

REVIEW

on a dissertation for obtaining the educational and scientific degree "**Doctor**" in the field of higher education 6. "Agrarian Sciences and Veterinary Medicine", professional direction: 6.5. "Forestry", scientific discipline: "**Forest Amelioration, Forest Protection and Non-Wood Forest Products**"

Author of the dissertation:

M.Sc. Asst. Veselin Georgiev Ivanov

Topic of the dissertation:

Health status of tree vegetation in field shelterbelts in Northeastern Bulgaria and measures for improvement

Reviewer:

Assoc. Prof. Dr. Gergana Ivanova Zaemdzhikova

1. Brief introduction of the doctoral student.

Veselin Ivanov was born on 01.06.1987 in the city of Dobrich. He graduated from the University of Forestry in 2013 with a master's degree in Forestry Economics. He worked as a forester at the State Forestry of Dobrich (2013-2016) and as a section chief at the State Forestry of Balchik (2016-2024). Since 2024, he has been an assistant professor at the Institute of Forestry (BAS), where he has been a part-time doctoral student since 2022.

Veselin Ivanov is a participant in 8 scientific and applied projects. He has 29 scientific publications (co-authored and independent). His main scientific interests in his publications include forest protection, biodiversity, and silviculture. He has completed doctoral courses in "Ecology of Urbanized Ecosystems", "Protection of Forests from Insect Pests and Pathogens", "English Language" and "Computer Skills". He uses MS OFFICE, PHOTOSHOP, accounting with RIVAL, GPS, professional forestry equipment.

2. General characteristics of the dissertation – volume and structure.

The dissertation has a total volume of 147 pages, of which 112 pages are main text, 23 pages are Literature review and 12 pages are Cited literature (References). The main text contains an Introduction (2 pages), Purpose and tasks (1 page), Material and methods (22 pages), Results and discussion (78 pages), Conclusions (4 pages), Recommendations (1 page), Contributions (2 pages), Publications list (1 page). There are no appendices - the primary data from the research are included in the main text. The main text of the dissertation contains a total of 18 tables and 68 figures, presenting maps, schemes, graphs, diagrams and photographs.

3. Relevance of the problem.

Field shelterbelts are forests created in agricultural lands to protect the soil from wind erosion and the crops from dry winds. They are managed under the Forest Act. Their field protection effect is mainly due to their ability to reduce wind speed. Their share of the country's forest cover is small (0.25%), but they have great economic and ecological importance in the

forest-steppe (Dobrudzha region). They were created mainly between 1950 and 1960. Their creation and maintenance is difficult for many reasons - steppe growth conditions, unsuitable tree species, lack of experience, insufficient guarding, regulatory weaknesses, etc. Of the 14,000 ha of field shelterbelts created, about 9,000 ha have survived to this day.

The state of the field shelterbelts has been considered alarming since around 2000. In 2003, a flexible approach to their management was proposed according to their condition. In 2014, the Executive Forestry Agency issued Guidelines for the Management of field shelterbelts and initiated the annual monitoring of their health status through inspections by local forest officials. The measures taken were clearly insufficient. Since the spring of 2020, dry tops and dieback have been observed in ash trees on the territory of the Balchik State Hunting Estate. Since then, monitoring has reported a growing deterioration in the condition of species of the genus *Fraxinus*, *Quercus* and *Acer* in the belts.

To date, there is a lack of targeted and in-depth studies on the health status of field shelterbelts in Northeastern Bulgaria, as well as on the impact of specific abiotic and biotic factors contributing to or causing the drying of trees in them.

4. Knowledge of Literature.

The list of used literature is 12 pages long and contains a total of 142 titles, 51 in Cyrillic, of which 7 in Russian, and 91 in Latin, of which 15 by Bulgarian and 2 by Russian authors. A significant period of time is covered - from 1907 to the present. 13 of the cited titles are publications in silviculture, the rest are publications in forest protection and interdisciplinary publications on the issue of field shelterbelts. Studies on the dieback of lowland forests and climate warming are not cited.

The included titles treat studies on various aspects of the creation and life of field shelterbelts. Pests and pathogens are covered in great detail, but abiotic factors and forestry characteristics are also taken into account. The study of Russian literature is essential due to Russia's 200-year experience in creating field shelterbelts, also in conditions similar to those in NE Bulgaria.

5. Purpose, tasks and research methods.

The purpose of this study is to make a comprehensive assessment of the health status of field shelterbelts by tree species, to determine the main reasons for the deterioration of their condition and their protective effect, and to propose measures for their improvement.

The following tasks were accomplished in the study:

1. Inventory of field shelterbelts, assessment of their health status and categorization by degree of damage.
2. Identification of the main causes of deterioration of the physiological condition of the belts.
3. Clarification of insect pests and fungal pathogens by individual species and review of their biological and ecological features.
4. Assessment of the impact of the most dangerous pests and pathogens on the condition of host plants.
5. Implementation of a system for monitoring the health status of field shelterbelts using remote sensing methods (drones with multispectral cameras and satellite images).

6. Development of measures to improve the health of the shelterbelts and selection of tree species for their reconstruction.

For the inventory of the shelterbelts and assessment of their health, a representative sample of 190 field shelterbelts was studied. The condition of the forest vegetation was determined and samples were taken for laboratory identification of pests and pathogens.

6. Significance of the obtained results, interpretations, visualization and conclusions.

In-depth studies have been carried out on a solid methodological basis. The territory of the Balchik State Hunting Estate (SHE) and the State Forestry Estates (SFE) Dobrich and General Toshevo was studied. 72% (7668.2 ha) of the field shelterbelts in Bulgaria are concentrated in the studied territory. Estate The study is based on a sample of 190 field shelterbelts, representative in terms of species composition and age of the stands. The belts with the largest participation in the sample are the belts of European ash *Fraxinus excelsior* (84 pcs.), followed by Cerris oak (43 pcs.), American ash *Fraxinus americana* (21 pcs.), honey locust *Gleditsia triacanthos* L.(20 pcs.), black locust *Robinia pseudoacacia* (11 pcs.).

In the period 2023-2025, a strong deterioration in the health of the field shelterbelts was reported. Dieback and degradation of about one third of the field shelterbelts of field elm *Ulmus minor*, *Acer* spp., black locust, *Fraxinus* spp., *Quercus* spp., walnut trees *Juglans regia*, etc. has been established. Dying and dead trees have been recorded for all tree species, with the exception of the manna ash *Fraxinus ornus*, horse chestnut *Aesculus hippocastanum* and small-leaved linden *Tilia cordata*. The deterioration is associated with the aging of the plantations, the majority of which are over 70 years old. The lack of winter moisture storage during the period 2020-2025, combined with prolonged periods of drought and heat waves during the growing season, lead to a strong physiological weakening of the trees and susceptibility to attacks by insect pests and diseases.

In the field shelterbelts of ash trees, significant damage is caused by xylophagous insects and 5 species of singing cicadas. The high population density of cicadas is also an obstacle to regeneration. The health status of red oak *Quercus rubra* is severely deteriorated by the aggressive development of the fungal pathogen *Biscogniauxia mediterranea*. The relative share of dying and dead trees for the three years of observation increased from 51% to 91%. Deterioration of the health status under the influence of *B. mediterranea* was also reported for pedunculate oak *Quercus robur* (from 2% to 79%) and frainetto oak *Quercus frainetto* (from 50% to 82%). The health status of silver linden *Tilia tomentosa* in the field shelterbelts has deteriorated as a result of the aggressive development of the fungal pathogen *Biscogniauxia cinereolilacina*.

Among the main tree species in the field shelterbelts, the best health condition was reported for *Q. cerris* and *Gleditsia*, although dieback and degradation processes were also observed in them. For the three years of the research, the relative share of dying and dead trees in the *Q. cerris* belts increased from 2% to 24%, and in the *Gleditsia* belts- from 1% to 20%. Errors were identified in the creation and management of the field shelterbelts: it was found that the black locust is unsuitable for the field shelterbelts due to its insufficient height. Black locust plantations remain low even at the age of 40, when they begin to dieback and degrade. Black locust coppices are even worse. Conversely, the *Gleditsia* remains in good health and shows no signs of dieback even after 60-70 years of age. However, by regulation it is clearcut at 50 years of age and is

converted to coppice instead of being maintained.

New methods have been applied for rapid field data collection via a mobile application and a comprehensive assessment of the condition of the field shelterbelts. It was found that PlanetScope/SkySat data are suitable for observations and assessment of the health status of woody vegetation in the field shelterbelts. The values of the normalized difference vegetation index (NDVI) correlate with the field observations. The index shows a high risk of mortality in the *Fraxinus* belts attacked by singing cicadas ($\text{NDVI} < 0.399$), while in the case of *Q. cerris* and *Gleditsia* it shows physiological weakening of the trees (NDVI in the range of 0.400 - 0.699).

Based on the above findings, the following recommendations are made:

1. An urgent phased reconstruction of the network of field shelterbelts in Southern Dobrudzha is necessary, using the most suitable for the region and resistant to abiotic and biotic impacts tree species – *Q. cerris* and *Gleditsia*.
2. When field shelterbelts in Southern Dobrudzha are reconstructed, in 35% of the cases this is done with red oak. Considering the massive dieback of the species in the area because of *Biscogniauxia mediterranea*, the afforestation of field shelterbelts with red oak should be stopped.
3. When calamities of the most dangerous insect pest – the gypsy moth (*Lymantria dispar*) occur in the field shelterbelts of oak (*Quercus* spp.), it is advisable to conduct biological control by introducing the species-specific fungal entomopathogen *Entomophaga maimaiga* in the initial phase of the attack, at a low population density of the pest, to prevent its mass multiplication and the defoliation of the field shelterbelts.
4. The collection of field data through a mobile application and the performance of a comprehensive assessment of the condition of field shelterbelts can be applied in practice in all field shelterbelts in Bulgaria and abroad.

7. Contributions of the dissertation work.

In my opinion, the doctoral student has 4 main contributions of direct importance to the state of the field shelterbelts, which represent **scientific applied contributions**.

1. Following main causes for the deterioration and dieback of the tree species in the field shelterbelts of Southern Dobrudzha have been identified: the fungal pathogens *Ophiostoma ulmi* on *Ulmus minor*; *Cryptostroma corticale*, *Stegonsporium pyriforme* and *Massaria macra* on *Acer* spp.; *Biscogniauxia mediterranea* on *Quercus* spp.; *Biscogniauxia cinereolilacina* on *Tilia tomentosa*; the singing cicadas (Hemiptera: Cicadidae) on *Fraxinus* spp., etc.
2. For the first time in Bulgaria, a successful biological control of the gypsy moth (*Lymantria dispar*) in the field shelterbelts of *Q. cerris* was carried out by the spread of *Entomophaga maimaiga* in atypical forest conditions (broken canopy, scarce rainfall, low air humidity, etc.).
3. A mobile application for field data collection, based on ArcGIS Field Maps of ESRI, suitable for Android and iOS with 31 specific fields for assessing the health of trees, has been developed and tested, which can collect data and photographs and transfer

them to electronic records without a direct connection.

4. A method for an integrated assessment of the condition of field shelterbelts has been developed and tested, including the structural and functional characteristics of the forest stands and the health status of tree species. It can be also applied in other regions and countries for making decisions about field shelterbelts and planning the necessary silvicultural activities.

In addition, numerous trophic relationships have been identified, which represent **scientific contributions**:

1. The first report of the pathogen *Biscogniauxia mediterranea* on red oak (*Quercus rubra*) in Europe has been made.
2. The fungal pathogens *Stegonsporium pyriforme* and *Massaria macra* have been identified for the first time in Bulgaria on Norway maple *Acer platanoides* and field maple *Acer campestre*.
3. Three new associations between xylophagous insects and tree species have been identified: *Agrilus graminis graminis* was identified for the first time from *Juglans regia*, *Agrilus hastulifer* - from *Quercus rubra* and *Agrilus litura* - from *Quercus cerris*.
4. Sixteen new trophic associations between xylophagous insects and tree species have been registered in Bulgaria: *Gasterocercus depressirostris depressirostris* - *Quercus cerris*; *Chrysobothris affinis affinis* - *Quercus cerris* and *Q. rubra*; *Agrilus graminis graminis* - *Quercus cerris* and *Q. rubra*; *Agrilus hastulifer* - *Quercus cerris*; *Agrilus laticornis* - *Quercus cerris*; *Melasis buprestoides* - *Tilia cordata*; *Lichenophanes varius* - *Tilia tomentosa*; *Plagionotus detritus detritus* - *Quercus cerris*; *Xylotrechus antilope antilope* - *Quercus cerris*; *Exocentrus adspersus* - *Quercus cerris*, *Q. petraea*, *Q. robur* and *Q. rubra*; *Mesosa nebulosa nebulosa* - *Quercus rubra*.
5. The discovery of the oak weevil (*Gasterocercus depressirostris depressirostris*) is the first written record of the occurrence of the species in Bulgaria.
6. From the larval stages of *Gasterocercus depressirostris depressirostris*, a new species for the asilidae fauna of Bulgaria was isolated for the first time - *Pogonosoma minus* (Diptera: Asilidae), which is also a new species for the Balkan Peninsula and Southeast Europe. The trophic relationship between the predatory fly and the weevil was previously unknown to science and is registered for the first time in this study.

8. Critical notes and questions.

The following critical remarks and recommendations can be made regarding the dissertation work:

- The "Literature Review" section was accidentally omitted from the table of contents.
- In both the text and the table of contents, the title "Study Area" appears twice: as the title of section 3.1. and as the title of section 3.1.2. An appropriate title for section 3.1.2. is "Sample Areas" or "Representative Sample".
- The "Purpose and tasks" section should be located after the "Literature Review"

section, because the purpose and tasks arise from the identified gaps and problems in the literature.

- In the description of the integrated approach for assessing the health status, Indicator 4 (stem damage) should be a separate point.
- In describing the health status by tree species, it is advisable to follow a uniform sequence in presenting the factors. For example, for oak and ash, insect pests are considered first, followed by fungal pathogens, while for the other species the sequence is reversed. A uniform structure would improve the readability of the text.
- In some places the name of *Biscogniauxia mediterranea* is spelled incorrectly (pp. 130 – 131) with one “r”.
- In Section 3.2.7, the NDVI index is called the “normalized difference vegetative index.” The commonly accepted term is “normalized difference vegetation index.”
- The semi-latin term “buprestids” is not ok. The common terms are “jewel beetles” or “Buprestidae spp.”. Similarly, the cerambycids – Cerambycidae spp. or long-horned beetles,

9. Evaluation of the quality of scientific publications.

The doctoral student has included three scientific publications in the dissertation: one without co-authors (in the journal “Forest Science”, published by the Institute of Forestry, Bulgarian Academy of Sciences), and two in co-authorship with his scientific supervisor and other scientists - one in proceedings of an international conference held in Bulgaria and one in a journal with an impact factor. They published results from the fieldwork and the literature review, which were subsequently included in the dissertation.

1. **Ivanov V.,** Kechev M., Georgieva M., Belilov S., Mirchev P., Hubenov Z., Georgieva L., Georgiev G. 2025. *Gasterocercus depressirostris depressirostris* (Fabricius) (Coleoptera, Curculionidae) - a new xylophagous pest of *Quercus cerris* L., and a new robber fly (Diptera, Asilidae) predator on it in Bulgaria. Biodiversity Data Journal, 13, e167767. doi: 10.3897/BDJ.13.e167767. (IF: 1.100).
2. **Ivanov V.** 2025. Bioecological features and harmfulness of *Pagiphora annulata* (Hemiptera: Cicadidae) in young field shelterbelts in Southern Dobrudja, Northeastern Bulgaria. Forest Science 60 (2), 39-47. [In Bulgarian Language: Ivanov V. 2025. Bioekologichni osobenosti i vrednost na *Pagiphora annulata* (Hemiptera: Cicadidae) v mladi polezashtitni gorski poyasi v Yuzhna Dobrudzha, Severoiztochna Bŭlgariya. Nauka za gorata 60 (2), 39-47..06.2026]
3. **Ivanov V.,** Georgiev G., Georgieva M., Dodev Y., Belilov S., Mirchev P., Madzhov S., Georgieva L., Petrova D. 2025. Health status of tree species of the genus *Fraxinus* in field shelterbelts in Southern Dobrudzha. In: Proceedings of the 34th International Scientific Conference „Management and Quality, Ecology and Management of Forest Resources“, Avangard Prima, 56-61. ISBN:2603-4409.

With these publications the doctoral student meets the scientometric requirements of the Law and the Regulations on the Conditions and Procedure for Acquiring Scientific Degrees and for Holding Academic Positions at the Bulgarian Academy of Sciences.

9. Personal contribution of the doctoral student.

My personal impressions of Veselin Ivanov's work lead me to conclude that the submitted dissertation is undoubtedly his own original work, and that the results presented, as well as their analysis, constitute an original contribution by the doctoral candidate to the research field under study.

CONCLUSION:

Based on the research methods applied by the doctoral student, the correctly conducted experiments and the generalizations and conclusions made, I believe that the presented dissertation **"Health status of woody vegetation in field shelterbelts in Northeastern Bulgaria and measures for improvement"** meets the requirements of the Law and the Regulations on the conditions and procedure for acquiring scientific degrees and for holding academic positions at the Bulgarian Academy of Sciences, which gives me reason to evaluate it **POSITIVELY**.

I propose to the Scientific Jury to **award** M.Sc. Asst. Veselin Georgiev Ivanov the educational and scientific degree "Doctor" in the field of higher education 6. "Agrarian Sciences and Veterinary Medicine", professional field: 6.5. "Forestry", scientific discipline: **"Forest Amelioration, Forest Protection and Non-Wood Forest Products"**

Date:

07.07.2026

REVIEWER:

Assoc. Prof. Dr. G. I. Zaemdzhikova