodox solutions (that require few resources).

*Comment date Sep 27, 2022, 12:18:41 PM*

Social media and mainstream media. Unfortunately, many of the first signals of change are coming outside from the "traditional" forest sector. Therefore, the sector usually can only be reactive in trying to address and resolve (or deny) the problems presented.

*Comment date Sep 27, 2022, 9:15:22 PM*

Weak signals of change likely appear first at the water cooler, where someone is reacting to a new development (in that case, there is both a change and a human reaction to it). However, verbal sources are clearly difficult to source and to cite, since they are transient and scale poorly.

Some low-quality internet media sources that cater to specific niche topics can be far ahead of other sources. They can provide leads to be followed, but are difficult to scan (and may not be reliable).

Research papers are an excellent source of leading-edge technological material for scanners savvy enough to evaluate them.

Mainstream publications are helpful, in part because they are far enough behind the leading edge of technology that they are able to provide insight into how technologies are being received or reacted to, and are less speculative.

*Comment date Oct 3, 2022, 1:20:12 PM*

Agree. Mainstream publications are relatively reliable to support relatively slow science.

*Comment date Sep 29, 2022, 5:19:57 AM*

Research papers are a good source, especially those studying consumer behaviour.

*Comment date Sep 30, 2022, 2:38:48 PM*

Agree, these help to analyze and predict also directions on topics seen on media.

*Comment date Oct 3, 2022, 1:18:45 PM*

Commonly, research time span is relatively slow. This is a risk that in the really high-speed changing world the outcomes come too late or they are not comprehensive enough in today's world.

*Comment date Sep 30, 2022, 2:38:00 PM*

I would say media, especially when suprising changes created by natural catastrophs or war situations (if these cannot be predicted, otherwise predictions based on weather forecasts, politics

situations etc). When not so suprising, there are trends that can be recognized through social media especially when touching human behaviors.

*Comment date Oct 3, 2022, 11:57:53 AM*

academic papers  
media  
politica debate  
ONGs debates

## Question 4/6: Sources of weak signals affecting the future forest bioeconomy

Answers of the first round question 4/6 (*Where do the possible future changes that may affect the forest bioeconomy appear in the present? What are some channels, platforms, or sources of information where those possible future changes may be identified?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below.

	climate change	EU commission	history and past development	same answers as in question 3/6	technology
number of references	2	2	2	5	2

Considering this summary and other information, what sources are likely to be useful for identification of weak signals that may affect the future forest bioeconomy?

Second round Question 4: What are some channels, platforms, or sources of information where weak signals of change affecting the future forest bioeconomy can be identified?

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

## COMMENTS

*Comment date Sep 22, 2022, 8:51:55 AM*

The same as the previous question but more focusing on activities and opinions on long term investments.

*Comment date Sep 23, 2022, 5:28:50 AM*

The different EU platforms are important. Also the research concerning the speed and direction and the different effects of climate change are important to be able to apply the different tools to adapt to climate change.

*Comment date Sep 27, 2022, 7:18:51 AM*

I agree that what happens at the EU-level is very important.

*Comment date Oct 3, 2022, 1:33:43 PM*

Yes, EU is important in what is coming in the next 5-10 years. To go beyond that requires the following of global/local grand/micro phenomena, e.g. through (social) media, multidisciplinary discussions and initiatives.

*Comment date Sep 26, 2022, 10:40:25 AM*

As earlier: In the meetings, seminars and papers of those who do not share similar (professional) background. In my opinion a good way is to stop and think if something happens that make you ask yourself What? and Why? .... It would be fruitfull to participate widely in non-professional and multidisciplinary events and meet people with different professional background.

*Comment date Sep 26, 2022, 1:33:41 PM*

News media, legislative authorities, forestry scholars and managers and other influential staff,

*Comment date Sep 27, 2022, 11:06:13 AM*

Global science, media, NGOs, social media in addition to various policy processes. For example, forest certification was rather a global south phenomenon in 1990's-early 2000's that expanded to North. The phenomenon was perceived a threat to the Finnish forestry in the beginning. Today 95% of forests are certified.

*Comment date Sep 29, 2022, 7:44:01 AM*

Certification in one channel to express the cultural understanding - what is regarded sustainable on average. The changes in certification minimum criteria show the cultural change which is interesting and one weak signal.

*Comment date Sep 29, 2022, 12:48:23 PM*

This is not my field of expertise, but what is the direction here? Are certification schemes becoming more permissive, or less so? Or what other changes are they undergoing?

*Comment date Sep 29, 2022, 4:02:01 PM*

Certification ambition levels are rising slowly (FSC and PEFC). They do not as such produce ecological sustainability in forests, only good starting point. In addition voluntary extra measures are needed plus more conservation. But what is enough - that is more a question of world view and personal values and the narrative one wants to follow. I suggest we try to find weak signals from changes in world views and values - Globally, locally,

*Comment date Sep 27, 2022, 12:20:41 PM*

As mentioned, social media, research and studies, mainstream media, and policy debate but by then the signal is not so weak anymore.

*Comment date Sep 28, 2022, 4:06:09 PM*

Relating back to the discussion in the previous question: specifically social media for marginalized, or outsider, groups. That said, it is very much hard to scan for an unknown problem, so it is hard to know specifically where to look.

*Comment date Sep 27, 2022, 9:19:14 PM*

Ecological research papers (good indicator of future supply).  
University press releases (indication of coming technologies)  
Trade press (value sense of whether technologies will be adopted)  
Other foresight work (scanning for different confirming/contradicting signals and analysis)

*Comment date Sep 30, 2022, 2:41:49 PM*

I would add here also UN sustainability goals and how they are applied, and if there is any future enforcement through increased regulation and their perhaps even unintended impacts.

*Comment date Oct 3, 2022, 12:02:19 PM*

IPCC reports  
UN sustainable goals  
academia papers

## Question 5/6: Features and characteristics of weak signals in general

Answers of the first round question 5/6 (*What do you think what might be some key features and characteristics of future changes?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below.

	bioeconomy	climate change	cross-sectoral	diversity	sustainability
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number of references	5	3	2	2	3
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Considering this summary and other information, what is the nature of weak signals in general?

Second round Question 5: What do you think what might be some key features and characteristics of weak signals in general? (not forest specific)

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

## COMMENTS

*Comment date Sep 22, 2022, 8:53:23 AM*

Supply and demand on the global market. Costs for energy and materials.

*Comment date Sep 28, 2022, 4:07:03 PM*

Reasonable. Rising costs tend to show the need for a solution to a growing problem.

*Comment date Oct 3, 2022, 1:43:24 PM*

Disagree, partly. Rising cost is a consequence of various political-economic hazards. The real problem is the over-consumption. How to decrease the consumption level of all, us, ordinary people to the sustainable level - this hardly would decrease even our quality of life.

*Comment date Oct 3, 2022, 2:22:53 PM*

I agree that over-consumption can be the (or, at the very least, "a") problem. However, rising costs tend to indicate that we are running out of a resource, often because it has been over-extracted. The rising prices aren't the problem itself, but they are a symptom of an emerging problem that needs to be addressed.

*Comment date Sep 23, 2022, 5:31:50 AM*

Climate change and biodiversity are controlling the discussion about the future. I don't know can they be considered as weak signals any more, they are quite every day issues nowadays. Discussions and subjects of social and cultural equality are the most interesting to me at this point because biodiversity and economy are controlling the discussion.

*Comment date Oct 3, 2022, 1:41:03 PM*

Agree. The next weak signals could be related to socio-cultural equal access to materials. The current technology aims at providing same good for all people. The technology is not aiming at solving the grand challenge of very limited resources of one planet. This leads to the increasing tension between global south and north.

*Comment date Sep 26, 2022, 10:41:37 AM*

They surprise when you notice them first. You may not understand meanings. They raise your curiosity.

*Comment date Sep 26, 2022, 1:34:41 PM*

Persistent, "low-amplitude", chronic, difficult to detect

*Comment date Sep 27, 2022, 10:51:24 AM*

MODERATOR'S COMMENT: Thank you, good commenting! I have a follow-up question: When thinking about weak signals, what kind of thoughts or feelings do they evoke? -Tuomas

*Comment date Sep 29, 2022, 12:52:08 PM*

I find that good weak signals can elicit strong emotional reactions both positive and negative--wonder or amazement, or disgust. But that can be very subjective.

A good sign to me is the discussion that a weak signal can generate among scanning teams, or elsewhere. If my scanning team spends a half hour discussing the various possibilities and concerns around a weak signal, it is a good sign to me that it is important.

*Comment date Oct 3, 2022, 1:38:33 PM*

Weak signal in ff bioeconomy is commonly something that is perceived somehow worth to deny among the traditional practitioners, science.

*Comment date Sep 27, 2022, 11:07:47 AM*

The essential issues is to really come out of the box to be able to read, interpret the surrounding societies at large, to note weak signals from different sectors that can be reflected directly and indirectly to ff bioeconomy.

*Comment date Sep 30, 2022, 2:47:10 PM*

I also think that one has to recognize the „big“ picture and how everything is connected to evaluate the impact to the „whole“ (social, economic, environmental and human sustainability).



*Comment date Sep 27, 2022, 12:25:24 PM*

The awareness of emerging issue/problem entailing need for a change. The problem or phenomena is yet to be fully understood or conceptualised. The majority does not recognise the raising issue at all, or deny its existence.

*Comment date Sep 29, 2022, 7:51:56 AM*

I agree - new thinking is often actively denied, and seen as an enemy that threatens existing belief structures and individual worldviews and values. Weak signals can be found from those ideas, that are most violently resisted in social media.

*Comment date Sep 29, 2022, 12:13:57 PM*

I agree, the majority may deny the existence of the signal. Maybe because of the narrative experience based views or simply because the signal is harmful for the things he/she represents.

*Comment date Sep 27, 2022, 9:26:04 PM*

Weak signals frequently occur outside of the domain in question. Otherwise, they are less "weak signals" and more "notable developments". What gives them power is their ability to surprise.

A weak signal should also present the potential for a significant departure from an existing, functioning system.

*Comment date Sep 30, 2022, 2:50:13 PM*

One has to experienced or knowledgeable to identify any smaller indicators which could trigger a greater change. The weak signal would be the indicator. So one needs to find that indicator from the trends etc and understand how that may impact the bigger picture,

*Comment date Oct 3, 2022, 12:04:40 PM*

outside bioeconomy for example climate change , biodiversity

*Comment date Oct 3, 2022, 1:35:19 PM*

Here, it is, likely, essential to go beyond the ecological box towards socio-cultural world: what is happening in peoples living styles, consumption habits, values etc.

## Question 6/6: Features and characteristics of weak signals affecting the future forest bioeconomy

Answers of the first round question 6/6 (*What features or characteristics may those possible future changes have that may influence the forest bioeconomy?*) were categorized using NVIVO qualitative data analysis software. The most referred topics and their frequencies are presented below.

	climate change	energy	European Union	use of forests	sustainability
number of references	3	2	3	5	3

Considering this summary and other information, what is the nature of weak signals that may affect the future forest bioeconomy?

**Second round Question 6: What are the features or characteristics of possible weak signals of change that may influence the future forest bioeconomy?**

Please give your answer in the comment section below (Elaborate on this topic (add a comment)).

After you have given your own answer, please comment on other answers and promote discussion.

### COMMENTS

*Comment date Sep 22, 2022, 8:54:45 AM*

Changes in policy, national and international and maybe especially EU.

*Comment date Sep 23, 2022, 5:32:25 AM*

Same as in the previous answer.

*Comment date Sep 26, 2022, 10:43:46 AM*

As earlier: They surprise when you notice them first. You may not understand meanings. They raise your curiosity. In addition: energy markets development reflects similar discussion as in nearly all other natural resource sectors; supply and demand, critics, opportunities, risks, public interest etc.

*Comment date Sep 27, 2022, 11:15:17 AM*

Precisely, one must have the capacity to read over-sectorial signals.

*Comment date Sep 26, 2022, 1:35:27 PM*

Same as in response to previous question

*Comment date Sep 27, 2022, 11:17:35 AM*

Knowing history: see, the previous example on the forest certification. The phenomenon may appear in a different context. One should be able to imagine how the phenomenon can move or be transferred from an other environment to ff bioeconomy. Out of the box thinking, application of various, non-traditional approach to ff bioeconomy interpretation and research.

*Comment date Sep 27, 2022, 12:35:15 PM*

The public debate of climate and nature loss may contribute to Increasingly to environmental awareness of public and consumers. On the other hand, need for societal and economic resilience due to other current crisis (Covid, Russia) will emphasise the need for increased self-sufficiency of the economy and use of natural resources nearby.

*Comment date Sep 27, 2022, 9:32:54 PM*

The bioeconomy is subject to a number of outside constraints that may help or hinder its progress. Changing climate will affect supply and could affect willingness to move away from a fossil fuel-based economy. It is dependent on a willingness by governments to address items previously considered externalities (i.e., pollution and carbon emissions) that previously not posed costs for its competition. It will also require value changes around consumerism, measurements of economic growth, and reducing the disposability of goods.

*Comment date Sep 30, 2022, 2:52:32 PM*

I think understanding of the sustainability goals and identifying there an indicator which may trigger the change on the usage of forests. Of course als the geopolitical situation, energy crisis etc may provide these indicators to predict the future of the usage of forests.

*Comment date Oct 3, 2022, 12:06:25 PM*

climate change  
biodiversity  
resilience  
just transition  
diversification of the production structure

Thank you!

Thank you for your answers and comments!

I encourage you to return to the query later to review the progress of the discussions and add comments on what others have said.

This round is open until September 30, 2022.

After the round has ended, I will inform you the results of this research. Please follow your email.

Once again, thank you for your participation!

Best regards, Tuomas Mauno