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EXPLORING MEDIA INFLUENCE IN DETERMINING FOREST ENGINEERS' PERCEPTIONS ON CLIMATE CHANGE

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Abstract: *Global climate change is one of the biggest threats to the environment, with direct consequences for the terrestrial life and the human activity. Thus, the analysis of public knowledge regarding the importance, causes and effects of climate change is entirely justified. The public knowledge about the phenomenon of climate change is influenced by the information available on the most accessible sources of information such web sources, TV shows and news. On the other hand, the perceptions of climate change are depending on many other individual cognitive factors such the level of education, the professional background or the direct experience with climate-change related events. The main questions asked in this study were: How the human perceptions on climate change are shaped? What role has the media in shaping the perceptions on climate change? To address these questions, we have considered a pool of 76 respondents, with education in forestry, from three counties situated in North - Eastern part of Romania. On the other hand, we have performed a search on several Romanian news portals using the keywords related with global change for the period 2009-2012. We have found 42 references about extreme weather events and their consequences (drought, floods, extreme precipitation, etc.), but only 19% of them were related directly to the global climate change. While the mass-media contribution to the formation of beliefs in climate change was difficult to prove, the professional background and the TV consumption habits appears to better discriminate the respondents. We conclude that the beliefs in climate change may be a kind of fashion amongst the forest engineers. While their perceptions on climate change are formed individually using different TV and internet sources, they seem to be shaped at the end by the professional milieu of the respondents.*

Key words: *media, climate change, forest engineer, perceptions.*

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1. Introduction

Climate change at the global level is the most important threat to the environment representing serious challenges for all governing structures at all temporal and spatial levels, especially for those working in the area of natural resource management [1]. Future climate change poses significant challenges for society, generating new living conditions.

The collective understanding of climate change has a critical importance for future human actions [35], [36]. Also, there are a lot of studies showing that the knowledge and the perceptions on climate change are influenced by information existing on media which means that media plays a major role in shaping and influencing public understanding and opinion about climate change [3], [39], [40].

Although beliefs in the reality of climate change seem to increase [9], a public consensus about the reality of the climate change and the need to adapt is far from being reached [27].

The media attention on climate change issue has started in late 1980's in European and US national daily newspapers and had peaks and declines over this time period. The peaks in media coverage are related to politicians' speeches during election period because they started to include climate change topic in their agenda, to IPCC reports, Kyoto protocol, COP meeting [8], [10] and to extreme weather events which were perceived to be caused by climate change (hurricanes, storms, windthrowns, droughts, floods) [2], [28], [40]. The declines are related to competing issues like wars, economic crisis or issues which were considered to have a greater importance [3], [4], [9], [10].

According to Downs (1972) [13], the social issues normally go through a cycle of increasing and decreasing interest. The decreased interest is due to the fact that the topic does not affect anyone anymore or the power holders want to drift the attention from climate change [2].

The US journalistic norms contributed to a deficient knowledge about climate change crucial issues [9], e.g. up to 50% of US articles about climate change doubted about its existence [8]. In Australia, the media suggested that Australian emissions were not amongst the causes of global warming [29]. In fact, Billett (2010) [6] showed how Australian and American scientific communities reached a consensus regarding the fact the climate change issue in mass media was deliberately distorted to reduce its importance. In comparison with North American and Australian sceptic press, the Finland, UK, New Zeeland are at the opposite [7], [12], [26]. For example, Indian press presents climate change as a scientific reality, 98% of articles from 2002-2007 attributed anthropogenic causes to climate change [6]. In conclusion, although the influence of the mass media sources has been proved to be short-lived due to switching mode from an issue to another [14], mass media is still a powerful tool for enhancing public consciousness on environmental issues [13], [37].

Some surveys made in Western countries have shown that for climate change one primary sources of information is represented by the television and daily newspapers [3], [38]. In India as well, a public poll argued that the print media was still the main information source on climate change [6].

However, the understanding of these

issues depends on individual characteristics like educational level, age, gender and occupation [42]. According to Lorenzoni et al. (2006) [25], people from rich countries do not view climate change as a threat, being more interested in health, family, safety and finances [24], [25] and people from poorer countries are more concerned about climate change [11].

The subjects of media coverage about climate change and the climate change effects on forests are particularly neglected in the Romanian literature. As a developing country, it is expected that Romania would confirm the pattern that the population concern about climate change may shift according to political, environment-related or economic events. The time period analysed in this study was marked by the economic crisis which has started in 2009 and by three years of extreme drought 2009, 2011 and 2012 [34]. The hypothesis of this study is that one may expect to find a link between the climate change issue presence in mass media and the public perceptions about the climate change.

2. Material and Methods

The data collection is based on the conceptual framework defined by Grothmann and Patt (2005) [18] on Model of Private Proactive Adaptation to Climate Change (Figure 1).

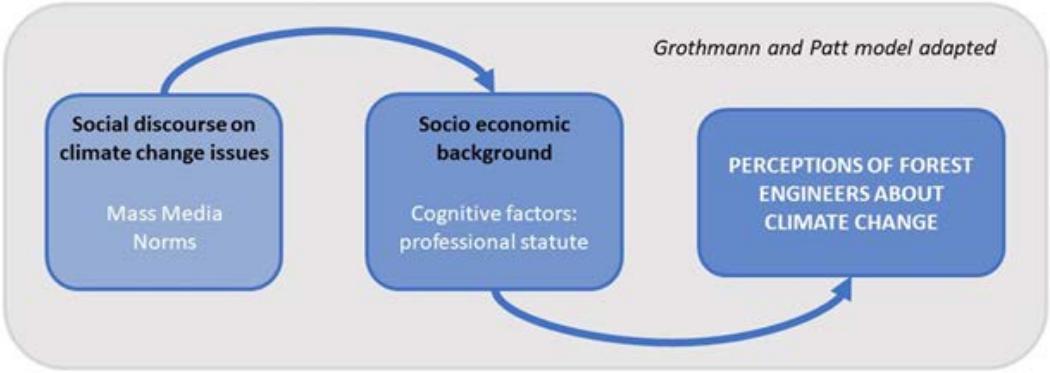

Fig. 1. *Grothmann and Patt (2005) model, adapted*

The main assumption is that the media directly influences the individual's perception on climate change risks and adaptation capacity. To investigate this hypothesis, we have chosen a population with homogenous professional background.

Thus, we selected as target population forest engineers with high education in forestry, employees of NFA (National Forest Administration), private forest districts or National Forest Guard. The target population was limited to these categories based on the hypothesis that 1) they have a comparable (homogenous) educational background on environmental and climate-change related issues; and 2) they have a direct contact with the forest and thus a direct perception of potential forest vulnerabilities under climate change threats. We assume that their individual cognition on climate change risks and

adaptation may be determined by the university curricula and by the social discourse on the climate change issue. Taking into account the fact that the population has received relatively poor information about climate change in their curricula, we hypothesised that personal experiences and media are the main factor differentiating the individual's perceptions on climate change risks and adaptation.

Thus, on one hand, we have collected data about individual perceptions about climate change in order to describe the individual cognition, and on the other hand we have collected data about the way the climate change issue is depicted in the media (severity, level of risks, effects).

To identify the individual perceptions about climate change, we have carried out a qualitative survey amongst forest engineers acting inside the forest management structures (forest districts – ocoale silvice) or inside the forest guards in three counties from Northern Eastern part of Romania (Suceava, Neamt and Botosani). In these counties, the maximum size of the target population (forest engineers working as forest managers or inside the forest guards) is estimated to be between 400 to 500 people, if taking into account that there are a number of 55 forest district (ocoale silvice), with 3 to 8 forest engineers in each forest district, and an estimated number of 50 forest inspectors inside the Forest Guards. First, we used the exploratory interview technique to pre-test on six respondents (forest engineers from a forest district in Suceava) which could be the relevant questions for identifying the individual perceptions about climate change in the Romanian context.

Based on these interviews, we have conceived a questionnaire organised in several sections. The questionnaire[2] includes a climate change section where the respondents were asked about their opinions on climate change causes and effects and about which phenomena are related to climate change. To establish a link between the individual's perceptions and media coverage, the questionnaire has a second part with a series of explanatory variables for respondent's media consumption habits and socio-economic factors (Table 1) that may shape the respondent's perceptions on climate change. The main questions are shown in Table 2. In total, we have undertaken 76 face-to-face interviews, the rate of answers being 100%.

Socio-economic variables Table 1

Respondent type N=76	***Proportion***
Forest owner unassociated	5%
State forest engineer	62%
Forest inspector	8%
Private forest engineer	21%
Other	4%
Forestry studies N=76	
Yes	100%
No	0%
Participation to climate change trainings N=76	
Yes	26%
No	74%

2.1. Data Analysis

The closed-ended questions were analysed based on contingency tables performed with log-linear models. The log

[2] The questionnaire contained several other three sections that were the subject of a different analysis undertaken by Mutu et al. (2014).

linear analysis is useful for examining more than two categorical variables compared to Pearson's chi test which allows only two variables at a time. The model built with this analysis shows the best variance in the observed frequencies [18]. For an easier results interpretation, we have chosen to draw mosaic graphs, introduced by Hartigan and Kleiner [19], [20] as a graphical view of the contingency tables [19].

Main questions analysis Table 2

Perception regarding climate change issues (N=76)
Which of the following opinions is closest to your opinion about climate change?
In your opinion, for the next 50 years the effect of climate change will be manifested by:
In your opinion, the global warming in the last decade is due to
Socio-economic background (N=76)
Category of the respondent
Education
Did you participate to climate change trainings?
Regarding climate changes, which is the main source of information?
Frequency of watching TV news
Experience as forest engineer, number of years.

In the mosaic charts, each cell of the contingency table is represented by a rectangle, the size of rectangle being proportional to the frequency of the response. The colours of the rectangles indicate the significance of the residual errors of the log-linear model (blue - positive significance and red - negative significance) which depicts the independence of each cell in the contingency table.

In order to identify significant responses from the mosaic graphs, the area of each rectangle represents the relative percentage of each type of response. The closed-ended questions related to climate change issues were compared with demographic and socio-economic variables (job position, type of studies, participation to climate change trainings).

From 67 mosaic charts generated, in only 7 charts the relationships between the responses were significant and the charts were kept in the study. Data analysis was done with R [16], multivariate processing being performed with the FactoMineR library [41] and the mosaic graphics with the Visualizing Categorical Data (VCD) [23].

3. Results

3.1. Mass Media Coverage of the Climate Change Issues

The search made on the five news portals revealed that there were only 42 references climate change-related for the period 2009-2012. The majority of news articles (81%) were related to extreme weather phenomena and their consequences (drought, floods, extreme rainfall etc.) and only 8 (19%) referred directly to global climate change. Thus, one may conclude that 1) the mass-media did not extensively cover in the period 2009-2012 the topic of the climate change and 2) whenever an extreme event occurred, in only one case of fifth the mass media related the event to climate change issue. The result is that, with only eight pieces of news about climate change events in five years, the mass media could not contribute to influence the formation of the individual perceptions about climate change. This finding does not exclude the potential effect of other types

of TV broadcasted information about climate change, e.g. TV documentaries.

3.2. The Main Source of Information about Climate Change Issues

For the respondents', the main source of information regarding climate change is represented by TV shows on climate change subject (43%), internet (22%) and journal news (17%). More than 10% of respondents mention scientific sources (articles, reports, conference participation) to be the main way of getting climate change-related information (Figure 2).

The analysis of the TV watching frequency shows that there are three consumer categories: big consumers (59% of the respondents) who are watching TV news daily, moderate consumers (30%) watching TV twice or three times a week and non-consumers (8%) watching TV news few times a month. Thus, television proved to be a relevant source of information on climate change and the TV consumer habits of our respondents comfort our approach of linking mass-media references on climate-change and respondents' climate change perceptions.

The frequency of watching TV was analysed in comparison with work experience and main source of information thus the main findings are as follows: the respondents with 10 or 20 years of work experience tend to watch TV daily and those with more 20 years of experience exceptionally watch TV (Figure 3a).

Our analysis also shows that the respondents who get information about climate change from TV shows mainly tend to watch TV daily, those who use internet to get climate-change related information tend to watch TV quite rarely and the respondents who use to discuss about climate change with colleagues tend to watch TV twice or three times a week (Figure 3b). In other words, the main information source used in general by the respondents would also be the source of information on climate-change related issue.

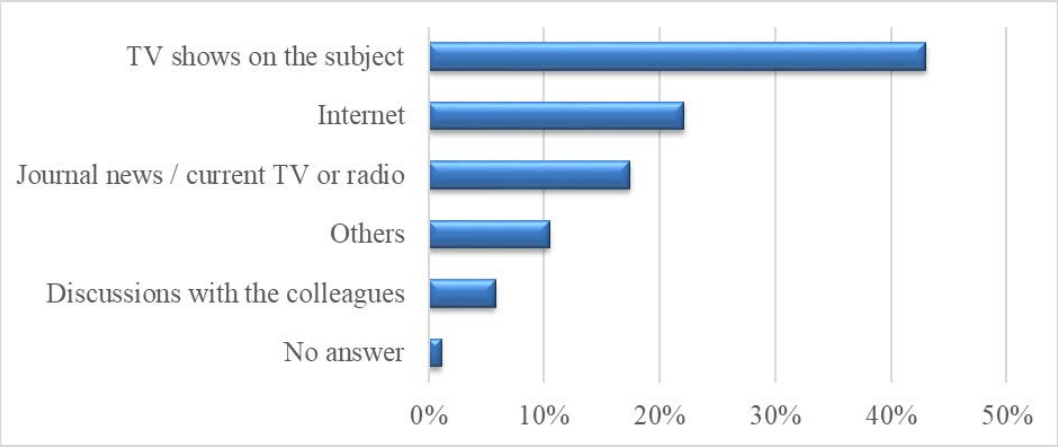

Fig. 2. *Source of information about climate change*

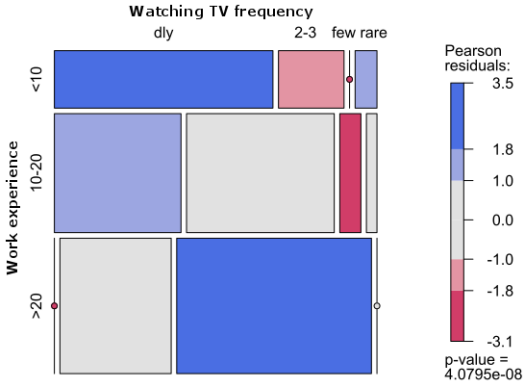

Fig. 3a. *Analysis of the relationship between working experience and frequency of watching TV (dly-daily, 2-3- two or three times/week, few- several times a month, rar- hardly ever). Longer the working experience, smaller is the TV consumption frequency*

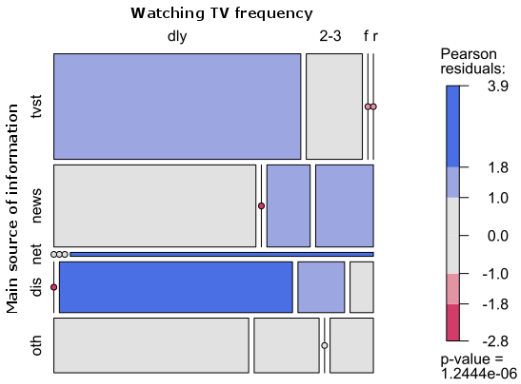

Fig. 3b. *Analysis of the relationship between source of information (dly-daily, 2-3- two or three times/week, f- several times a month, r- hardly ever) and frequency of watching TV (dly-daily, 2-3- two or three times/week, few- several times a month, rar- hardly ever). For those who are big TV consumers, the main source of climate-change related information is the TV*

3.3. Perceptions about the Climate Change

A high percentage of forest engineers (84%) believe that climate change is happening and just 3% of them do not believe climate change is real (Figure 4).

According to the respondents, the effects of climate change in the next 50 years will manifest through catastrophic climate change events like floods, droughts, flow reduction and extreme temperature variations (desertification, aridity), this perception cumulating 63% of respondents' options.

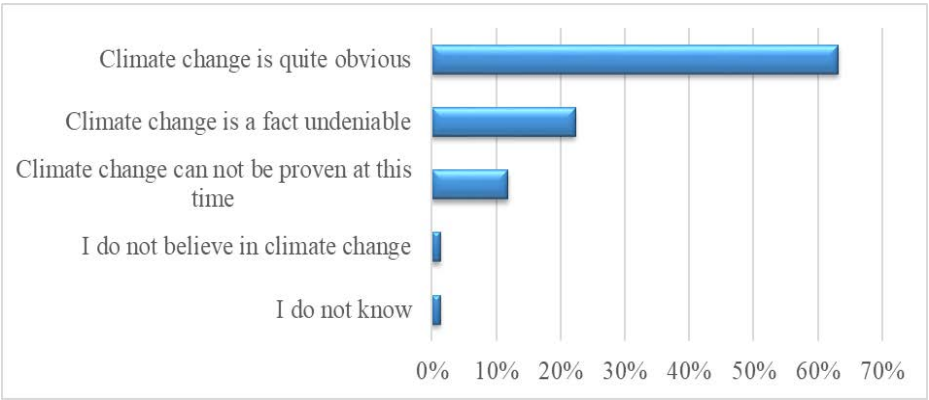

Fig. 4. *Respondents' perception about climate change*

Only a low percentage of the respondents (2%) agreed that there would be no changes of the climate in the next 50 years. Most of the respondents admit that both natural and anthropogenic activities are at the origin of the climate changes (72%) (Figure 5). The share of those denying the anthropogenic causes of the climate change (5%) is smaller than the share of those who do not believe in climate-change (slightly more than 11%).

Most of the respondents associated climate change with extreme events, extreme weather, and floods. The high percentage of no answer (32%) showed that the individuals do not know exactly what the climate change means in reality (Figure 6).

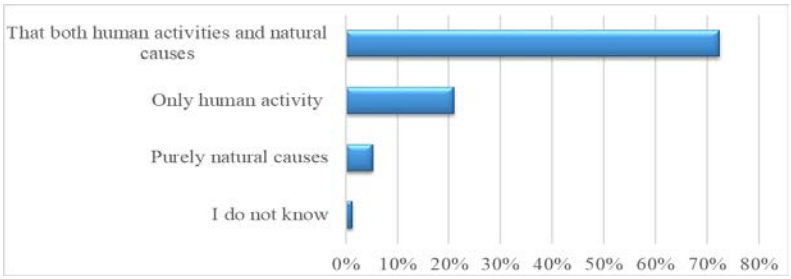

Fig. 5. *Opinions about the causes of global warming*

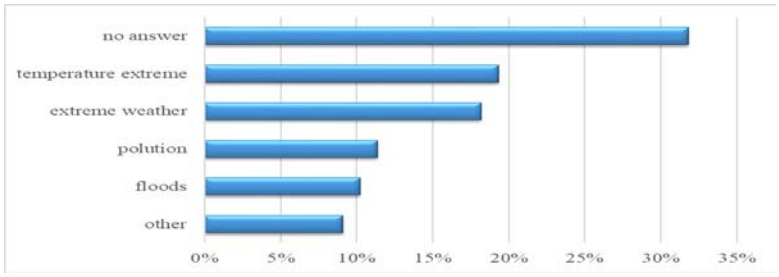

Fig. 6. *Opinions about recent phenomena due to climate change*

3.4. Role of Cognitive and Situational Factors in Determining Perceptions about Climate Change

We have tried to relate these perceptions with cognitive and situational factors that may influence the perceptions formation.

In Figue 7a, the tiles shaded in light blue (*hac*, *real*) and dark blue (*dnk*, *dk*) whose residuals are greater than +8.6 indicate a much greater frequency in those cells than would be found if *Global warming cause* and *Climate Change Opinion* were independent.

So, the respondents who admitted that climate change is real tend to say also that human activity is the cause of the global warming and those who do not have an opinion about climate change reality tend to ignore the causes of global warming.

The small dot shade in deep red (*nx*, *hac*) corresponding to the residual -1.4 indicates that this combination is extremely rare under the hypothesis of independence.

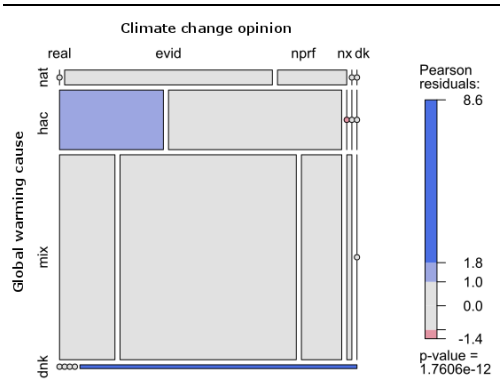

Fig. 7a. *Analysis of the relationship between global warming causes (nat- natural, hac- human activity, mix- mixed causes, dnk- do not know) and climate change opinion (real- real, evid- evidence, nprf- no proof, nx- no existence, dk- do not know)*

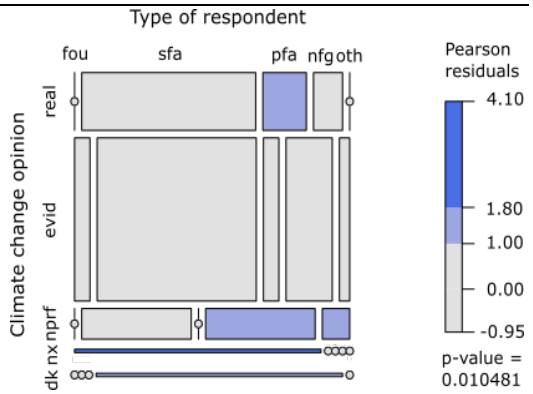

Fig. 7b. *Analysis of the relationship between respondent type (fou- forest owner unassociated, sfa- state forest administration, pfa- private forest administration, nfg- national forest guard, oth- others) and climate change opinion (real- real, evid- evidence, nprf- no proof, nx- no existence, dk- do not know)*

There is a low probability that the respondents who said that climate change could not be proved would think that human activity is causing the global warming.

In the Figure 7b, the tiles shaded in light blue and dark blue indicate a greater observed frequency than expected under the independence hypothesis showing a tendency of private forest administrator (pfa) to say that the climate change is real (real). The respondents who work at the national forest guard tend to say that there are no proofs of climate change or do not know about the topic while the forest owners (fou) and the forest engineers working for the National Forest Administration (sfa) tend to deny the existence of climate change (dk).

In the Figure 8a, the dark blue shaded tile (high, yes) with residuals greater than +2.2 indicates that there is a high probability that the respondents who participated in climate change trainings to say that Romanian forests would be highly affected by climate change in the future than to say there are no effects of climate change. Red shaded tile (no, high) with residuals equal to -1.6 indicates there is a low probability that respondents who did not participate to climate change trainings to declare that climate change effects on forests are high.

When analysing the relationship between respondents' category and opinion about climate change effects on Romanian forests (Figure 8b), the tiles shaded light blue, whose residuals are greater than +2.4, indicate much higher frequency that would be expected and -1.6 which indicate a lower frequency than expected under independence. Thus, it is a high probability that the state forest administrators (*sfa*) will say that climate change would moderately affect the Romanian forests.

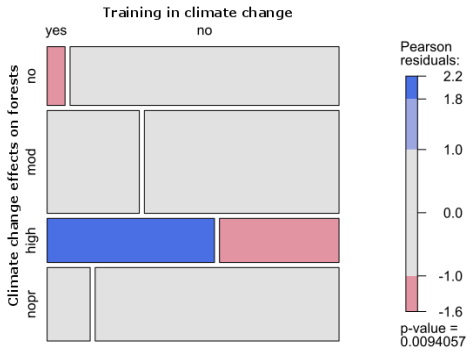

Fig. 8a. *Analysis of the relationship between opinions about climate change effects (no – no effects, mod- moderate, high-high, nopr- cannot be said exactly) on forests and participation to climate change trainings*

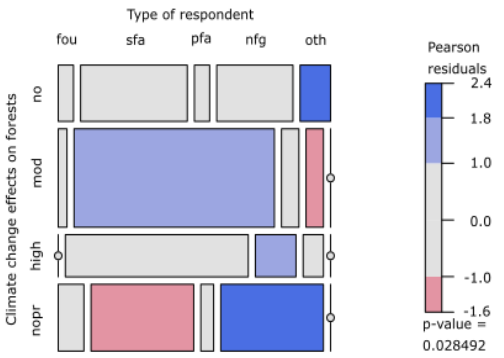

Fig. 8b**.** *Analysis of the relationship between opinions about climate change effects (no – no effects, mod- moderate, high-high, nopr- cannot be said exactly) on forests and respondent type (fou- forest owner unassociated, sfa- state forest administration, pfa- private forest administration, nfg- national forest guard, oth- others)*

The private forest administrators (*pfa*) opinions about climate change effects on forests differ from state forest administrators. There is a high probability that private forest administrator will say that forests are highly affected by climate change and a low probability to say that climate change effects cannot be proved.

Regarding the National Forest Guard (nfg), the dark blue shaded tile (nfg, nopr) with residuals greater than +2.4 indicates a higher frequency than expected under the hypothesis of independence, therefore there is a high probability of national forest guards to respond that climate change effects on forest cannot be proved rather than the Romanian forests will be moderately affected.

4. Discussions

We have analysed the influence of several factors in shaping the climate change perceptions amongst forest engineers in Romania. The population was chosen to have a homogenous educational background (forestry studies) which allows the search for other factors differentiating the individuals' responses, such as years of experience, professional background or news consumption habits.

Overall, the respondents have considered climate change an important issue, their perception confirming national and European perceptions that the climate change is the second important problem for mankind after poverty and starvation [17].

The results presented above have shown a good perception of respondents about the existence and manifestations of climate change, over 85% of respondents being aware of the reality of these phenomena, compared to some 40% of well-informed people in Romania as indicating by the Eurobarometer study

(2009) [44]. Also, the respondents have shown a good knowledge of the consequences of these phenomena, most of them admitting that increasing frequency of the extreme weather events is a consequence of the climate change. However, the general public in Romania seems to be more convinced about the anthropogenic causes of climate change than the people with forestry qualifications (46% in Eurobarometer study, 2009 against 21% in our study). The facts presented here should be interpreted as a dynamic phenomenon. Thus, according to Reynolds et al. (2010) [32], the US respondents were more aware about climate change in 2009 than the respondents from 1992 [32]. Some polls show that public understanding and public action on climate change issue is still low [40] and there is room for improvement.

The sources of information about climate change vary from colleague discussions and internet use to watching TV shows on climate change topic. Our respondents watch daily TV news, showing a similar percentage with other studies [6], [31]. While in other studies, the respondents link floods, extreme temperatures and droughts to climate change because media coverage have led people to think that they can draw deduction about climate change by looking out their windows [40], there is not the case in our study, e.g. climate-change issue was scarcely covered by Romania mass-media. In regard to this, there was a certain discrepancy between the absence of mass-media reference on climate change and the respondents' beliefs on climate change, e.g. 84% of the respondents believe that climate change is happening. At the same time, the effect of the absence of mass-media references on climate change may be perceived on the fact that 32% of the respondents could not give an example of climate change effect, while additional 11% respondents named the pollution amongst the effects of the climate change. In other words, the study suggests that while the beliefs in climate change may be a form of fashion amongst the forest professionals, there is a critical lack of information about the effects of climate change, and, therefore, about the potential adaptation measures.

The most convinced about the reality and the effects of the climate change are the forest engineers working for the private managing structures, while the most sceptics are the forest engineers working for the national forest guard, a structure with control of law implementation. In the study on forest decision makers from South-eastern Norway, all the participants (forest managers, forest advisors and private forest owners) with one exception agreed that climate change exists and would continue to change but with uncertainties and dissents among them due to the causes of climate change [30]. The 63% of focus group participants have forestry studies [30] which means that professional background tends to differentiate the individuals' beliefs in climate change.

5. Conclusions

Perceptions on climate change are formed individually, based on the aggregation of information from TV and internet mostly and subsequently shaped by the professional milieu of the respondents. Thus, forest engineers working for private forest managing

structures and those who have attended trainings tend to say that climate change is real and that the Romanian forests will be highly affected by climate change in the future. The respondents who work at the national forest guard tend to say that there are no proofs of climate change or effect of climate change in forests, while the forest engineers working for the National Forest Administration tend to deny the existence of climate change and to say that climate change will moderately affect the Romanian forest.

While it was not possible to establish a clear link between the information from the media and the attitudes of the people questioned, however the study suggests that there is a critical lack of information about climate change amongst the forest engineers. This occurs due to the feature of information consumption habits (most of the forest engineers being active TV consumers) and the lack of attention paid by mass-media to the climate change issue.

Acknowledgements

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