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STAKEHOLDERS' INTERESTS AND ROLES IN THE CONTEXT OF SECONDARY NORWAY SPRUCE FOREST CONVERSION: UKRAINIAN CARPATHIANS CASE STUDY

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Abstract: *The investigation of stakeholders' relationships is a crucial aspect of collective action in natural resource governance as well as in the participatory process to involve all groups of interests in sustainable forest management. The paper aims to identify and analyze stakeholders' interests and roles in the context of secondary spruce forest conversion in the Ukrainian Carpathians. The research is structured into three steps: (1) identification of stakeholders; (2) questionnaire survey; and (3) data processing to analyze the stakeholders' interests and roles. The results show that almost all stakeholders mainly receive benefits rather than losses from the secondary spruce forest conversion. Seven potential "supporters" and six potential "opponents" were identified. The most impacted groups of stakeholders are harvesting enterprises, wood processing enterprises, and users of forest products. The results obtained provide support for the forest policy formulation aimed at implementing sustainable forest management in the Ukrainian Carpathians context.*

Key words: *sustainable forest management, stakeholder analysis, questionnaire survey, Venn diagram, Ukrainian Carpathians.*

1. Introduction

In the last decades, the importance and necessity of including a broad range of stakeholders' interests and requests in natural resources management were investigated in the scientific literature [1], [10], [19], [21], [28], [34]. Stakeholders' involvement in the decision-making process is important to improve the quality of damaged forest ecosystems, such as secondary Norway spruce (*Picea*

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abies (L.) Karst.) forests. During the 19th century, Norway spruce forests were planted for economic reasons on a place of native European beech (*Fagus sylvatica* L.) forests or mixed forests [32]. Currently, these forests are drying out in many Central European countries.

In the Ukrainian Carpathians, spruce monocultures were planted replacing broadleaved- or mixed natural forests on an area of 1,800 km^2 [31]. Nowadays, these forests are very vulnerable to climate change [11, 12, 30] and subjected to increasing anthropogenic pressure [13]. The results of previous investigations [34] show the disturbed structure and functionality of these forests are caused by ecological, socio-economic and institutional driving forces and require a complex response. Secondary spruce forest conversion into native, mixed, uneven-aged stands should be conducted to decrease the pressure on these forest ecosystems and solve the drying problem [13], [15], [23, 24], [32].

The implementation of forest conversion provides a broad range of ecological and economic benefits [36]. In particular, it can increase resilience and the resistance of forest ecosystems to natural and anthropogenic disturbances [22]. In addition, forest conversion can improve the adaptation of forest ecosystems to climate change [13, 22, 24]. Some authors [20, 29] show the economic benefits of forest conversion implementation, such as an increase in the biomass productivity of forests. In Norway spruce and European beech mixed stands, the stand productivity increases on average by 20% in comparison with pure stands of the same species, and decreases financial risk due to forest species diversification [27].

In the Ukrainian Carpathians, such silvicultural treatments are carried out only on small forest management units. The slow dissemination of the forest conversion process is due to a strong focus on short-term financial interests by forest owners. The benefits by secondary spruce forest conversion are provided in a long-term perspective. Therefore, these benefits are not attractive for forest owners in a short-term perspective. In addition, many forest conversion projects have been suspended due to discrepancy and lack of coherence in the stakeholders' activities [13], [35].

Starting from these considerations, the main aim of this study is to identify and analyze the stakeholders' interests and roles in the context of secondary spruce forest conversion in the Ukrainian Carpathians taking into account that the stakeholders' relationships are a crucial aspect of collective action in natural resource governance [29].

2. Materials and Methods

2.1. Study Area

The study of the stakeholders' roles and interests in the context of secondary spruce conversion was conducted in five cities (Lviv, Ivano-Frankivsk, Uzhhorod, Rakhiv, Skole) and three villages (Bogdan, Roztoky, VerkhnyeSyn'ovydne) located in the Ukrainian Carpathians (Figure 1). The total area covers 56,635 km^2 (nearly 3.5% of the surface of Ukraine) subdivided into four administrative oblasts (first-level political and administrative division in Ukraine), namely Lviv, Ivano-Frankivsk, Chernivtsi and Zakarpatska. The population is 6.07 million inhabitants with a density of 108 inhabitants/km^2.

The landscape of the Ukrainian Carpathians is characterized by glacier shaped valleys. The altitude ranges from 120 m to 2,061 m a.s.l. The climate conditions are temperate with a moderate continental influence. The average annual precipitations range between 900-1200 mm and the temperature ranges from +6 °C to +20 °C in summer and from -3 °C to -10 °C in winter [14].

The forest area covers 20,856 km^2 (37% of the Ukrainian Carpathians) and the main forest types are: Norway spruce (*Picea abies* (L.) Karst.), European beech (*Fagus sylvatica* L.), and Silver fir (*Abies alba* Mill.) forests. The secondary spruce forests cover 28% of the total spruce forests area (1,843 km^2) [31]. According to Parpan et al. [22], an intensive dieback of secondary spruce forests is now revealed on an area of 193 km^2 (volume of 6 million m^3). Most of these forests are located in the Lviv oblast (51.9% of the total secondary spruce forests) and Ivano-Frankivsk oblast (31.6%) [5].

Fig. 1. *The geographical location of the study area in the Ukrainian Carpathians*

2.2. Research Framework

The research was structured into three steps to investigate the stakeholders' interests and roles in the context of secondary spruce forest conversion: (1) identification of stakeholders; (2) questionnaire survey; and (3) data processing to analyze the stakeholders' interests and roles.

2.2.1. Identification of Stakeholders

The snowball sampling method was applied to identify the stakeholders' interests and roles in the context of secondary spruce forest conversion. This method is a non-probability sampling technique used for the difficult nature of defining and accessing the population of interests. During the interviews, all respondents were asked to indicate the name of other potential respondents to be involved in the survey. The two main criteria used to identify the respondents were: (i) professional experience and skills in forest management and planning, biodiversity conservation, forest economics and policy; (ii) knowledge about socio-ecological and economic

features and consequences of the secondary spruce conversion process.

At the end of the stakeholder analysis, 50 respondents were identified and directly contacted, but only 25 stakeholders were willing to participate in the survey (response rate of 50%). Thus, the respondents were at the same time stakeholders of secondary spruce forest conversion. Therefore, they knew the interests and roles of each stakeholder.

The 25 respondents involved in the survey belong to the following organizations and institutions: Ukrainian National Forestry University (4 respondents), Ivan Franko National University of Lviv (1), Ukrainian Research Institute of Mountain Forestry (1), Carpathians Biosphere Reserve (2), Zacharovanyi Krai National Park (1), State Enterprises "Rakhiv Forestry" (2) and "Skole Forestry" (1), local people (2), environmental Non-Governmental Organization "Ecosphere" (1), and "Rakhiv.Tourist" (1). The remaining respondents are representatives of the following groups of interest: forest harvesters (1), paper manufactures (1) wood processing enterprises (1), local authorities (1), pickers of non-wood forest products-NWFPs (1), and hunters (1).

2.2.2. Questionnaire Survey

Many authors highlighted the fact that the analytical characterization of the stake-holders can be done based on certain attributes such as urgency, legitimacy, influence, proximity, level of interest and influence, cooperation/competition, access to resources, and power [4], [8], [17], [18], [21].

In this study, a semi-structured questionnaire was developed for identifying such stakeholders attributes as the level of interest and the role in the context of secondary spruce forest conversion in accordance with Lindenberg and Crosby [17].

A first version of the questionnaire was pre-tested to ensure that the questions were clear and generated the required information. The final version of the questionnaire was subdivided into four thematic sections: (1) personal information of the respondents; (2) assessment of the forest conversion impacts on the stakeholders' well-being; (3) assessment of the stakeholders' influence on the forest conversion process; (4) relationships between the stakeholders in the context of secondary spruce forest management.

The first thematic section focused on the personal information of the respondents such as name, location, and respondent's role in the community/organization.

The second thematic section dealt with the respondents' assessment of the forest conversion impacts on the stakeholders' well-being (Question: Who wins or loses in the result of forest conversion?).

The third thematic section focused on the stakeholders' influence on the decision-making process regarding the forest conversion process (Question: Who influences and who is influenced by forest conversion?). A 5-point Likert scale format (from 1 = very low to 5 = very high value) [16] was used to rate the forest conversion impacts on the stakeholders' well-being and the stakeholders' influence on the decision-making process. The results of these two thematic sections were used as an indirect indicator of the stakeholders' roles and interests.

The fourth thematic section considered the relationships between the

stakeholders regarding forest management. The strength of the relationships was measured through the respondents' answers, distinguishing between strong and weak ties [7]. Strong ties are relationships associated with frequent contact, deep feelings of affection and obligation, while weak ties are relationships characterized by a lower frequency or emotional involvement [7]. The strength of the relationship was quantified by the respondents using a 3-point Likert scale (1 = very weak ties, 2 = weak ties, 3 = strong ties).

In addition, comments and qualitative information provided by the interviewees were collected. The comments helped in the interpretation of the results. In our case study, this information was used to explain the results of the respondents' assessment.

The questionnaire was administered as a set of face-to-face interviews that lasted 15-25 minutes each. This administration system was chosen because the face-to-face interview was able to provide a higher response rate, a higher quality of the data acquired, and a better opportunity to explain the unclear questions to the respondents [2, 6].

2.2.3. Data Processing

In this paper, the results of the second and third thematic sections of the questionnaire are presented. The information provided in the second thematic section was used to classify the stakeholders into two groups of interest, namely "supporters" and "opponents" of secondary spruce forest conversion. The information provided in the third part was used to divide the stakeholders into two groups of roles, namely "active" (stakeholders that influence) and "passive" (stakeholders that are influenced) in the context of secondary spruce forest conversion. This aggregation of stakeholders was done based on median values provided by the respondents. If the median value of benefits was higher than the median value of losses, the stakeholders were classified as "supporters", otherwise as "opponents". Similarly, if the median value of a stakeholder influence was higher than the median value of his value of being influenced, the stakeholders were classified as "active", otherwise as "passive". All descriptive statistics (mean, median, standard deviation) were developed using XLStat 2012.

The Venn diagram was developed to show the stakeholders' interests and roles in the context of secondary spruce forest conversion based on a top-down "analytical categorization" method [3]. The Venn diagram is an analytical and creative tool [28, 33] that can represent social relationships among stakeholders and power differences between them. This instrument is an easy-to-use visual tool that helps participants to explore relationships between stakeholders. The Venn diagram synthesizes the information concerning the stakeholders' interests and influences to emphasize potential synergies and conflicts between them.

In this study, the space of Venn diagram was divided by two axes (influence/be influenced and win/lose) into four quadrants:

- Quadrant A: Stakeholders capable of influencing the decision-making process ("active role") and positively affected by the secondary spruce forest conversion ("supporter");
- Quadrant B: Stakeholders not able to

influence the decision-making process ("passive role") and positively affected by the secondary spruce forest conversion ("supporter");
- Quadrant C: Stakeholders not able to influence the decision-making process ("passive role") and negatively affected by the secondary spruce forest conversion ("opponent");
- Quadrant D: Stakeholders capable of influencing the decision-making process ("active role") and negatively affected by the secondary spruce forest conversion ("opponent").

Each group of stakeholders is represented by a circle with a different size and spatial location. The size of the circle indicates the relative power of each stakeholder. Spatial closeness or separation indicates the relative strength or weakness of the existing relationship/interaction between different groups of stakeholders.

3. Results and Discussion

In the context of secondary spruce forest conversion in the Ukrainian Carpathians, 13 groups of stakeholders were identified by all respondents: nature conservation organizations (NCOs); state forest enterprises; harvesting and wood processing enterprises; paper manufacturers (PMs); environmental non-governmental organizations (ENGOs), tourists; recreationists; hunters; pickers of mushrooms, berries and other non-wood products (NWFPs); scientists; local authorities, and local people. Only respondents from the Ukrainian National Forestry University and State Enterprise "Rakhiv Forestry" indicated additional stakeholders such as government organizations (Department of Ecology and Environmental Protection under the Regional State Administration, the Ecological Inspection and Ukrainian government forest inventory organization Lisovporyadne Production Association "Ukrderzhlisproekt").The results show that almost all the stakeholders - except PMs, hunters, pickers of NWFPs, harvesting and wood processing enterprises - receive benefits from the secondary spruce forest conversion (Figure 2).

The main beneficiaries of the secondary spruce forest conversion are the NCOs (mean=4.17). The benefits for this stakeholder group are related to the opportunity to eliminate the massive dieback process of secondary spruce forests and prevent its spread through the conversion of these forests to mixed uneven-aged ones. Conversely, the main losers are PMs (mean=1.40) due to their preference for softwood fibres over hardwood species in producing high-quality paper. The fibres of softwood species are characterized by a much longer length compared to hardwood fibres and add longer paper durability. In addition, softwood fibres are more easily workable in processing operations. Some types of paper -*e.g.* paper for sacks and bags - can be made from 100% softwood fibres to increase their strength. Thus, the respondents estimated that the losses outweigh the benefits for PMs (mean=1.75). The respondents indicated significant benefits for tourists (mean=4.10) and recreationists (mean=3.74) due to the secondary spruce forest conversion. These benefits are related to changes in the tree species composition (from pure forest to mixed forest) and in the age structure (from even-aged to uneven-aged) [23, 24]. Therefore, the forest conversion

contributes to the increasing recreational attractiveness of the forest sites. Several authors confirmed the people's preference for these changes in the forest structure. A preliminary study in the Ukrainian Carpathians shows that people prefer mixed forests over monocultures, and uneven-aged forests over even-aged forests [25, 26]. Similar results were obtained in Italy and Poland [9, 20].

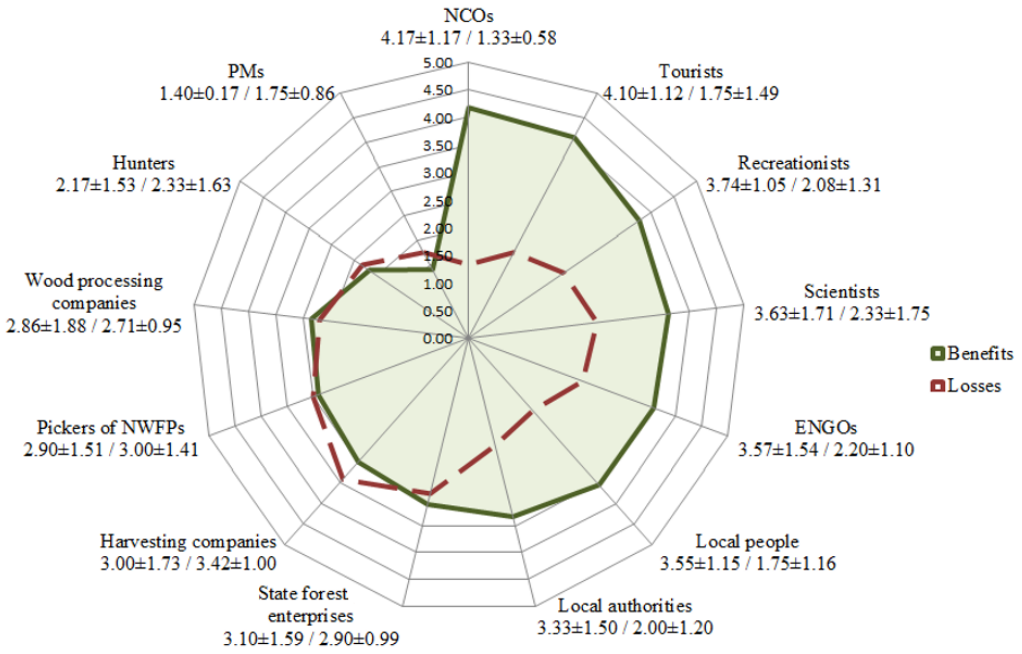

Fig. 2. *Stakeholders' benefits/losses from the secondary spruce forest conversion according to the respondents' opinions (mean value ± standard deviation)*

According to the respondents' opinions, the benefits for scientists (mean=3.63) and ENGOs (mean=3.57) are related to the new opportunities to develop their professional skills in the adaptive forest management (*i.e.* forest conversion practice). A holistic vision of the benefits associated to secondary spruce forest conversion from the forest ecosystem services perspective, close-to-nature paradigm and triggered conversion processes should be well-articulated in the curriculum by scientists and representatives of ENGOs. The local community can also benefit from the forest conversion process. The taxes on revenues from the sale of timber and firewood become part of, the local budget increasing the welfare of the local people (mean=3.55) and the revenues of the local authorities (mean=3.33).

As a result of the secondary spruce forest conversion, state forest enterprises can obtain benefits in the long term. However, in the first stages of the conversion process, state forest enterprises had to bear the financial costs primarily due to higher harvesting costs associated with the modernization of logging equipment, extension of the forest roads network, and additional training of staff involved in the forest conversion

process. In addition, planting and protection of native tree species (European beech and silver fir) could be necessary if there is a lack of natural regeneration or mature seed trees. These forestry operations can increase the costs of the forest conversion. Considering the economic and ecological risks of implementing this silvicultural measure, the respondents considered on the same level the benefits (mean=3.10) and losses (mean=2.90) for the state forest enterprises. The benefits and losses of pickers of NWFPs and hunters depend on a way of promoting the new products provided by the forest conversion [15]. If forest access is prohibited to avoid damage to new regeneration after the secondary spruce conversion, pickers of NWFPs (mean=3.00) and hunters (mean=2.33) have mainly losses rather than benefits from the forest conversion. The wood processing enterprises require high quality raw material (straight stems without knots). Generally, in uneven-aged forests, conifer trees have longer crowns, and this compromises timber quality. Therefore, the respondents assigned to the losses of wood processing enterprises an average value of 2.71. The harvesting enterprises incurred the greatest losses from the secondary spruce forest conversion (mean=3.42). These losses are due to the greater complexity of the harvesting operations in uneven-aged mixed forests compared to a clear-cutting (even-aged pure forests). The two main stakeholder groups - in terms of capacity to influence the forest conversion decision-making (Figure 3) are the state forest enterprises (mean=4.33) and the NCOs (mean=3.47).

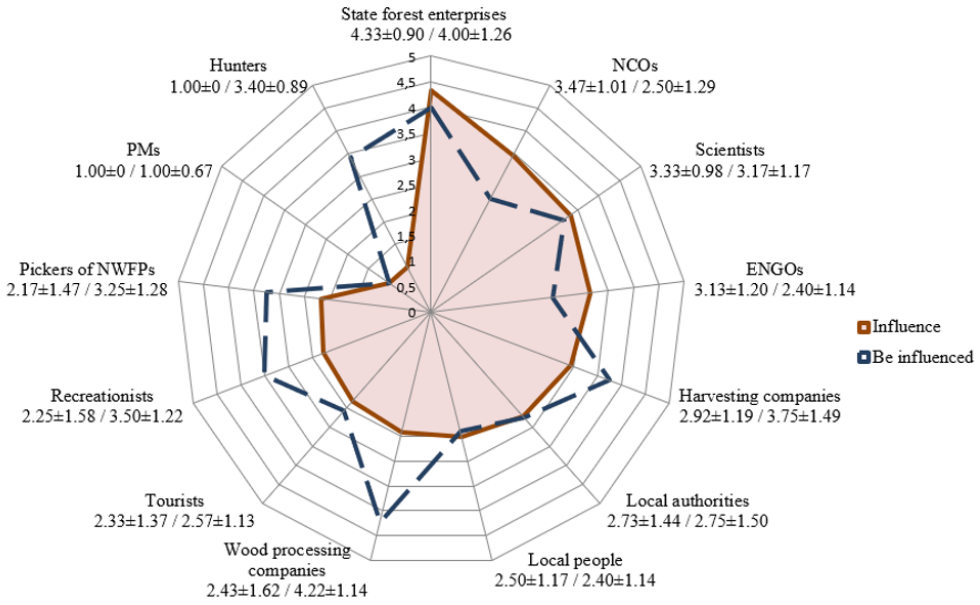

Fig. 3. *Stakeholders' influence on the secondary spruce forest conversion according to the respondents' opinions (mean value ± standard deviation)*

These two groups have a high decision-making power because they implement the forest management strategies in the field. The influence of scientists (mean=3.33) and ENGOs (mean=3.13) on the forest conversion decision-making process has an advisory character. Their role is limited to technical-scientific support or consulting on some specific issues. For example, the "Recommendations for forestry management in secondary Norway spruce forests of the Ukrainian Carpathians" (2013) and the "Proposals to the regional program of secondary Norway spruce forest conversion of the Ukrainian Carpathian Mountains" (2006) have been developed through many years of cooperation between scientists from the Ukrainian Research Institute of Mountain Forestry and the Ukrainian National Forestry University. These official documents prescribe the main criteria, stages and methods for secondary spruce forest conversion [23].

The influence of the local authorities (mean=2.73) and people (mean=2.50) on the forest conversion decision-making process is related to their involvement in the Community Councils at the Regional Departments of Forestry and Hunting. The Community Councils were established with the aim of discussing the use of forest resources at regional and local level. According to the respondents' opinions, the remaining stakeholders are affected by the results of the secondary spruce forest conversion. Wood processing (mean=4.22) and harvesting enterprises (mean=3.75) are the most affected by this silvicultural treatment. The results highlight a common view among the respondents concerning the fact that almost all stakeholders mainly receive more benefits than losses from the secondary spruce forest conversion (Figure 2). The comparison between median values of benefits and losses (Table 1) confirms that NCOs, ENGOs, tourists, recreationists, scientists, local authorities and people are potential "supporters" of secondary spruce conversion. Conversely, the respondents consider that the main losers related to the secondary spruce forest conversion are: harvesting and wood processing enterprises, hunters, and PMs. These stakeholder groups can be considered potential "opponents" of the secondary spruce forest conversion.State forest enterprises and pickers of NWFPs are characterized by equal median values of benefits and losses (median=3). Therefore, these stakeholder groups were included in the "opponents" category considering the qualitative comments provided by the respondents during the questionnaire administration. The respondents emphasized that the costs of the first stages of forest conversion (*e.g.*, harvesting costs, extension of forest roads network, additional training of forest staff) are quite explicit for state forest enterprises. More intensive financial investments over a conversion period with a questionable commercial return in a long-term perspective prevent the dissemination of the forest conversion practice.

The results show that an active role in the secondary spruce forest conversion was played mainly by "supporters" such as: NCOs, ENGOs, scientists, local authorities and people. Only state forest enterprises play an active role in the promotion and implementation of the secondary spruce forest conversion, although they can be considered an

"opponent". According to the respondents' point of view, the other stakeholders do not have the power to influence the secondary spruce conversion decision-making process.

Stakeholders' interests and roles in the context of secondary spruce forest conversion in the Ukrainian Carpathians Table 1

Groups of stakeholders	Benefits	Losses	Interests	Influence	Be influenced	Roles
NCOs	5	1	Supporter	3	2.5	Active
ENGOs	4	3	Supporter	3	2	Active
Tourists	4	1	Supporter	2	2	Passive
State forest enterprises	3	3	Opponent	5	4.5	Active
Harvesting enterprises	3	4	Opponent	3	4	Passive
Hunters	1.5	2	Opponent	1	3	Passive
Pickers of NWFPs	3	3	Opponent	1.5	3	Passive
Recreationists	4	1.5	Supporter	1.5	3	Passive
Scientists	4	1.5	Supporter	3.5	3	Active
Local authorities	3	1.5	Supporter	3	3	Active
Local people	3	1	Supporter	3	2	Active
Wood processing enterprises	2.5	3	Opponent	2	4	Passive
PMs	1.2	2	Opponent	1	2	Passive

Finally, the Venn diagram was developed in order to highlight potential synergies and conflicts among the identified stakeholders (Figure 4). Environmental protection agencies (NCOs and ENGOs), scientists, and the local community representatives (local authorities and people) are located in Quadrant A. These stakeholders can be considered "supporters" of the secondary spruce forest conversion and they play an active role in the decision-making process. In Quadrant B, there are only the stakeholders of the tourist sector (tourists and recreationists). These stakeholders are "supporters" of the secondary spruce forest conversion, but have low power to influence the decision-making process (passive role). The remaining stakeholders are located in Quadrant C. These stakeholders - as users of forest products (hunters and pickers of NWFPs), the wood processing sector (wood processing enterprises and PMs), and harvesting enterprises - are negatively affected by the secondary spruce forest conversion ("opponents") and they are not able to influence the decisions concerning the secondary spruce forest conversion (they play a passive role).

The circle of state forest enterprises is located in the middle between all four Quadrants, because this stakeholder group influences and is influenced by the secondary spruce forest conversion. In addition, state forest enterprises incur losses during the first stages of forest conversion, but they have benefits in the long-term perspective.

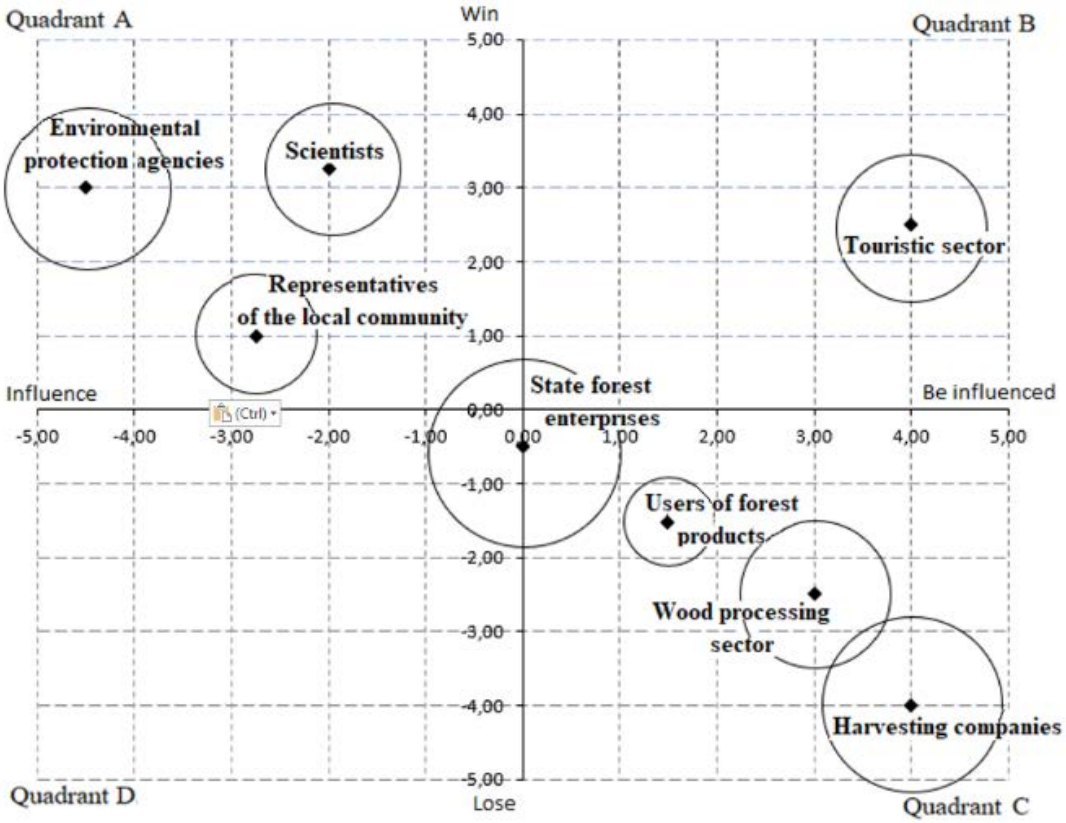

Fig. 4. *The Venn diagram of stakeholders' interests and roles in the context of secondary spruce stands conversion in the Ukrainian Carpathians*

4. Conclusion

The main advantage of the proposed method is that the collected data is based on expert opinions. Therefore, the information processed is the result of experts' experience and skills. On the other hand, the main disadvantage of the proposed method is that the collected data is mainly quantitative. In order to improve the method in the future, it would be advisable to integrate the collected data with qualitative data such as interests, needs, conflicts, and synergies among stakeholders. The qualitative data could be collected through in-depth interviews and focus groups involving all groups of stakeholders.

The present study identifies potential "supporters" and "opponents", and the relationships between them related to the secondary spruce forest conversion processes. These results are important for decision-makers (forest planners and managers, practitioners) in at least two major aspects. The first one refers to understanding the advantages and disadvantages of the secondary spruce conversion process for different groups of stakeholders in the Ukrainian Carpathians context. The second one refers to the identification of the stakeholders' power and influence during the forest conversion process, and to finding a way to reduce

unwanted effects. These findings provide some support for the forest policy formulation aimed at implementing the close-to-nature approach in the Ukrainian Carpathians context.

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