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Constrained liquidity during forest calamities: an explorative study for adaptation in private forest enterprises in Germany

Liquiditätsengpässe während Kalamitäten: Eine explorative Studie zur Anpassung in privaten Forstbetrieben in Deutschland

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Schlüsselbegriffe: Private Waldbesitzer, Kleinwald, steuerfreie Rücklage

Abstract

Successive calamities, including bark beetle outbreaks and windthrow, have caused severe damages in German forests since 2018. The loss of forest stands as an important source of income makes it increasingly difficult for forest management to secure sustainable revenues, which in turn threatens the livelihood of many private forest enterprises. In addition, valuable ecosystem services are affected and there is a lack of financial resources for the necessary investments in reforestation and climate change adaptation. An online survey was used to investigate the attitude of private forest enterprises towards solving liquidity problems.

Zusammenfassung

Aufeinanderfolgende Kalamitäten haben seit 2018 schwere Schäden in deutschen Wäldern verursacht. Der Verlust von Beständen als wichtige Einkommensquelle macht es zunehmend schwer für die Forstwirtschaft, nachhaltige Einnahmen zu erzielen, was in Folge das Überleben vieler privater Forstbetriebe gefährdet. Darüber

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hinaus sind wertvolle Ökosystemdienstleistungen betroffen und es fehlt an finanziellen Mitteln für die notwendigen Investitionen in Wiederaufforstung und Anpassung an den Klimawandel. Mittels einer Online-Umfrage wurde die Einstellung von privaten Forstbetrieben zur Lösung von Liquiditätsproblemen untersucht.

1. Introduction

It is well known, that making profit is often not the primary goal of small-scale forest owners (Arnim *et al.*, 2020; Feliciano *et al.*, 2017). These forest owners rather follow multiple objectives (Dayer *et al.*, 2016; Selter *et al.*, 2009; Straka, 2011). The most common goal of private forest enterprises is to preserve their forest for future generations (Feliciano *et al.*, 2017). In contrast to multiple-use forestry, the main form of financing in private forest enterprises is self-financing through the proceeds of the timber sold. According to the data of the German Westphalia-Lippe Forest accountancy network, this amounts to a share of around 80 % of all revenues (Arnim *et al.*, 2020). Since 2018, losses of timber revenues due to calamities such as storms, beetle attacks, droughts and fungus (*e.g.* BMEL, 2020b; Möhring *et al.*, 2021) show that this form of financing is reaching its limits. Yet, a systematic analysis of the current status of liquidity of forest enterprises and their strategies of adaptation is missing.

For this purpose, an explorative field study was conducted, evaluated and, in cooperation with the North Rhine-Westphalian Association of Forest Farmers and the agricultural and forestry consultancy BB Göttingen GmbH, distributed among forest enterprises and forest owners from December 2019 to January 2020. The aim of the study was to obtain an overview of the current situation and to analyze the approaches of private forest enterprises towards liquidity problems. To this end, operational measures and forest policy instruments such as a tax-free financial reserve for securing liquidity were examined.

2. Methods

An online survey was used to investigate the attidudes of private forest enterprises towards solving liquidity problems. Operational measures for adapting to the ongoing calamity and forest policy instruments for securing liquidity were examined. 156 online questionnaires from private forest enterprises covering a total area of over 210,000 ha were evaluated. The average forest area per surveyed forest enterprise was 957 ha. 60 % of the correspondents were forest owners, and the remaining 40 % were their representatives such as district managers, partners, service providers and supervisors. The enterprises were grouped according to the size of the forest area – small (< 50 ha), medium (50 – 500 ha) and large (> 500 ha) – and according to the dominating tree species group in percent of forest area – Norway spruce, hardwood (this includes European Beech, Pedunculate and Sessile Oak), and Scots pine. 42 % of the enterprises surveyed fell into the category of medium-sized, 30.5 % were small and 28.5 % large forest enterprises. The spruce group dominates with a share of 57 %

of all enterprises. 28.5 % of all forest enterprises manage hardwood-dominated forests, and 14.5 % manage pinedominated forests (Table 1).

Table 1: Number of investigated forest enterprises grouped by their business forest area and tree species group, n = 165 (Arnim et al., 2020, with amendments).

Tabelle 1: Anzahl der befragte Forstbetriebe nach Betriebsgröße und Betriebstyp sortiert, n = 165 (Arnim *et al.*, 2020, verändert).

		Business size			
		small **< 50 ha**	**medium** **50 – 500 ha**	**large** **> 500 ha**	**sum**
Business type	**Norway spruce**	32	46	16	94
	Hardwood	15	19	13	47
	Scots pine	4	4	16	24
	sum	51	69	45	165

The survey included questions on the equipment and objectives of the forest enterprises, the incidence of calamities in 2018 and 2019, the tax-free reserve in accordance with § 3 of the Forest Damage Compensation Act (ForstSchAusglG; it enables private forest enterprises to set aside money tax-free and preventatively in case of forest calamity; the money can be used for specific measures such as forest protection, supplementation of revenues, reforestation and repair of damages), and, finally, business and forestry strategies for adaptation after forest calamity. We did not ask for personal and site-specific data.

Closed questions with single or multiple answers, as well as open questions with optional self-nomination were asked. The respondents were asked to prioritize and evaluate suggested answers and supplement them with further information if necessary. Because some of the respondents did not answer every question the numbers of valid answers varied.

The following analysis of the answers was carried out in "SPSS", using the SPSS statistical software functions such as tables, cross tabulations, descriptive statistics, multiple response sets, bivariate correlation and linear regression. The supplementations in the free-text field were summarized according to their content.

3. Results

3.1 Aims and goals stated by forest owners

Figure 1 shows that the forest enterprises primarily aim at maintening asset value in forest management. The medium-sized and large forest enterprises included in the survey show an economic focus in their stated objectives. Small forest enterprises have a strong ecological and social orientation and consider firewood production to be more important than the other groups.

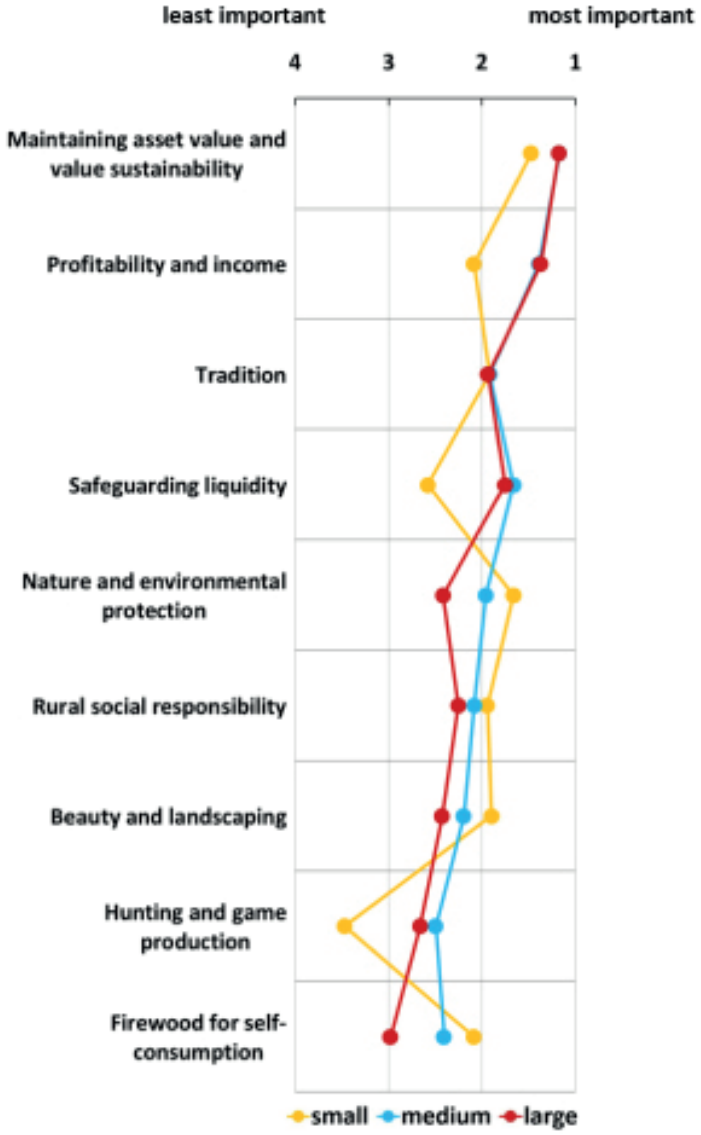

Figure 1: List of operational objectives according to business size, n = 160, the prioritization of the proposed answers was done by assigning a score from 1 (most important) to 4 (least important). We group means sorted in descending order of importance over all surveyed forest enterprises (Arnim et al., 2020, with amendments).

Abbildung 1: Liste der wichtigsten Betriebsziele nach Betriebsgröße, n = 160, Die Priorisierung der vorgeschlagenen Antworten erfolgte durch die Vergabe einer Punktzahl von 1 (wichtig) bis 4 (unwichtig). Wir zeigen Gruppenmittelwerte in absteigender Reihenfolge über alle befragten Forstbetriebe sortiert (Arnim *et al.*, 2020, verändert).

3.2 Forest calamity in numbers

In order to obtain an overview of the extent of ordinary and calamityrelated logging in the years 2018 and 2019, the survey asked for the extend of annual logging within each forest enterprise. The results show that calamity-related logging was on average two to three times higher than the regular logging during this time period. Small enterprises were particularly affected. This could be due to the lack of infrastructure and staffing in smaller businesses as well as some self-selection bias as a result of particularly affected forest businesses responding to the survey.

Table 2: Average logging per hectare, n = 167, (Arnim et al., 2020, with andenments).

Tabelle 2: Durchschnittlicher Einschlag pro Hektar, n = 167, (Arnim et al., 2020, verändert).

	2018 in m^3 per ha	**2019** in m^3 per ha
Ordinary planned logging	2.1 ± 0.3	1.5 ± 0.5
Calamity related logging	7.2 ± 1.3	10.3 ± 1.5
Total logging	9.3 ± 1.3	11.8 ± 1.6

In terms of species, spruce-dominated enterprises were particularly affected. This was not unexpected as this species is particularly susceptible to storms and subsequent pests such as bark beetle attacks.

3.3 The tax-free financial reserve of the Forest Damage Compensation Act

About 14 % of the forest enterprises surveyed have tax-free reserves. This particularly applies to large forest enterprises that meet the legal requirements for bookkeeping (§ 125 AO, 194/1961). The current level of financial reserves is on average about 80 € ha^{-1}. This is around 20 % of the maximal amount they could set aside tax-free. About 42 % of the forest enterprises with reserves stated that they had not liquidated their reserves at the time of the survey, although some forest enterprises had formed the reserve more than 10 years ago. The main reasons for the liquidation of the financial reserve of the remaining 58 % are measures for reforestation, improvement and subsequent forest maintenance and the repair of damage to paths and operational facilities.

The problems mentioned in connection with the tax-free reserve relate mainly to the bureaucratic burden, practical suitability and economic conditions of the holdings.

Many enterprises mention organizational problems with regard to the establishment of the reserve such as the high level of formalities involved in the application and accounting, difficulties in understanding the tax forms, the need of a direct use and the lack of information about the reserve. Some companies state that they are not permitted to form a reserve as non-accountable companies.

In addition to the organizational and company-specific requirements, problems of financial nature were also listed. Several companies describe their current economic situation as not convenient to build up a reserve. After the storm "Kyrill", the reserve had been used for processing costs in 2007 and since then, not enough income has been to the company.

There is also criticism that the amount of the reserve is hardly sufficient to compensate for the current shortfall in revenues and to implement the necessary measures, such as rejuvenation and reforestation.

Several forest enterprises also argue that the reserve as form of investment is not profitable as the low interest rates and the high and long commitment of the money create disproportionally high opportunity costs. Instead, the money could be invested in a more profitable way. Furthermore, the investment form is outdated and hardly offered by the banks. Thus, the inappropriate liquidation of the reserve was more attractive than the use of the money for a specific purpose.

Proposed improvements to the reserve concern the investment type of the money. The fixed deposit as investment form, which is required for the reserve, is usually not offered by banks. The bureaucratic burden also needs to be reduced. In order to make greater use of reserve accumulation forest enterprises, which are not obligated for accounting, could, furthermore, be considered to use them. To simplify the law (ForstSchAusglG), the proof of the operational use of the money should be simplified. The maximum size of the reserves is limited to the average annual revenue (§ 3 para 1 ForstSchAusGlG) and has to be increased significantly in order to have liquidity buffers when wood prices are low. Finally, the reasons allowed for dissolution should be expanded.

3.4 Adjustments after forest calamity

Following the specification of an operational forest calamity scenario, the forest enterprises enumerated various areas in which they could contribute to overcoming the forest damages and to the survival of the enterprise by means of liquidity-securing measures. These measures aim, on the one hand at saving on expenditure and on the other hand at increasing turnover.

It can be seen across all forest enterprises that, after the forest calamity event, they seek to increase their turnover, firstly, by developing or expanding the business portfolio, secondly, by intensifying ancillary uses and thirdly, by making use of more subsidies. The evaluation of the responses by businesssize class shows differences between the groups (Figure 2). While large forest enterprises aim for expanding their business portfolio, medium forest enterprises propose a greater uptake of subsidies, small forest enterprises however, intend to reduce standing timber.

In the free text, some forest enterprises mentioned further turnover measures. These include new business areas outside the forestry sector, such as compensation and replacement measures and other payments for ecosystem services. Some forest enterprises indicated that they wanted to sell their forestry assets and leave the sector.

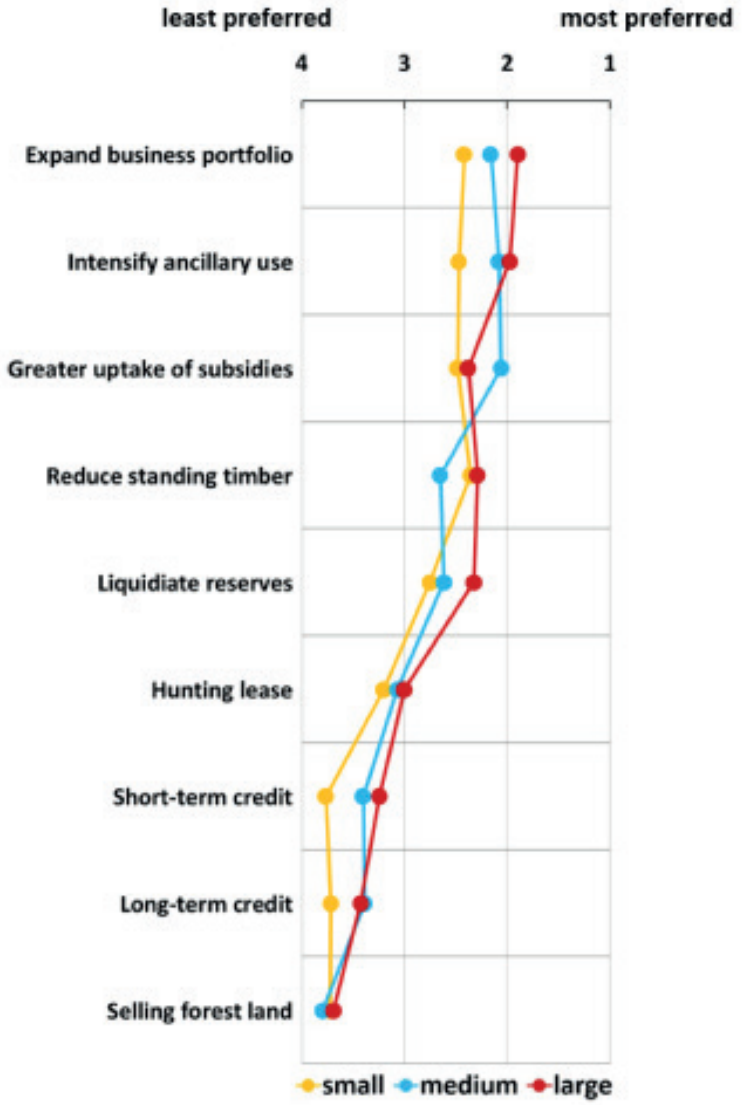

Figure 2: List of prioritized measures to expand income after forest calamity according to business size, n = 109, the prioritization of the proposed answers was done by assigning a score from 1 (most preferred) to 4 (least preferred). The group means are sorted in descending order of importance over all surveyed forest enterprises (Arnim et al., 2020, with amandments).

Abbildung 2: Liste der priorisierten Maßnahmen , in denen zusätzliches Einkommen nach einer Kalamität gewonnen werden kann, nach Betriebsgröße, n = 109, Die Priorisierung der vorgeschlagenen Antworten erfolgte durch die Vergabe einer Punktzahl von 1 (vorrangig) bis 4 (nachrangig). Die Gruppenmittelwerte sind nach absteigender Wichtigkeit über alle befragten Forstbetriebe sortiert (Arnim *et al.*, 2020, verändert).

When analyzing the responses on expenditure savings by business size, it becomes obvious that all enterprises primarily want to save on private withdrawals (Figure 3). On average small forest enterprises assess the potential for savings in the area of forest protection measures as well as in forest regeneration and renewal as larger than medium-sized and large forest enterprises. Large forest enterprises plan to cut on expenditures in the areas of nature conservation, recreation and environmental services.

The evaluation of the free text fields shows that the proposed measures have already been implemented by some enterprises. For example, one company claims to have cut back on staff in forest work. Some forest enterprises state that they want to reduce fixed costs and costs not directly related to earnings such as path maintenance, nature conservation and environmental education.

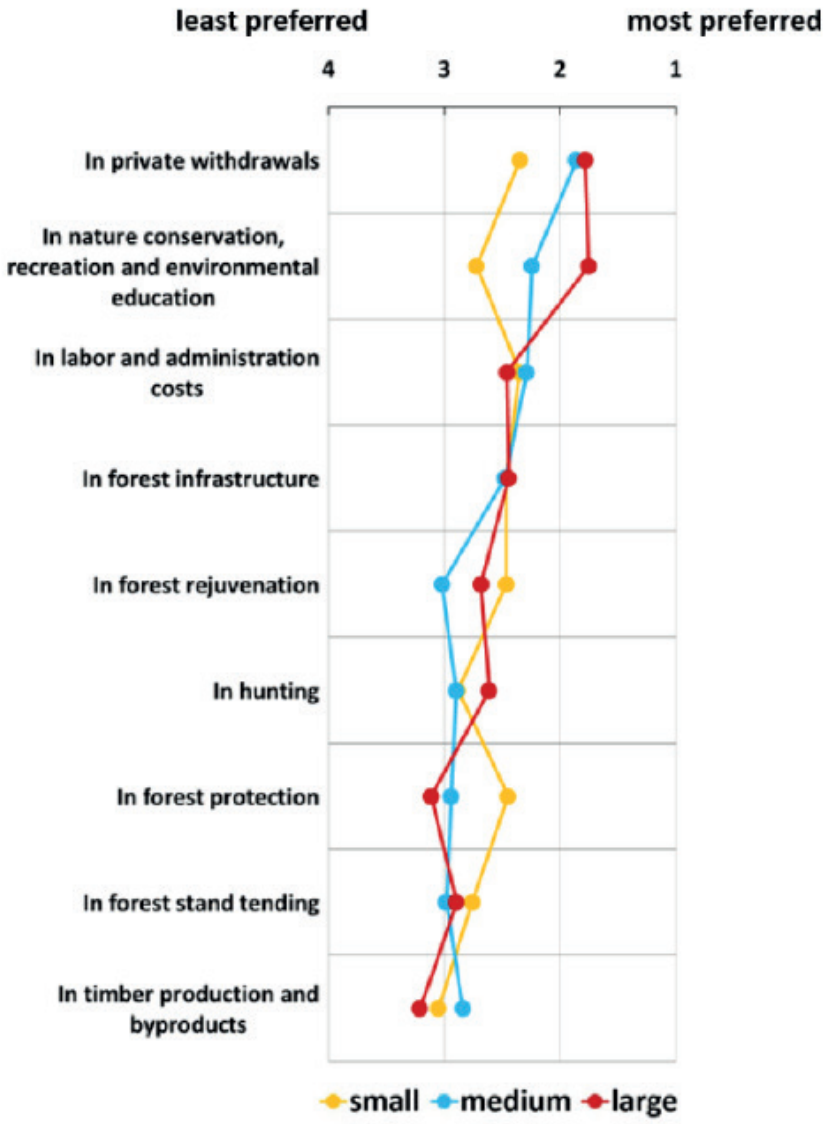

Figure 3: List of prioritized measures to save expenses after forest calamity according to business size, n = 108, the prioritization of the proposed answers was done by assigning a score from 1 (most preferred) to 4 (least preferred). The group means are sorted in descending order of importance over all surveyed forest enterprises (Arnim et al., 2020, with amendments).

Abbildung 3: Liste der priorisierten Ausgabenbereiche, in denen nach einer Kalamität gespart werden kann nach Betriebsgröße, n = 108, Die Priorisierung der vorgeschlagenen Antworten erfolgte durch die Vergabe einer Punktzahl von 1 (vorrangig) bis 4 (nachrangig). Die Gruppenmittelwerte sind nach absteigender Wichtigkeit über alle befragten Forstbetriebe sortiert (Arnim *et al.*, 2020, verändert).

The third block of questions on adaptation after a severe forest damage dealt with possible policy instruments. Across all enterprises, CO_2 compensation was considered the most important policy instrument for adaptation following forest calamity events. Second most important has been the reduction of public charges, such as property tax, employer´s liability insurance, association fees and membership fees in soil and water associations (Figure 4).

A number of companies add other policy instruments in the free text field. The most frequently mentioned instrument is the honoring of nature conservation services. In addition, several forest enterprises are calling for a simplification of the application process for subsidies. There are also calls for a uniform approach to forest calamity management, for example by using plant protection products, and for the adoption of the obligation to maintain traffic safety in and around forests.

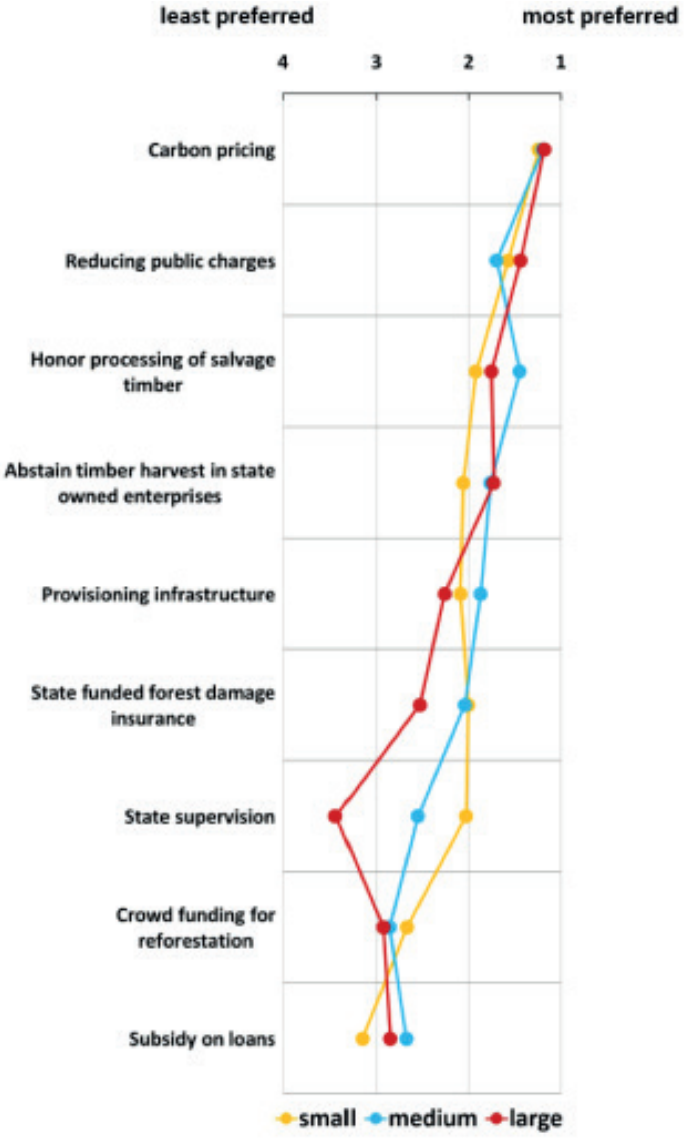

Figure 4: List of prioritized forest policy instruments after forest calamity according to business size, n = 127, the prioritization of the proposed answers was done by assigning a score from 1 (most preferred) to 4 (least preferred). The group means are sorted in descending order of importance over all surveyed forest enterprises (Arnim et al., 2020, with amandments).

Abbildung 4: Liste der priorisierten forstpolitischen Instrumente nach Betriebsgröße, n = 127, die Priorisierung der vorgeschlagenen Antworten erfolgte durch die Vergabe einer Punktzahl von 1 (vorrangig) bis 4 (nachrangig). Die Gruppenmittelwerte sind nach absteigender Wichtigkeit über alle befragten Forstbetriebe sortiert (Arnim *et al.*, 2020, verändert).

4. Discussion

The high response rate (41 %) for social-empirical surveys may be explained by the current calamity situation in the sector at the time of the survey (Krott and Suda, 2001). It can be assumed that primarily affected forest enterprises participated in a survey on "financing and securing liquidity in times of calamity". It may, therefore, be possible, that the results on the extent of the calamity are overestimating the actual extent.

For the categorization the forest enterprises were grouped by their forest area into the classes small (< 50 ha), medium (50 to 500) and large (500 ha and more). Gehrke and Hercher (2017) propose a wider classification with only two groups (< 200 ha and > 200 ha). For comparability with forest accounting networks or the National Forest Inventory (BWI^3), the classification as in Bürgi *et al.* (2016) would also be applicable. In further studies, this would have to be adapted to the research objectives and the collected data.

For further – less explorative and more profound – investigations of the financing behavior of private forest enterprises and their adaptation strategies in times of calamity an analysis of exemplary enterprises for each category of forest enterprises would be more suitable, as is done, for example, in Frauendorfer (1976).

The average farm size of around 957 ha recorded in the survey is compared to with the BWI^3 data not representative of the average 2 ha of all German forest enterprises (BMEL, 2017, 2012). Nor is it possible to classify the respondents geographically within Germany, as no location-based data were collected. Due to the small number of participants the results of the study cannot be extrapolated to the national level.

The analysis of the responses to the questions on the tax-free reserve shows that the reserve is only formed in a few larger forest enterprises. In addition, the amount currently set aside, averaging around € 80 ha^{-1} per holding, is not sufficient to compensate for the financial bottlenecks of 2018 and 2019, let alone to offset future liquidity shortfalls and asset losses. Via the free text field, many enterprises indicated their need of public financial support and their dissatisfaction with the current regulation.

The statements made by forest enterprises explain the low level of setting up and liquidating the reserve, as well as the restriction of compulsory accounting, from which forest enterprises without compulsory accounting do not benefit (Hogg and Jöbstl, 1997). In theory, the legal provision offers a potential for setting up reserves for forest calamities, but the criticisms listed above explain the low level of use of this legal provision, particularly as the reserve is denied to the forest holdings with the greatest relative forest calamity burden. Therefore, a revision of the tax-free reserve as policy instrument is recommended, so that small and medium-sized forest enterprises in particular are entitled to form reserves.

Very little is known about the financing behavior of private forest enterprises, not least because the actual amount of private withdrawals and borrowing is not usually recorded in Forest Accounting Networks. The questionnaire section on operational adjustments following forest calamity aims to investigate the financing behavior of forest enterprises. The preferred liquidity-securing measure of the forest enterprises surveyed is the reduction of private withdrawals. This is likely to vary considerably from one enterprise to another. However, it can be assumed that this measure alone will not be sufficient to avoid constrained liquidity in the current forest calamities. Instead., large investments will be necessary to rebuild the income and asset losses (Möhring *et al.*, 2021).

All in all, the results of the survey reveal that forest policy instruments, in particular the rewarding of climate protection, are considered to be of great importance for improving the financial situation of private forest enterprises. Temporary relief in the form of deferral and waiving public charges could also contribute to an improvement of the perspectives of the forest enterprises. In order to make greater use of support funds for forest enterprises, measures must be made more needs-orientated and efficient so that a rapid financial flow to secure liquidity can be guaranteed.

5. Conclusions

Up to now, forest research has not considered the consequences of severe forest damages for the liquidity situation in private forest enterprises . With regard to the financing of the enterprises, the current forest damage underlines that self-financing or even redeployment financing is reaching its limits. The investment decisions of private forest enterprises are made in accordance with the financing situation. Since private forest enterprises avoid borrowing even in the event of forest calamity, only profitable or legally prescribed measures are implemented. The tax-free reserve is not sufficient as a forestry policy instrument due to lack of profits, its legal requirements, and its lack of flexibility. Private forest enterprises therefore demand financial support from the public through, for example, the remuneration of ecosystem services, relief from public charges and subsidies. In addition, the forest enterprises are developing ideas for alternative sources of income. With regard to intergenerational forest management in private forest enterprises, the aim should be to ensure that the current forest damage situation can be survived financially without cutting on investments. These are essential for reforestation, forest protection and forest management and are, thus, decisive for the stability of future forest generations. In fact, the reconstruction and adaptation of forests to climate change demands intensified efforts in forest establishment, hunting and forest management. This requires internal adaptation and changes in the forestry policy system. Forest policy measures should, therefore, consider liquidity in forest enterprises. This will be crucial for maintaining the interest of private forest owners in the adaptation of forests to climate change and in sustainable forest management.

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