# D.T2.2.3
# FOREST STATE EVALUATION

Final Version

Testing of the forest state evaluation methodology

09 2021

# Content


1. Introduction ........................................................................................ 2

2. Background ........................................................................................ 3

2.1. Background project ........................................................................ 3

3.1 Realistic goals, thematic coverage........................................................ 5

3.3 The data collection protocol developed in 2020...................................... 6

3.4 Principles for designating sampling points ............................................ 7

4. Results ................................................................................................ 8

4.1. Intensity and spatiality of wood use implementation ............................ 8

4. 2. Tree species composition, mixture ..................................................... 9

4. 3. Tree structure.................................................................................. 10

4. 4. Deadwood conditions........................................................................ 10

4. 5. Tracks of the tree utikization............................................................ 11

5. General conclusions ............................................................................ 12

6. Literature ............................................................................................ 27

# 1. Introduction

The area of Börzsöny National Park is typically a forested landscape, understanding and monitoring the processes taking place in the forest is a priority nature conservation task. For this purpose, the application of the forest condition description methodology (Standovár 2020) developed during the Swiss Contribution tender developed in the period 2012-2017 and modified for monitoring purposes in 2020 within the framework of the present work, within the framework of the Centralparks Interreg CE1359 project, commissioned by the Danube-Ipoly National Park Directorate.

Among the possible impacts, the present work focuses primarily on **tree utilization** since the surveys, **silvicultural interventions**, and any significant **natural disturbances** that may occur.

# 2. Background

## 2.1. Background project

The consortium led by the Danube-Ipoly National Park Directorate carried out the tasks of the project “Multi-objective condition assessment in the Hungarian Carpathians” supported by the Swiss-Hungarian Cooperation Program. The project, implemented between 2012 and 2017, was researched to promote the conservation of the Natura 2000 forest habitats of the Northern Central Mountains, including the Börzsöny, Mátra, and Aggtelek karsts, and the populations of some groups of associated organisms (forest birds, bats, and xylophagous insects). The most basic step for the effective conservation of the plant and animal species of forest communities is the proper description and interpretation of the condition of the forests. Before the start of the project, not only the forest condition descriptive data serving the above objectives, but also the forest condition survey methodology suitable for the objectives were available. The task was therefore twofold:

1. Develop the appropriate methodology;
2. Carry out a forest condition survey in a large area.

The basic aim of the developed methodology was to be able to evaluate the forests of the surveyed areas on a fine spatial scale in many aspects. Sampling for a large number of variables has been developed, providing opportunities for multifaceted evaluation. In addition, the methodology focused on a detailed description of the condition of forests in Natura 2000 areas, which are typically close to nature. In this way, it can effectively support forestry-conservation planning and control tasks.

Sampling was based on a systematic grid that completely covered the area. At the sampling points, some variables of the stand (qualitative and quantitative conditions of living and dead trees), herbaceous level, place of production, and microhabitats of high biological importance were surveyed in an area of 500 $m^2$. In the 30 $m^2$ subplots located concentrically in the middle of the plot, the regeneration of shrubs and woody trees was recorded. The environment of the route between two adjacent sampling points represented the sampling section, where, among other things, site-specific microhabitats, as well as fresh natural disturbances, were recorded.

Field surveys conducted between 2014 and 2016 were carried out at nearly 60,000 sampling points in the entire project area. The results of the project are included in Volume 9 of the ROSALIA study volume series (Standovár et al. 2017). Only the basic information related to the area of Börzsöny, which is relevant to the current task, is included here.

Between 2014 and 2016, a total of 35,048 sampling points were taken in the approximately 29,100-hectare forest-planned area planned for mapping in Börzsöny. Nearly two-thirds of the sampling points (64.22%) were measured at a sampling density of 100 × 100 m (1 point/ha intensity). In the eastern-south eastern part of the mountains, however, a sampling net of 70.71 × 70.71 m (2 points/ha intensity) was applied in a significant area (34.26%). The denser sampling was justified on the one hand by the intention of a more detailed survey of the forest image due to previous natural disturbances, and on the other hand by the data requirements of the forest planning tasks (Diósjenő – Királyréti District, 2017). A 50 × 50 m spatial net (4 points/ha intensity) was applied in the area of the Pagan – Rose Forest Reserve.

## 2.2. Lessons learned from the preliminary study of monitoring

Within the framework of the 6th work package of the SH-4/13 project, the objective was to develop and test a monitoring system that effectively serves to understand the impact of activities and interventions in forest-planned forests for farming or management purposes on the condition of the forest. Due to the shortness of time, only initial steps could be taken within the project to squeeze the completion of many ongoing project tasks.

The most important experiences of the pre-screening of impact monitoring, which influenced the implementation of the current task, were the following:

1. Due to the objectives/nature of the forest condition survey protocol developed under the project, it uses rough estimation scales for many variables and individual sampling sites will not be permanent.
2. All these properties make the method suitable for capturing the character of a larger area (say a few tens of hectares) by characterizing many (1-2- (4) points per hectare).
3. The combination of the recorded average coordinate and the documentary photographs taken during the survey made it possible to retrieve each point with such high accuracy.
4. For point-based comparisons, differences in estimates may be due to an estimation error (for the first or second recording) or may indicate an actual change.
5. In addition to repeating the survey, field records describing the work performed may be of great importance in the evaluation phase, e.g. subject to questions specific to the particular use (e.g., "is there a trace of removal of the bumps during completed care and cleaning").
6. Different parts of the original protocol were relevant for each wood use, so it is recommended to develop a protocol and an application that flexibly supports the assessment of variables relevant to each intervention.

# 3. The structure and methods of the applied monitoring system

## 3.1 Realistic goals, thematic coverage

According to the original objectives, monitoring should have two groups of effects:

1) **Tree utilization:** this heading refers to the types of interventions carried out for forest management affecting the majority of the forests of Börzsöny. Typical pre- and end-use types for cut mode, non-cut mode use types, and other uses. The available data distinguish the following types of use:

cleaning (C / TI); selection thinning (ST / TKGY); increment thinning (IT / NFGY); demolition cutting (DC / FVB); rend cutting of the renovation cutting (RC / FVV); Clear cutting (CC / TRV); selective cutting (SC / SZV); inventory management (single-tree selection cutting) (IM / KGH); for-profit thinning (PC / HGY); sanitary cutting (SC / EC); other production (OP / ET).

Given that there are many types of use (11 in total), a decision must be made on the level of representativeness of each type when planning the sampling.

2) **Natural disturbances**: under this heading mainly abiotic disturbances that have strongly affected the forests of Börzsöny in the last 2-3 decades (windfall, icebreaking, snow breaking) and biotic effects that affect certain tree species (e.g. spruce - high ash; *Hymonescyphus fraxineus* (formerly *Chalara fraxinea*)).

## 3.2 Supporting data for planning

One of the bases for monitoring planning is the database containing the data of nearly 36,000 points surveyed between 2014 and 2016 within the framework of the Swiss-Hungarian Cooperation Program. In addition to the factual data describing the “before” status, the date of the survey is very important for planning, as well as a total of about 216,000 document photos per point 6, which play a key role in the retrieval.

DINPD provided access to the current forest plan map and data from which parts of the forest could be used. The data content relevant to the monitoring planning of the transmitted data is as follows:

- forest plan identifiers (AZOK, City, Member, Detail)
- area
- forest manager
- mode
- tree type
- disease
- primary and secondary uses
- naturalness
- the basic requirement for a state of naturalness

- year of last use (2019 is the latest data)
- method of last use

The combined use of these two data sources made it possible to tell at each point whether the planned use of wood had taken place since the SH project, i.e. to establish the validity of the data stored in the database (excluding spontaneous changes).

The resulting image was far from complete/accurate. As **there was no information on the intensity and spatial extent of each intervention** (whole forest area or sub-area), the picture shown in the figure above shows that a much larger proportion of points may be obsolete than would be justified by the actual situation.

However, there was no accurate data on the use of wood in the spring of 2019/2020 and in progress in 2020, which would increase the number of invalid points. DINPD has provided data on the cut classification for the intended wood uses, but there is no valid data on the uses carried out.

Finally, we received accurate data on the use of wood and silvicultural activities from the records of Ipoly Erdő Ltd., For which we are especially grateful.

Of the natural disturbances affecting the Börzsöny area, we have data on the ice-breaking at the beginning of December 2014 for the most affected areas. No systematic information is available on other subsequent disturbances.

## 3.3 The data collection protocol developed in 2020

Due to the variety of possible goals outlined in Section 3.1, a “multipath”, flexible approach according to user needs is required. The technical implementation of this was achieved by the flexible design of the android application (ForestDataCollect) used for the forest condition survey.

For each type of wood used, the protocol presented in Table 3 below has been proposed. During the recording, the recording is first divided according to the type of intervention. Given that due to sub-area uses, we cannot know in advance whether an intervention has taken place at a given point, the protocol asks for this as well. Depending on whether an intervention has taken place and if so, the different main categories of plots may be in the same forest area (e.g. in the case of FVV where a restoration area has been carried out, where not yet, a plot of middle age or old forest category should be taken). Therefore, there are 3 tables below, where we specify the variables to be included and omitted for each main category. So at first, there are plenty of “green cells” in the tables, but it’s worth noting. that there are so many combinations that are rarely realized. For example, even if the protocol indicates what to record in the juvenile when using clearing, this can only happen if the data is incorrect. However, in the case of young people, the anthill pen may seem very “narrow-minded”, but it is worth considering that it is almost impossible to get this category for most types of wood used, it is typically a brush-dense stock between 1.5 and 5 m high.

In the case of forest fragments to be designated as controls, it is practically recommended to include the entire original protocol.

Based on the type of intervention and the main category, the developed form offers the different groups of variables according to the content detailed in the study for DINPI in 2020, and at the beginning of the survey, it is recorded whether there is a trace of wood used in the forest area.

## 3.4 Principles for designating sampling points

In Section 3.2, we briefly review what data sources the design can rely on. We emphasized that the original data are spatially explicit, and in addition to the many (in our case 5-7) years of retrieval, an important question is also to what extent can the areas affected by different interventions and natural disturbances be localized?

For all these reasons, the basic feature of the monitoring recording is that:

3.2. is not intended to compare the time series of individual points;
3.3. the basic unit for monitoring change in the forest area;
3.4. the interpretation of forest-scale comparisons can be refined, enriched by point-based analysis in case of accurate retrieval.

The forest plots to be included in the sample for 2021 were selected taking into account the following criteria:

- Sampling focuses on pre-uses (TI, TKGY, NFGY, KGH), fiber cutting, and fiber supply.
- Sampling takes into account the farming layer (4 state forestry)
- Sampling also includes untreated control
- Sampling was performed only for the 3 main FATI_CSOPs (B, GYT, CS).
- Sampling focused on the effects of interventions in 2019 and 2020.

A total of 118 forest areas with an area of 1010 ha have been selected (Map 1)

The distribution of the sample areas between forestry and wood use types is shown in Table 1.

| Forest manager | TI | TKGY | NFGY | SZV | SZAL_KGH | controll | SUM |
|---|---|---|---|---|---|---|---|
| Diósjenő Forestry | X | 5 / 74,9 | 6 / 61,4 | 7 / 77,0 | X | 7 / 55,9 | 25 / 269,3 |
| Kemence Forestry | 7 / 50,4 | 5 / 54,9 | 9 / 73,9 | X | X | 7 / 75,7 | 28 / 254,9 |
| Királyrét Forestry | X | 2 / 6,9 | 5 / 36,3 | 11 / 61,1 | 13 / 104,6 | X | 31 / 208,9 |
| Nagymaros Forestry | 5 / 34,9 | 10 / 71,5 | 10 / 104,1 | 9 / 67,7 | X | X | 34 / 278,1 |
| SUM | 12 / 85,2 | 22 / 208,2 | 30 / 275,8 | 27 / 205,7 | 13 /104,6 | 14 / 131,7 | 118 / 1011,3 |

Table 1. Distribution of sampled forest fragments (pieces/ha) between farmers and types of use.

# 4. Results

Data from 118 forest plots and 4070 sampling plots surveyed in 2021 allow for versatile analysis. This report addresses the following issues:

- the proportion and spatial pattern of the planned wood use;
- how the composition of the tree species changes, the fate of the mixed tree species;
- how the variability of the diameter distribution develops;
- whether dead wood associated with wood uses has been removed;
- how intense the traces of wood use work are on the site and the remaining trees

## 4.1. Intensity and spatiality of wood use implementation

One of the important goals of treatment impact monitoring is to monitor what happens to the tree species composition during use, how the fate of the mixed tree species changes (number, mixture ratio). After all, it is during the pre-uses that the representation of older species of these species will / will be decided.

The number of tree species did not change significantly in the forest parts affected: the smallest decrease (-0.05) was measured in the forest parts of Nagymaros, while the largest decrease (-0.3) was measured in the forest parts examined in Kemence Forestry. If we look only at the data of the forest parts affected by TI, it can be stated that we experienced the largest decrease in the average number of tree species here (Nagymaros Forest -0.99; Kemence Forestry -0.72). In the case of TKGY, there was no significant change in the average number of tree species. In the case of both NFGY and SZV interventions, we measured the largest (NFGY -0.3; SZV 0.52) decrease in the average number of tree species in the examined forest parts of Nagymaros Forestry. The spatial development of the average number of tree species per forest plot is shown in maps 3-4.

If we focus our analyzes on the species treated as mixed tree species (the number of native tree species except for KTT, CS, B, GY), then in addition to their number of species, it is also worth examining the evolution of their mixture ratio. Our interest was mainly focused on the direction and extent of the use of TI, TKGY, and NFGY. According to the combined data of all examined use types, the average number of mixture species decreased minimally (-0.16), and their mixture proportion (calculated based on coverage in these surveys) decreased minimally, on average by 1.8%. There is a large variance in the proportions of the forest behind the minimum average change in the forest fragment scale. The range of the average change in the proportion of mixed tree species per forest section was between 24.77% and + 22.1%. Positive values - i.e. the increase in the proportion of mixed tree species as a result of the intervention - occurred mainly in all forestry and almost all types of wood use. To interpret these, it is worth looking at the itemized description of each forest detail. After all, this result can be caused by the targeted extraction of the target tree species (B, GY, KTT, CS), but it is also simply that the spatial resolution is higher than the original survey (4 plots/ha in 2021, while only 1 plot in 2014-2016). / ha), the patches of the forest part richer in mixed tree species were also included in the sample. The average value of the mixture ratio of mixed tree species per forest plot is shown in maps 5-6.

Concerning changes in tree species composition, it is worth briefly addressing the issue of non-native species, especially aggressively spreading non-native species. The area studied is generally, fortunately, still very poor in these species. Nevertheless, we examined forest fragments where the proportion of aggressively spreading alien tree species (mainly acacia and/or idol) increased. The most worrying manifestation of this is the parts of the forest affected by the felling, where the dense idol tree has grown young in the open-planned open-air stand without great care.

| Forest manager | TI | TKGY | NFGY | SZV | SZAL_KGH | controll | SUM |
|---|---|---|---|---|---|---|---|
| Diósjenő Forestry | X | 65,5 | 72,8 | 58,1 | X | 0 | 46,8 |
| Kemence Forestry | 76,9 | 85,7 | 78,9 | X | X | 0 | 59,9 |
| Királyrét Forestry | X | 57,1 | 74 | 41,1 | 44,2 | X | 48,7 |
| Nagymaros Forestry | 67,3 | 69,4 | 72,3 | 51,8 | X | X | 65,3 |
| SUM | 72,9 | 71,1 | 74,7 | 49,1 | 44,2 | 0 | 55,7 |

Table 2. Distribution of the intensity of the interventions (in what percentage of the actual areas used) between farmers and types of use.

## 4. 2. Tree species composition and mixture

One of the important goals of treatment impact monitoring is to monitor what happens to the tree species composition during use, how the fate of the mixed tree species changes (number, mixture ratio). After all, it is during the pre-uses that the representation of older species of these species will / will be decided.

The number of tree species did not change significantly in the forest parts affected: the smallest decrease (-0.05) was measured in the forest parts of Nagymaros, while the largest decrease (-0.3) was measured in the forest parts examined in Kemence Forestry. If we look only at the data of the forest parts affected by TI, it can be stated that we experienced the largest decrease in the average number of tree species here (Nagymaros Forest -0.99; Kemence Forestry -0.72). In the case of TKGY, there was no significant change in the average number of tree species. In the case of both NFGY and SZV interventions, we measured the largest (NFGY -0.3; SZV 0.52) decrease in the average number of tree species in the examined forest parts of Nagymaros Forestry. The spatial development of the average number of tree species per forest plot is shown in maps 3-4.

If we focus our analyzes on the species treated as mixed tree species (the number of native tree species except for KTT, CS, B, GY), then in addition to their number of species, it is also worth examining the evolution of their mixture ratio. Our interest was mainly focused on the direction and extent of the use of TI, TKGY, and NFGY. According to the combined data of all examined use types, the average number of mixture species decreased minimally (-0.16), and their mixture proportion (calculated based on coverage in these surveys) decreased minimally, on average by 1.8%. There is a large variance in the proportions of the forest behind the minimum average change in the forest fragment scale. The range of the average change in the proportion of mixed tree species per forest section was between 24.77% and + 22.1%. Positive values - i.e. the increase in the proportion of mixed tree species as a result of the intervention - occurred mainly in all forestry and almost all types of wood use. To interpret these, it is worth looking at the itemized description of each forest detail. After all, this result can be caused by the targeted extraction of the target tree species (B, GY, KTT, CS), but it is also simply that the spatial resolution is higher than the original survey (4 plots/ha in 2021, while only 1 plot in 2014-2016). / ha), the patches of the forest part richer in mixed tree species were also included in the sample. The average value of the mixture ratio of mixed tree species per forest plot is shown in maps 5-6.

Concerning changes in tree species composition, it is worth briefly addressing the issue of non-native species, especially aggressively spreading non-native species. The area studied is generally, fortunately, still very poor in these species. Nevertheless, we examined forest fragments where the proportion of aggressively spreading alien tree species (mainly acacia and/or idol) increased. The most worrying manifestation of this is the parts of the forest affected by the felling, where the dense idol tree has grown young in the open-planned open-air stand without great care.

## 4. 3. Tree structure

The average closure of the forest stands affected by the affected areas decreased only slightly. Different variances were observed behind the similar small mean change for each bout. The largest variance (13.9) was observed in Királyréti Forestry, while the smallest (7.8) was observed in the affected forest parts of Diósjenő and Kemence Forestry.

The relative cover values of the 5 thickness classes used to describe the stand (0-8 cm; 9-20 cm; 21-35 cm; 36-50 cm; 50p cm) depend on the thickness distribution of the starting stand and in this context on the type of intervention. Accordingly, e.g. As a result of TI, the relative coverage of the 0-8 cm thickness class decreases (by 11.5% on average), while that of the 9-20 cm class increased (by 17.6% on average). Similarly, general effects of other types of use can be observed.

Among the variables used to describe the tree structure, the average values of diameter class diversity and pseudo-species number (number of non-empty cells in the species * thickness class matrix) are only our minimum, increased minimally, but also significantly varied between forest parts. The more significant increase in the number of pseudo-species is recorded in several cases (e.g. NM 38 / A), where the pre-intervention sampling was much less intensive.

## 4. 4. Deadwood conditions

During the monitoring, we paid special attention to the change in the supply of deadwood. The question was how the number of standing dead trees would change, in other words, would the conscious removal of dead trees be achieved during the interventions? In addition to the registration of the standing dead tree according to the protocol (only in the case of NFGY, SZV, SZAL-KGH), we also asked if the surveyor noticed any traces of the dead tree felling in the forest area. The surveyors gave a positive answer to the latter question in the case of 22 forest districts, i.e. in almost one-fifth of the examined forest districts affected by the intervention, we detected traces of deliberate removal of standing deadwood. Before presenting the obtained results, it is worth emphasizing that the forests of Börzsöny are poor in deadwood. According to the data of the baseline survey between 2014 and 2016, the average number of dead trees thicker than 8 cm per plot (500 $m^2$) is only 1.17 (i.e. 23 per hectare). On the average of the forest stands affected by the intervention, the number of all standing dead trees per plot decreased by 0.52, i.e. by almost 45%, the largest (0.78) in Nagymaros Forestry and the smallest (0.39) in Királyréti Forestry. Most of the standing dead trees were thin, only 23% of the plots contained standing dead trees thicker than 20 cm (Királyrét 19.9%; Diósjenő 20.8%; Nagymaros 24.1%; Furnace 35.2%), this decreased down to an average of 15% (Diósjenő 7.8%; Királyrét 12.8%; Nagymaros 18%; Kemence 27.2%). The largest decrease (17.8%) was measured in Diósjenő and the smallest (9.6%) in Kemence Forestry. The frequency of plots with deadwood thicker than 20 cm before and after the procedure is shown in maps 7-8. The average number of all standing dead trees per forest plot before and after the interventions is shown in Figures 9-10. maps show.

Similar to standing deadwood, the supply of lying deadwood was relatively low even before the interventions. The average amount of lying deadwood per forest was 5.1-7.5 m³. The smallest dead trees were in Nagymaros and the most in Kemence Forestry. The proportion of plots with deadwood thicker than 8 cm was between 0.84 and 0.87, while the proportion of plots with thicker than 35 cm was only 0.028 in Nagymaros Forestry, and between 0.07 and 0.092 for the other three forests. . As a result of the interventions, the amount of lying deadwood showed a small decrease (on average 0.59 m³ / ha). The largest average decrease (-1.07 m³) was detected in the area of Nagymaros Forestry, which already contains the least dead wood, -0.57 m³ in the Diósjenő Forestry, -0.39 m³ in the Királyréti Forestry, and -0.3 m³ in the Kemence Forestry. A decrease of 24 m³ was measured. Maps 11-12 show the amount of lying deadwood before and after the procedure. The proportion of plots with a thickness of more than 8 cm increased minimally, while the proportion of plots with a thickness of more than 35 cm increased minimally in two cases (Diósjenő 0.024; Nagymaros 0.028), decreased in two cases (Királyrét -0.02; Furnace 0, 04). The proportion of plots with deadwood thicker than 35 cm before and after the procedure is shown in Maps 13-14.

## 4. 5. Tracks of the tree utilization

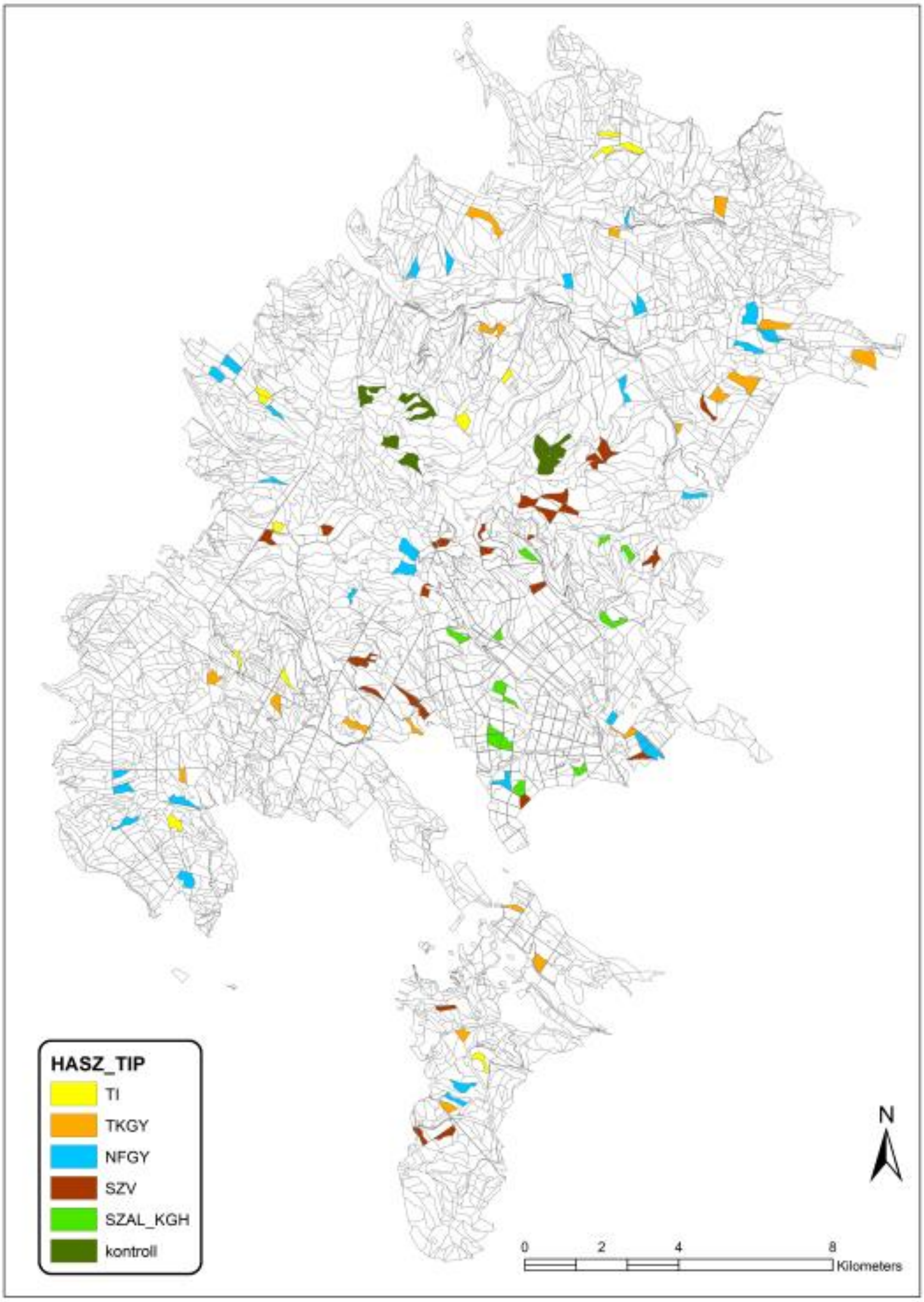
It is difficult to conclude this issue directly from the data of the protocol recording. This is why we designed a questionnaire that the surveyors filled in after taking the plots belonging to the 1-1 forest plot, i.e. after visiting the whole forest plot. The level of soil damage associated with wood use was not considered dangerous by the surveyors in the majority of the forest areas affected by the treatment (41 barely and 46 poor ratings), giving a strong rating in 11 cases and a brutal rating in only 4 cases. From this point of view, the most favorable situation was registered in the area of Nagymaros Forestry, wherein half of the affected forest parts (34) the soil damage was weak, and in only 4 cases the soil damage was weak. The other extreme was found in the examined forest details of Királyréti Forestry, where 11 strong and 3 brutal were born in addition to 11 barely, 13 weak ratings. Kemence Forestry is similar to that in Nagymaros, while weak soil damage was predominant in Diósjenő Forestry (12 out of 18 cases).

The question on cortical damage was absent in 60 cases, scattered in 39 cases, and in 3 cases the surveyors gave many answers. The differences between the individual forests are similar to those described for soil damage. The no-scatter ratio in Nagymaros is 26 - 7; Furnace 12 to 8; In Diósjenő 9 - 8, while in Királyrét 13 - 16.

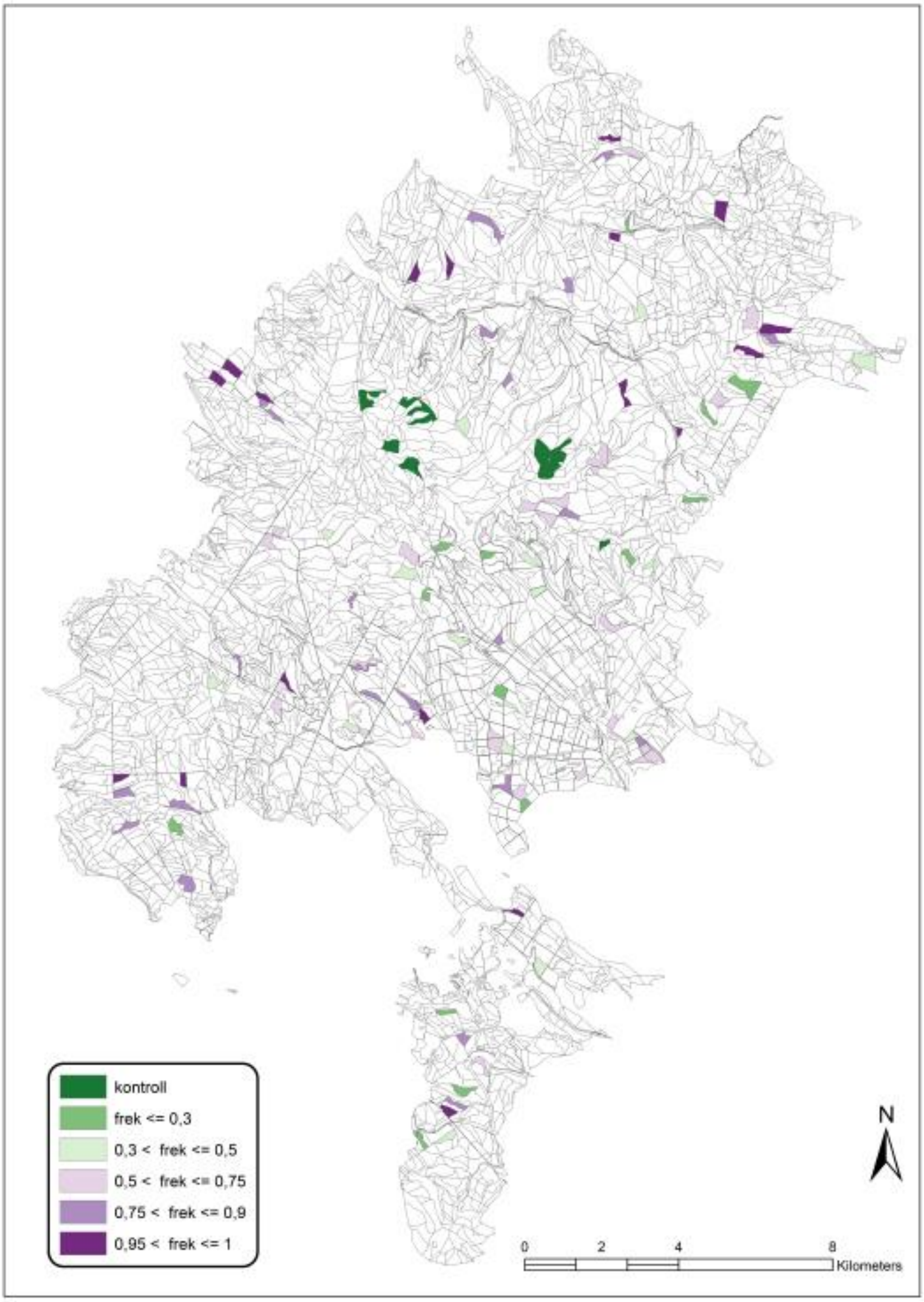
# 5. General conclusions

From the experience of the 2021 monitoring survey, I consider the following to be important for the future:

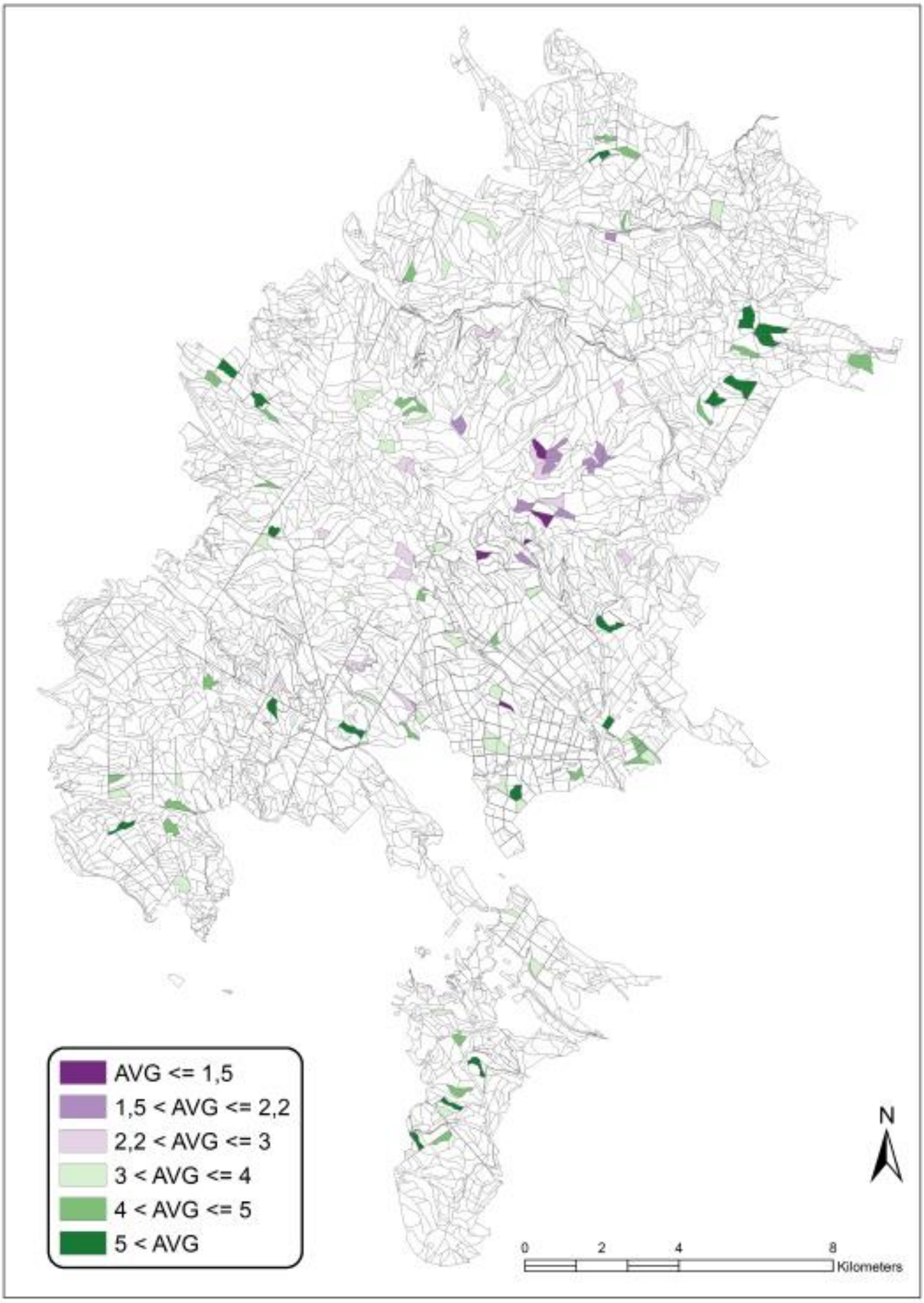
1. It was a good decision to use the sampling intensity of the 50 * 50-meter network (4 plots/ha) to characterize the forest areas
6. The method used was suitable for detecting the important effects analyzed in this report, even if the current analysis is complicated by the fact that the sampling was different in the baseline survey, in many cases up to a quarter, but this will not be a problem in future iterations.
2. In addition to the results discussed in the report, which are mainly aggregated by farmer and type of timber use, a detailed study of the forest-based and plot-based thematic shape files in the digital annexes provides answers to many specific targeted questions.



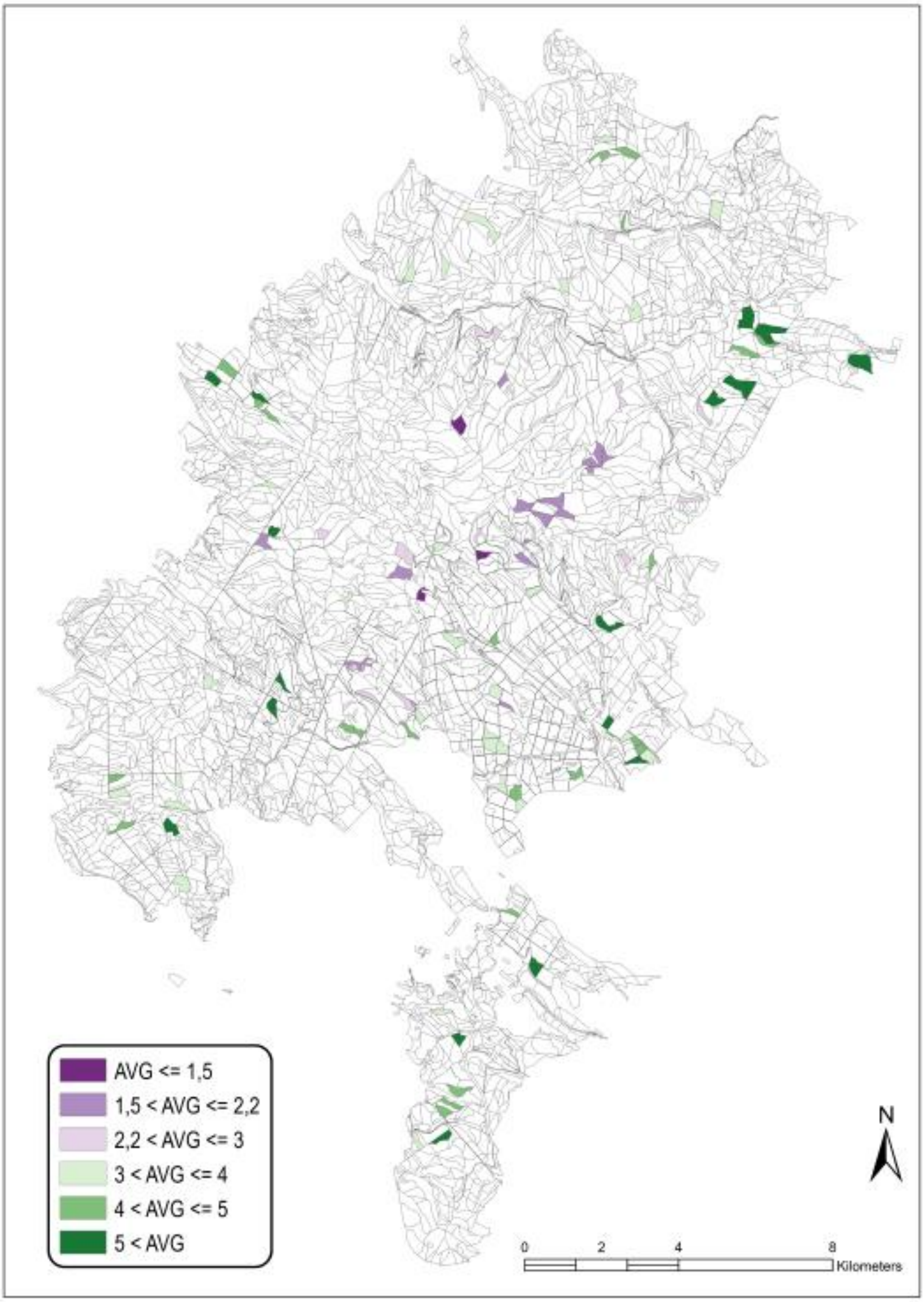

Map 1. In the area of Börzsöny in 2021, the forest parts were affected by sampling.



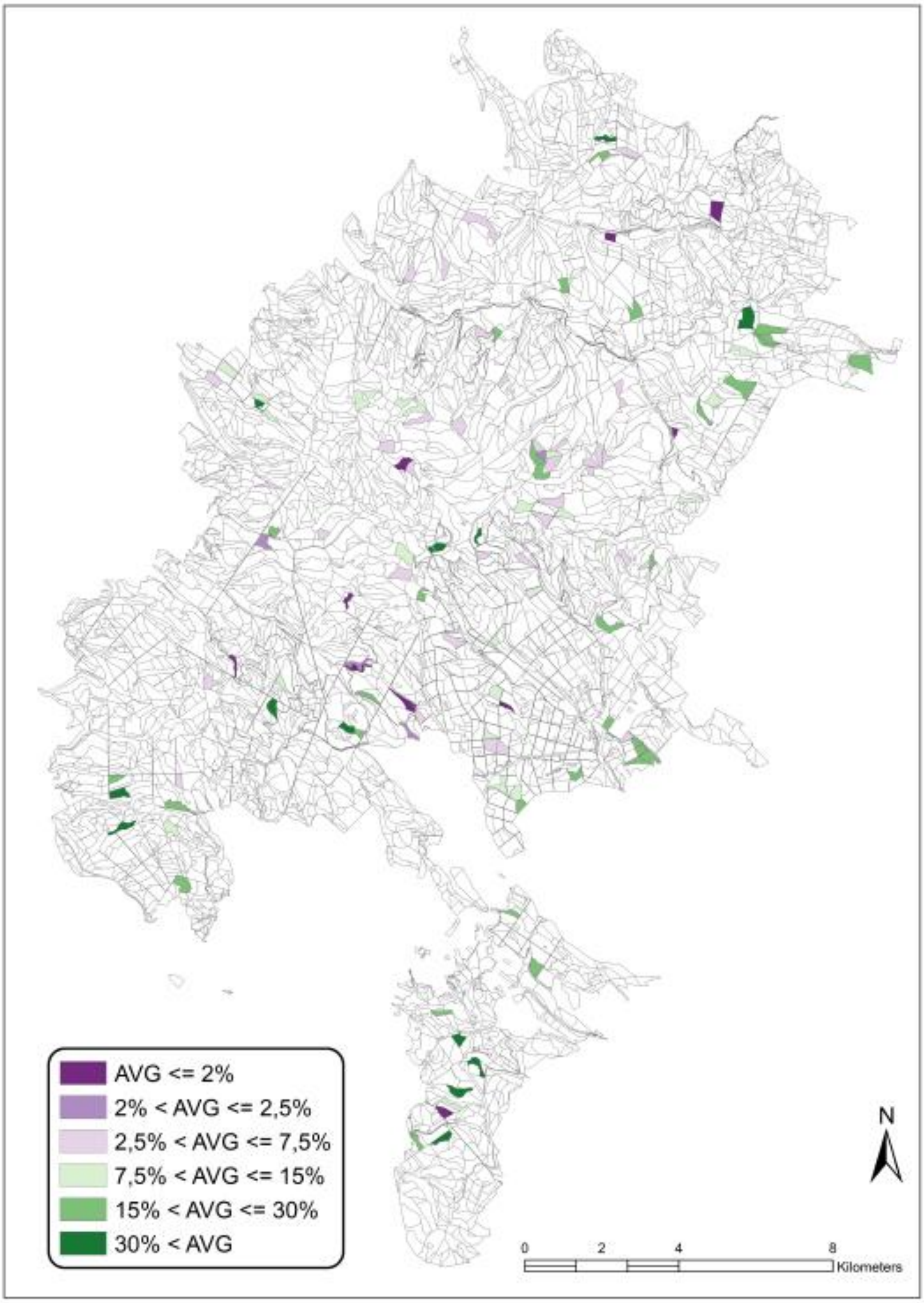

Map 2. Frequency of wood use by forest parcel (use in a proportion of the plots in the forest parcel)



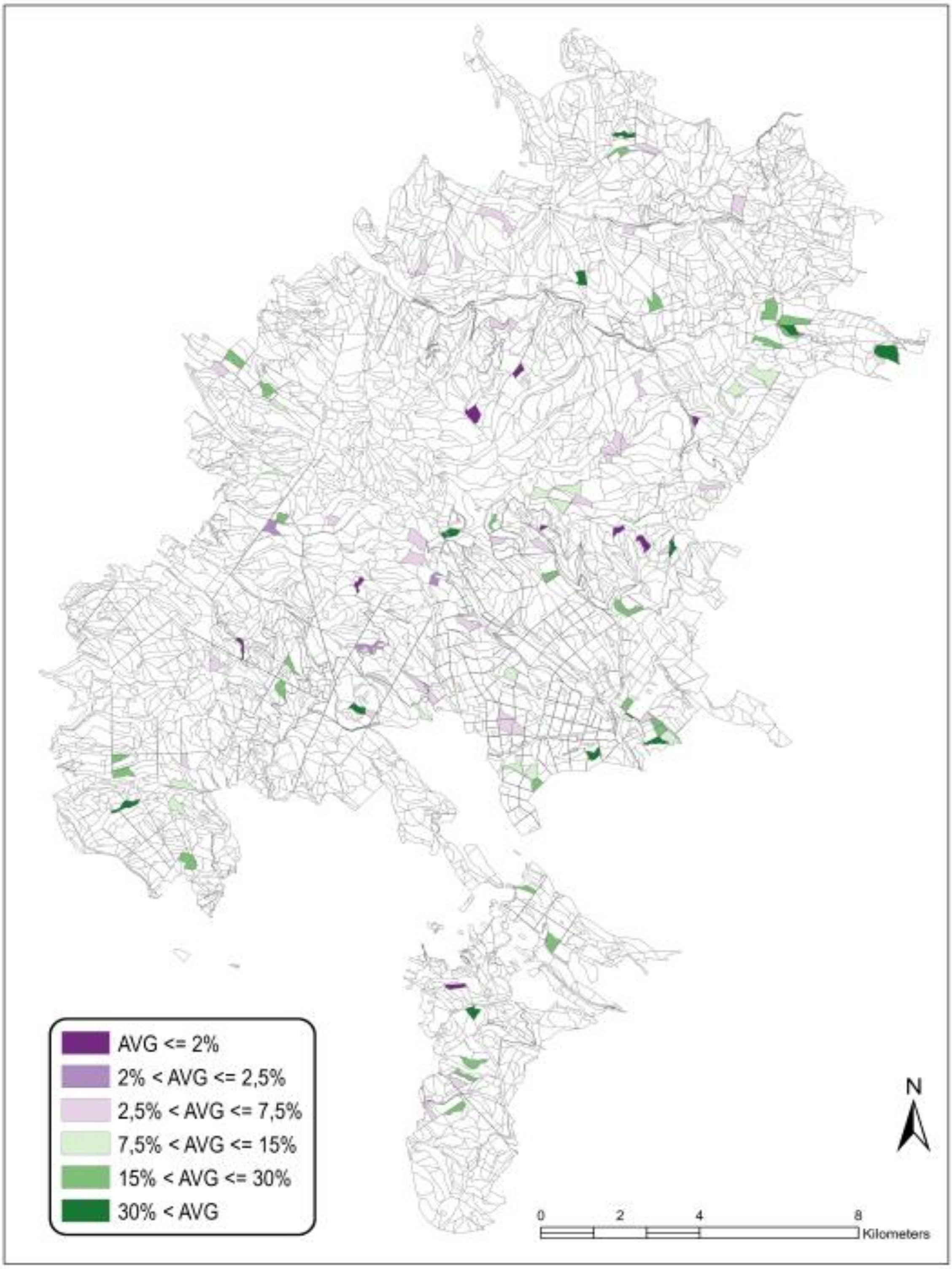

Map 3. The average number of tree species per forest plot before the use of wood in 2019-2020



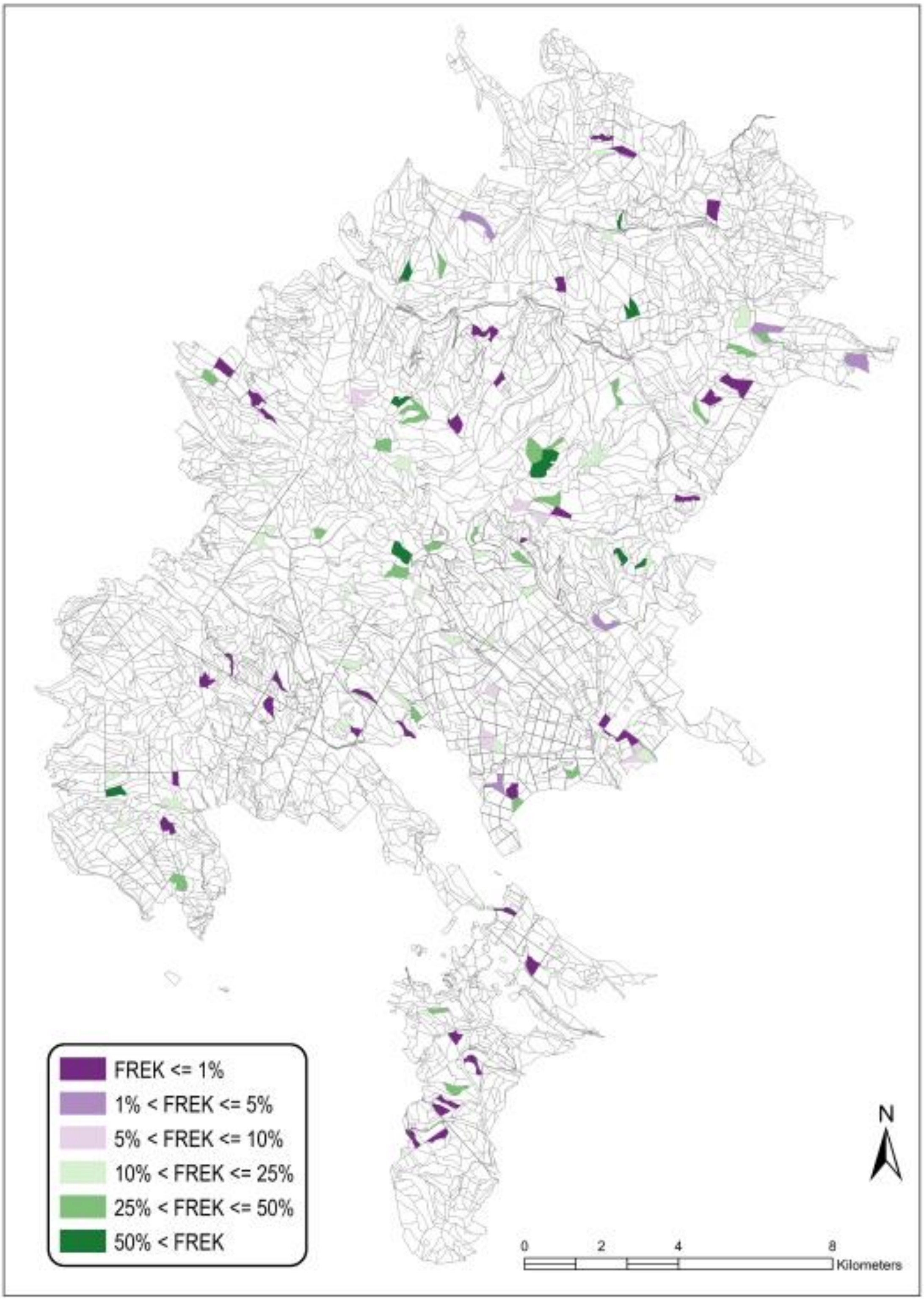

Map 4. The average number of tree species per forest plot after 2019-2020 tree uses



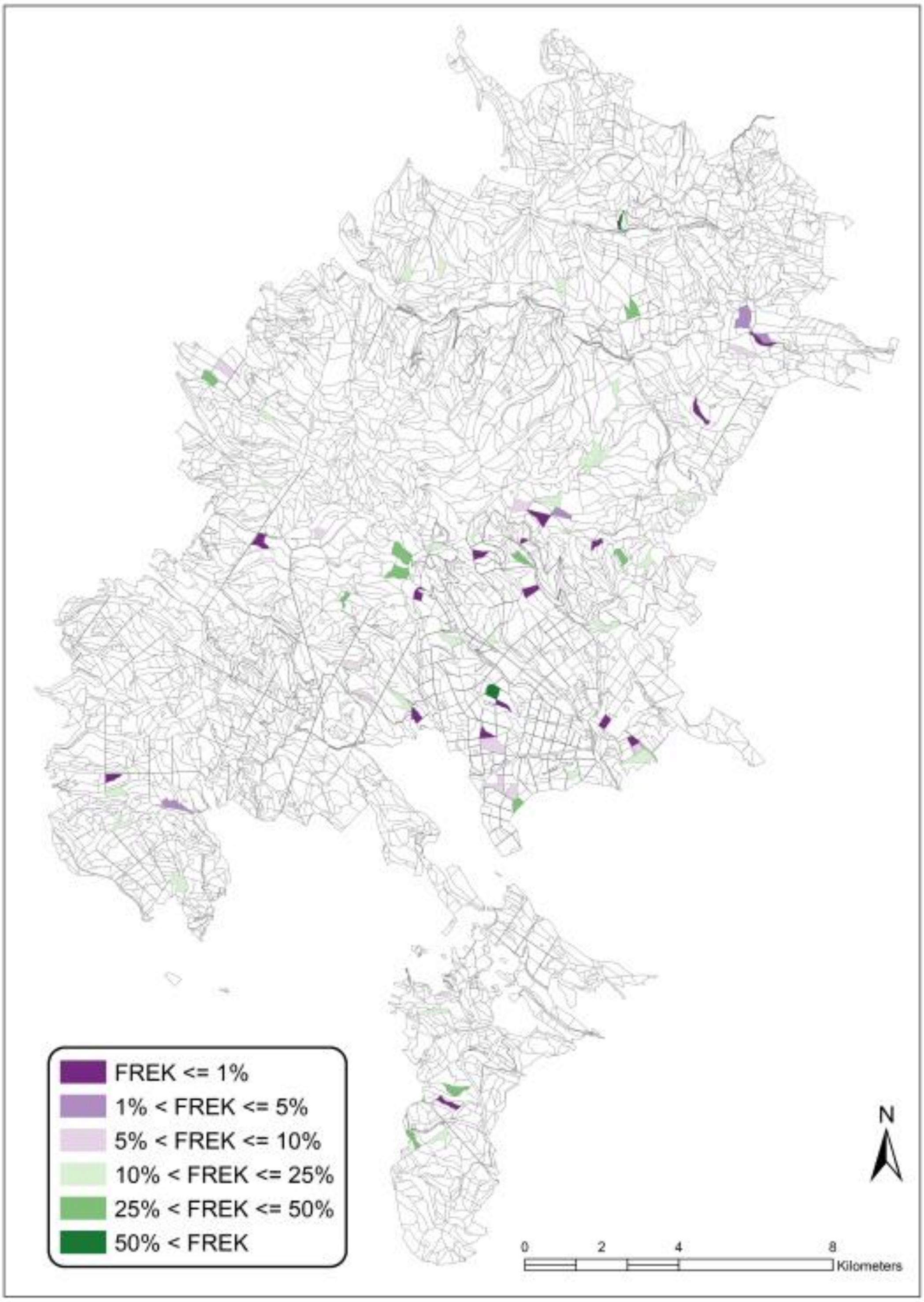

Map 5. The average proportion of mixed tree species per forest plot before timber use in 2019-2020



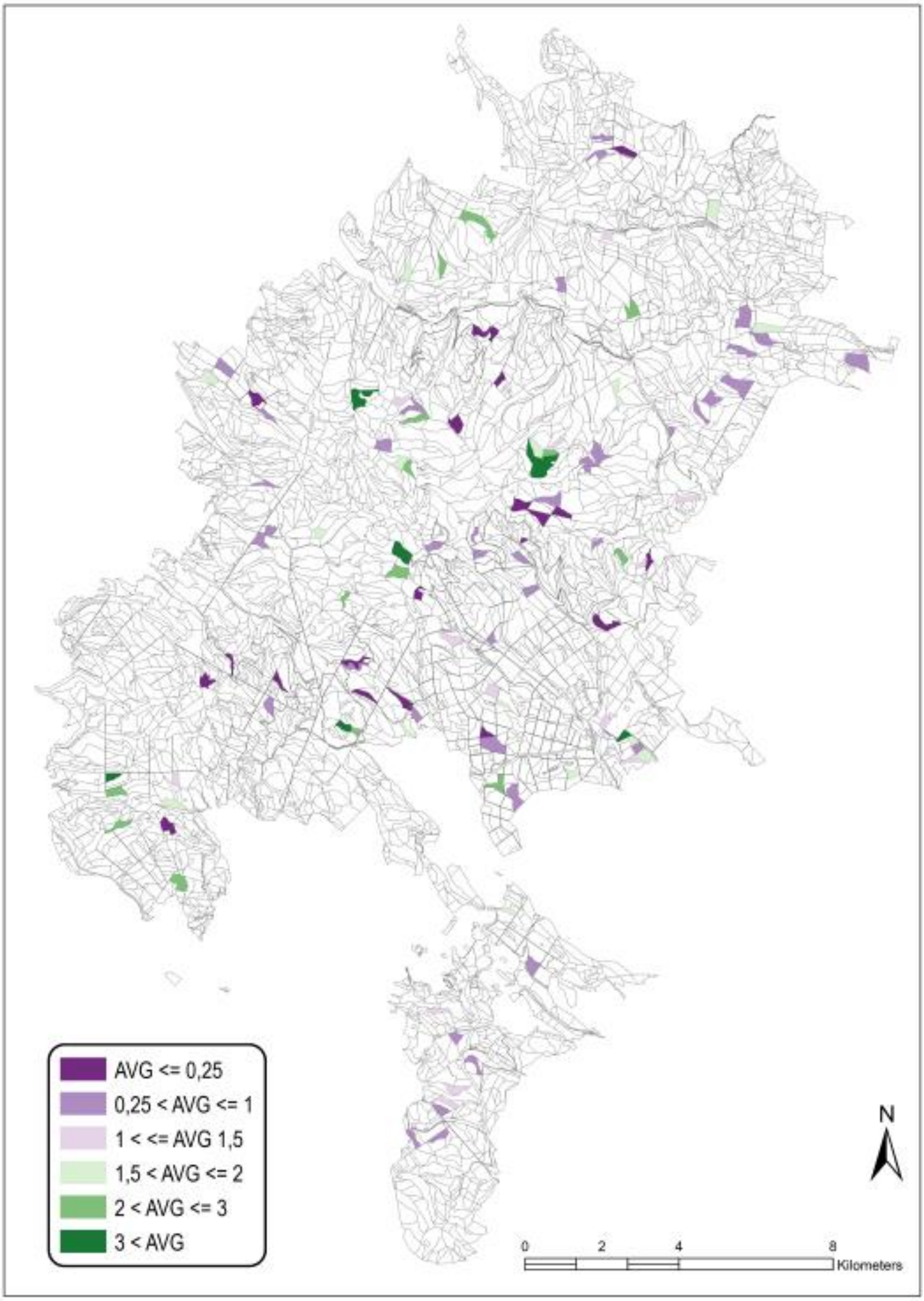

Map 6. The average proportion of mixed tree species per forest section after wood uses in 2019-2020



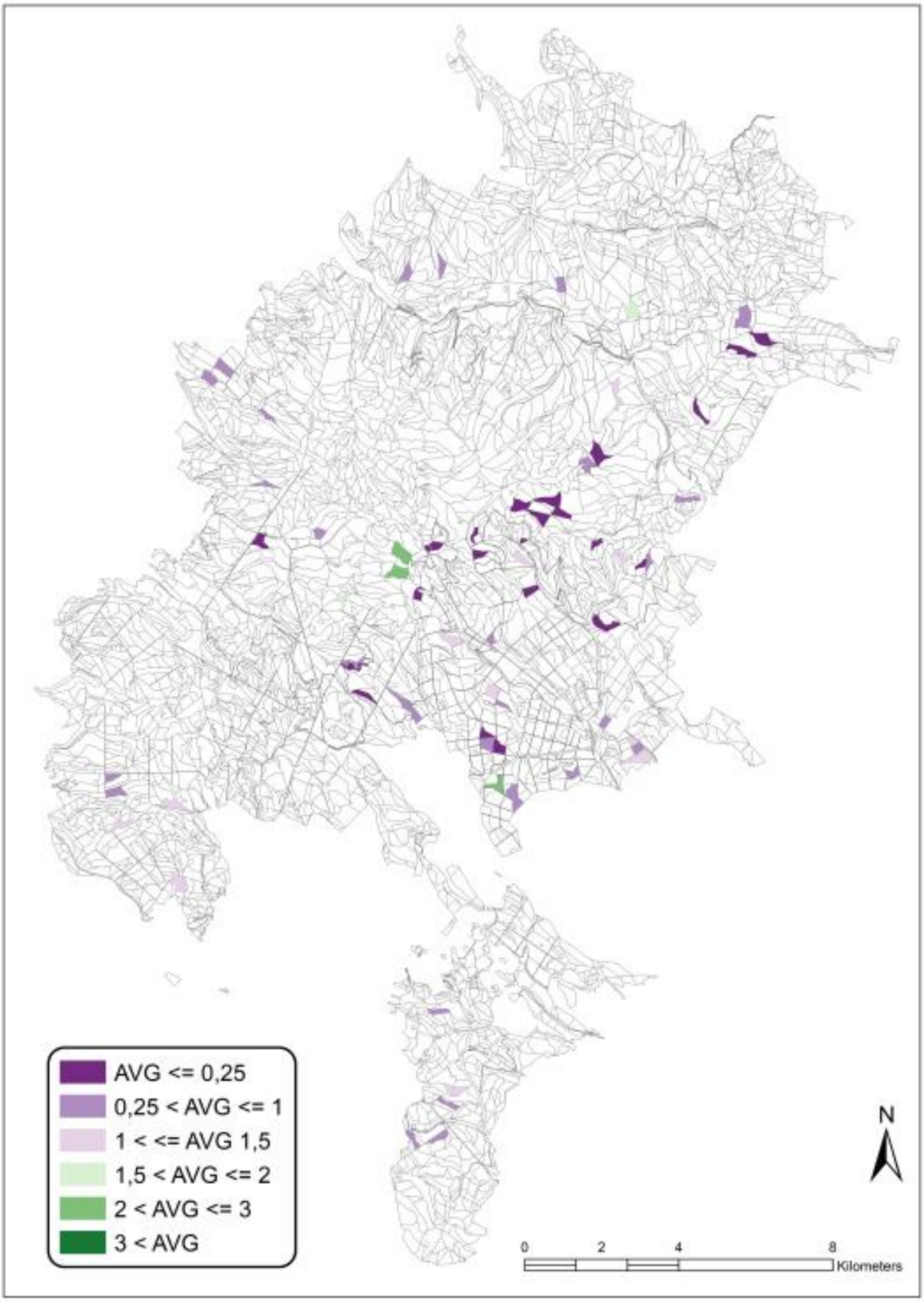

Map 7. The proportion of plots with standing deadwood thicker than 20 cm before wood use in 2019-2020



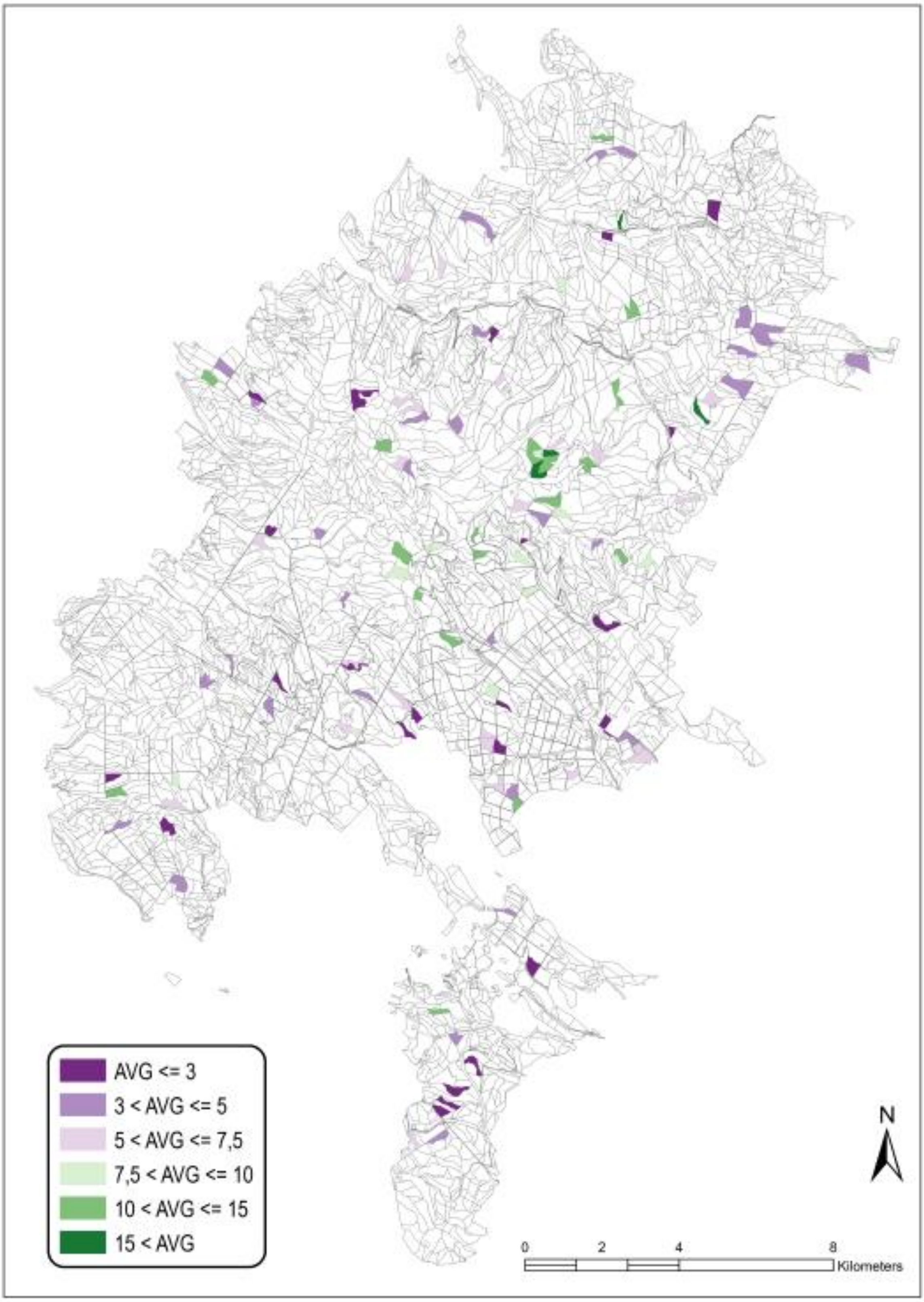

Map 8. The proportion of plots with standing deadwood thicker than 20 cm after wood uses in 2019-2020 (shown only for NFGY, SZV, SZAL-KGH)



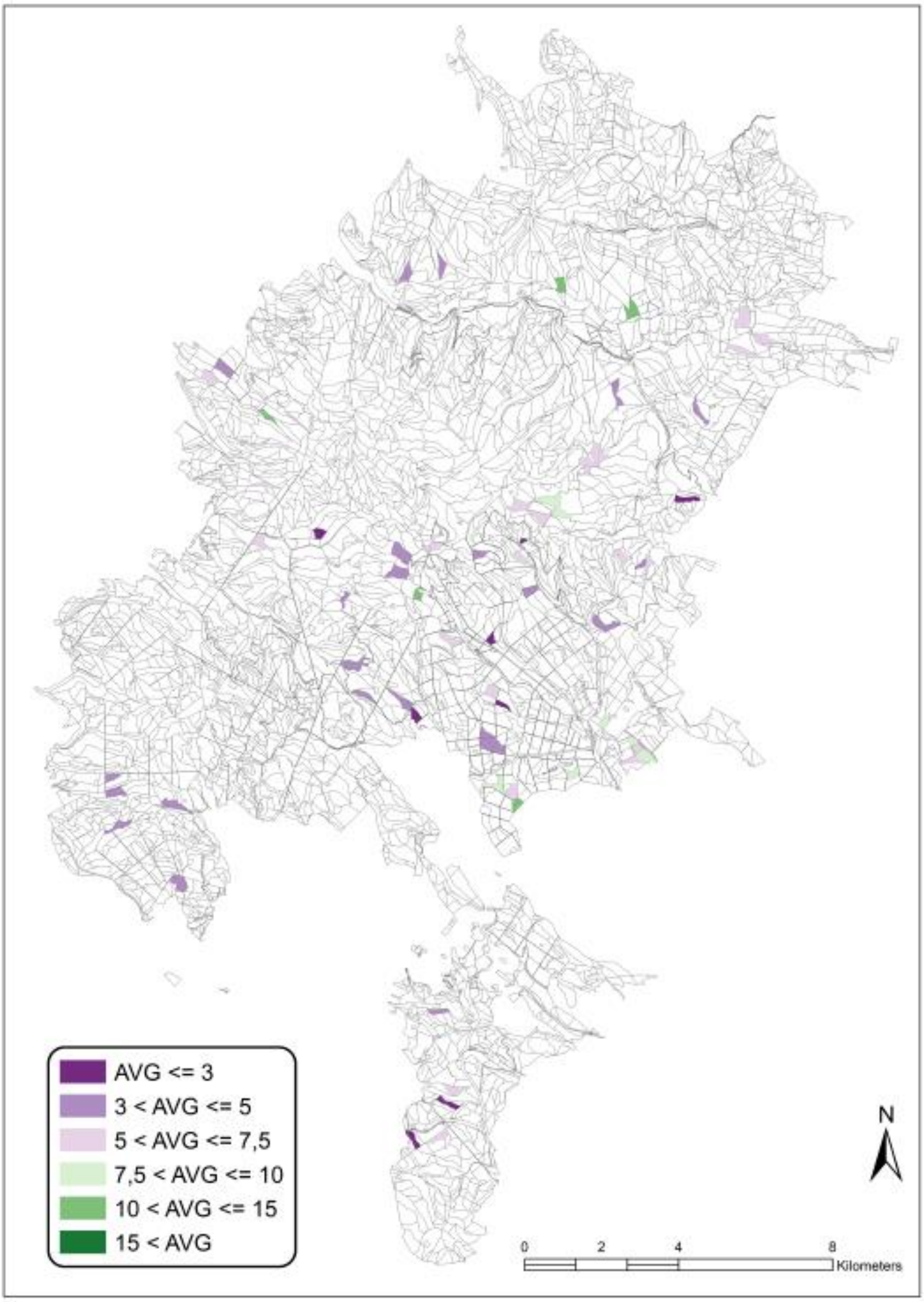

Map 9. The average number of standing dead trees per plot before timber use in 2019-2020



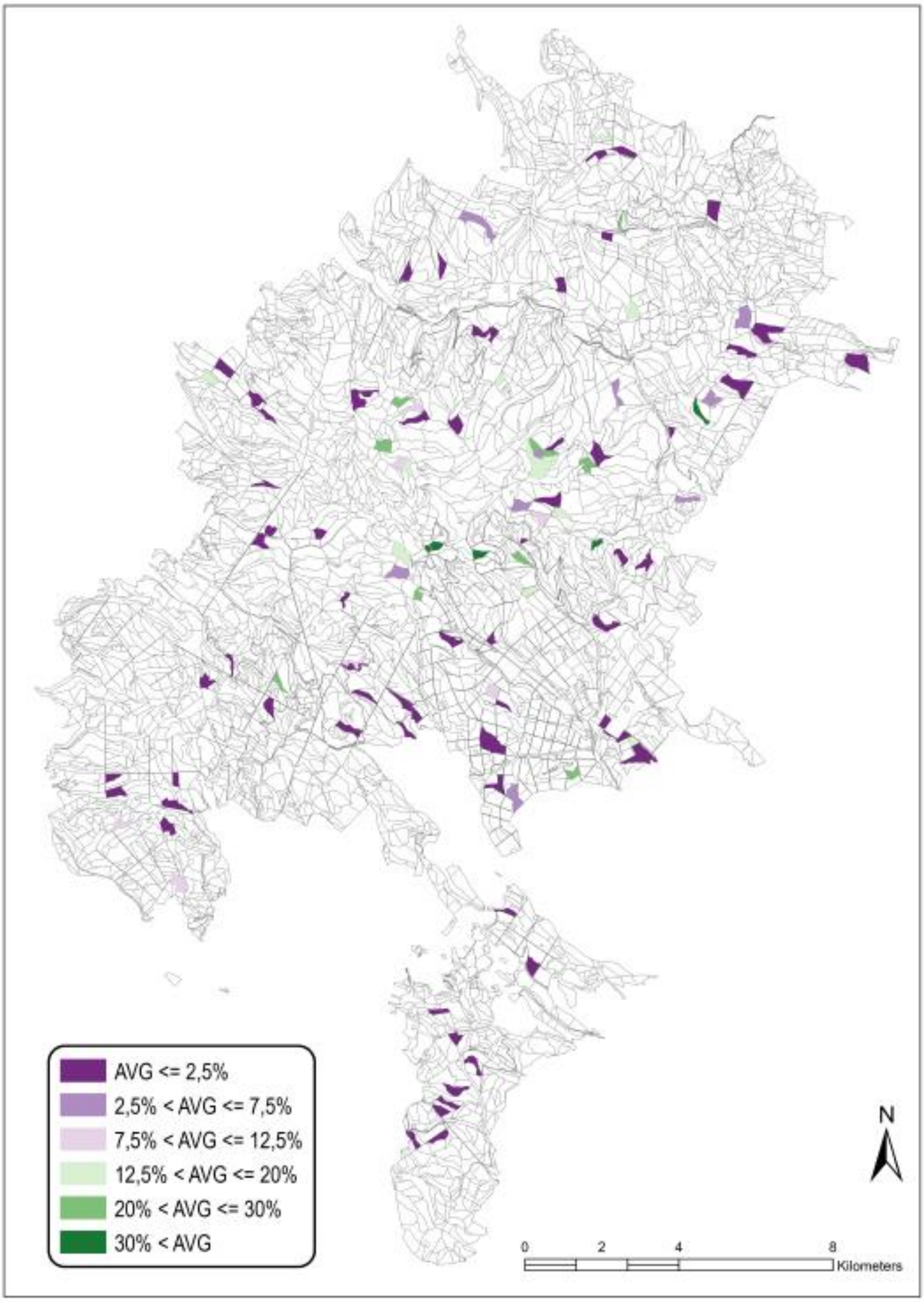

Map 10. The average number of standing dead trees per plot after timber uses in 2019-2020 (shown only for NFGY, SZV, SZAL-KGH)



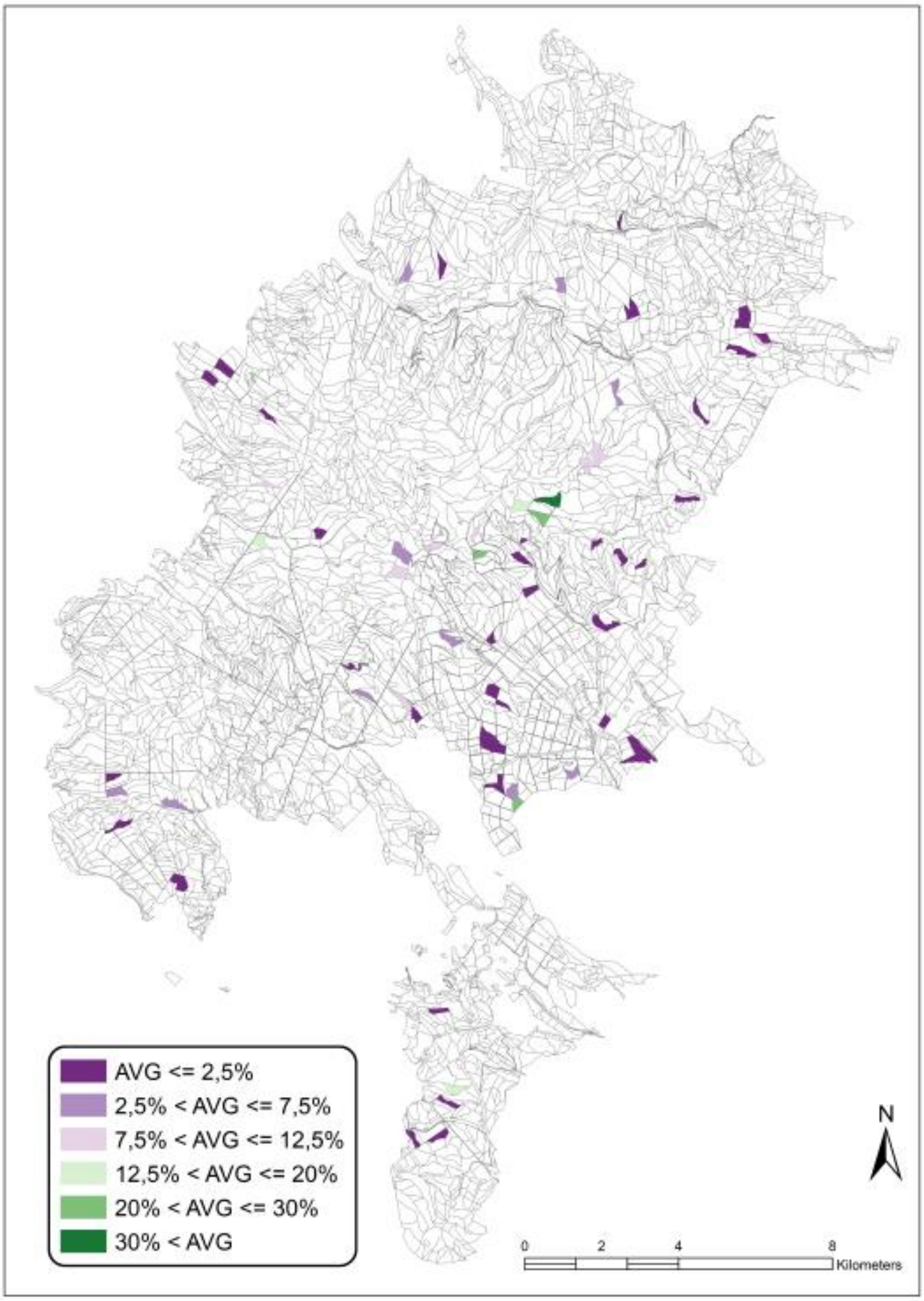

Map 11. The average amount of lying dead trees ($m^3$ / ha) before wood use in 2019-2020




Map 12. The average amount of lying dead trees ($m^3$ / ha) after wood uses in 2019-2020 (shown only for NFGY, SZV, SZAL-KGH)




Map 13. The proportion of plots with deadwood thicker than 35 cm before wood use in 2019-2020




Map 14. The proportion of plots with deadwood thicker than 35 cm after wood uses in 2019-2020 (shown only for NFGY, SZV, SZAL-KGH)

# 6. Literature

EcoLingua Bt. 2020. Revision of the forest condition description methodology to establish the forest management impact monitoring to be carried out in Börzsöny within the framework of the CENTRALPARKS tender. Research report

Standovár, T., Bán, M. & Kézdy, P. (szerk.) 2017. Erdőállapot-értékelés középhegységi erdeinkben. – ROSALIA A Duna-Ipoly Nemzeti Park Igazgatóság tanulmánykötetei 9. Duna-Ipoly Nemzeti Park Igazgatóság, Budapest, 612 pp.

| | |
|---|---|
| Editors: | Borbála Szabó-Major (Danube-Ipoly National Park Directorate) |
| Contributors: | dr. Tibor Standovár (Ecolingua Ltd.)<br>László Zoltán<br>Soma Horváth (Danube-Ipoly National Park Directorate) |
| Reviewer: | Isidoro De Bortoli (EURAC) |
| Security Sensitivity check: | |