

Final Evaluation Report

Your Details	
Full Name	Jovana Janković
Project Title	Intra-species differences in flammability of natural Serbian spruce populations
Application ID	35959-1
Date of this Report	17.07.2023.

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Identification of populations and estimation of stand conditions				It was planned to record the state of <i>P. omorika</i> populations on the territory of Serbia, which was accomplished in a high percentage. Relevant information is provided in Table in Project Update January 2023.
Determination of the intra-specific variability in flammability traits				This goal was completely met, and we and we mastered the skill of carrying out this experiment (which was very demanding in terms of performance conditions). This type of experiment has never been conducted in Serbia; we are excited to begin pioneering work in this area in Serbia, and we hope to be able to conduct similar experiments with other fire-threatened species in the future.
Evaluation of the intra-species variability of plant traits relevant to flammability properties				To assess natural intra-species variability, the following morpho-ecophysiological parameters were determined: needle length, weight, thickness, width, flatness, volume, area, density, and moisture content. Another ongoing analysis is the determination of the chemical composition of needles (this procedure requires several months of sample preparation and measurements). The measurement results were statistically analysed and incorporated into a manuscript that was submitted in March 2023 and published in May 2023 in an international ISI highly ranked journal.
Developing a specific modelling approach				We tested the FRaMe (an R package) that was already implemented for certain types of vegetation. More adjustments appear to be required for the final version of the model, which should be compatible with our findings. Because this work is still in progress, we marked it as partially completed.
Presentation and dissemination				Our findings were presented at the International Meeting of the COST action "Fire in the Earth System: Science & Society" in Antalya, Turkey. This was an opportunity to promote the Rufford Small Grants Programme and to meet new forest conservation and fire

			<p>protection professionals and practitioners (details provided in Project Update June 2023). On the day of Plant Earth, a presentation had been arranged for school and pre-school children (details provided in Project Update June 2023).</p> <p>We published an original scientific article in the peer-reviewed international journal <i>Frontiers in Forestry and Global Change</i> in open access (details in Project Update June 2023).</p> <p>All reports and materials containing the results obtained thus far have been uploaded to my ResearchGate profile. https://www.researchgate.net/profile/Jovana-Jankovic-5</p>
--	--	--	---

2. Describe the three most important outcomes of your project.

- a). One of the most significant outcomes of this project is a detailed phytogeographic description of the majority of *P. omorika* populations in Tara National Park. For the first time, samples from these populations were examined for morphophysiological flammability-related features.
- b). Contribution to knowledge of the variability of plant traits important for fire adaptation. This can help in ecological and evolutionary studies of relict species. Contribution to understanding of the current state and the vulnerability of certain populations to fire events.
- c). Providing data that can be used to model species responses to fire events in future climate scenarios. This will allow for better monitoring and protection of *P. omorika* natural populations, as well as management in protected areas.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Extremely steep and congested terrain, occasionally slick forest floor due to dew or rain. In some populations, the lowest branches were about 6 m tall. This was overcome thanks to the additional equipment (e.g., hiking poles, waterproof shoe covers, branch cutter with extension) lent to us by NP Tara employees, with whom we were in constant phone contact in case we needed assistance in the field.

Flammability tests are extremely demanding due to the sudden development of flames that can reach extremely high temperatures, as well as the development of smoke and combustion gases. Additional safety measures are required for both the person working and the environment in which the experiment is carried out. This was overcome by ensuring that two researchers were always present, conducting the experiment in a digester with a powerful fan, and informing people in charge of workplace safety that the experiments would take place ahead of time.

The *P. omorika* population, which is located at about 800-900 m asl, is visible but inaccessible from the rock. We approached from the river, but only got to the point where we could take a picture (recording was also impossible with conventional equipment; it would have been possible with a drone, which we didn't have). Climbing without the proper equipment and experience, according to our guides, is dangerous. As a result, this population will be assessed in the future when all necessary conditions (safety, professional mountain guides, equipment, and weather conditions) are met. (More details and pictures are provided in Project Update January 2023).

4. Describe the involvement of local communities and how they have benefited from the project.

We developed a great collaboration with the authorities from Tara National Park, who introduced us to local community representatives. We provided every relevant information to local residents about the ongoing project as well as the most recent findings in fire prevention and protection (already implemented in counties with a long history of firefighting, but relatively unknown in our conditions). Elementary and pre-school children were educated on the significance of *P. omorika* as a unique relict species of our autochthonous flora. Children were also taught the fundamentals of fieldwork and fire safety.

5. Are there any plans to continue this work?

Populations selected by traits indicating the lowest flammability should be marked, and seed material from these populations can be used for plantation establishment. Further research would focus on determining flammability-related traits of species that typically constitute plant communities with *P. omorika*. This should provide insight into community-related flammability and allow for the selection of resilient species that can be proposed as vegetation protective belts.

6. How do you plan to share the results of your work with others?

We've already put in a lot of effort to share our findings. We gave a presentation at the international convention. Our findings were presented at the International Meeting of the COST action "Fire in the Earth System: Science & Society" in Antalya, Turkey. This was an opportunity to promote the Rufford Small Grants Programme and make new connections with professionals and practitioners in forest conservation and fire protection. Many colleagues with varying levels of experience working in forest conservation were drawn to our presentation. It resulted in fruitful discussions and the development of ideas for future academic and institutional collaborations.

We published a scientific paper in the highly regarded scientific journal "Frontiers in Forests and Global Change" (top ranked in the fields of Ecology and Forestry, with an Impact Factor of 4.32). It is published in open access (OA) format, making it widely available to both the scientific community and the general public. The contribution of the Rufford Fund to the research, as well as the project number, are noted in the Acknowledgement section.

Popović Z., Vidaković V., Janković J. (2023). Variability of leaf traits in natural populations of *Picea omorika* determines ignitability of fresh foliage. *Front. For. Glob. Change* 6:1196809. doi: 10.3389/ffgc.2023.1196809.

The link for free download:

https://www.frontiersin.org/articles/10.3389/ffgc.2023.1196809/full?utm_source=Email_to_authors&utm_medium=Email&utm_content=T1_11.5e1_author&utm_campaign=Email_publication&field=journalName=Frontiers_in_Forests_and_Global_Change&id=1196809

We also organised project promotion for pre-school and elementary school children.

Our intentions to share project results do not end with the project's completion. On the contrary, we anticipate being able to publish additional papers based on the existing results. Furthermore, we believe that at future thematic conferences, we will be able to promote our idea and establish collaboration with colleagues involved in conservation and protection.

7. Looking ahead, what do you feel are the important next steps?

As previously stated, some chemical analyses require months of sample preparation and examination. In this regard, one of the project's most important remaining tasks is to complete the chemical analysis of all samples. After that, we will compile all of the results and subject them to advanced statistical procedures and model testing. Every opportunity for public performances, professional and scientific thematic conferences, and project promotion should be taken advantage of.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, we used The Rufford Foundation logo in the ppt presentation at the international conference, as well as in the poster and ppt presentation at the school lecture. We also acknowledged the grant and the foundation in a peer-reviewed paper that was published.

9. Provide a full list of all the members of your team and their role in the project.

Jovana Janković (Plant Protection Engineer, MA, PhD Student, Young Researcher, Institute for Biological Research, University of Belgrade, Serbia) - field work, photo documentation, laboratory analyses, report writing, video and poster presentation design, text and organizing.

Zorica Popović (PhD, Full Professor, Institute for Biological Research, University of Belgrade, Serbia) - field work, photo documentation, laboratory work, results dissemination, paper writing and reviewing, conference presentation.

Vera Vidaković (PhD, Research Assistant, Institute for Biological Research, University of Belgrade, Serbia) - field work, laboratory analyses, databasing and modelling.

10. Any other comments?

We are grateful to The Rufford Foundation for their support and the opportunity to conduct this research. We hope to continue collaboration in the future.