

The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details

Your name	Milica Petrovic
Project title	Sustainable use and management of halophytic grasslands as key element for biodiversity conservation
RSG reference	9636-1
Reporting period	August 2012 - September 2013
Amount of grant	£4530
Your email address	mpetrovic.azs@gmail.com
Date of this report	

1. Please 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
Assessment of biodiversity of flora and vegetation of selected saline habitats in Serbia			x	<p>Upon review of available floristic data and soil maps, target halophytic habitats were selected: Melenci (Rusanda and Okanj bara) and Slano Kopovo at the province of Vojvodina and three sites at the south of Serbia (Lalinacka slatina, Oblacinsko jezero and Bresnicic).</p> <p>Field research included both analyses of flora and vegetation and the soil characterisation at the all proposed sites. In total, 125 halophytic species were recorded, belonging to 11 plant families. Among selected sites, the highest and the lowest plant diversity was determined for, Slano kopovo and Lalinac site, respectively. However, the smallest number of species was found at Lalinac locality, the habitat of the highest soil salinity. Having in mind the qualitative aspects of biodiversity, in term of presence of rare, endangered, internationally protected, and endemic species, the sites Bresnicic and lalinac in our opinion needs special attention and should be considered for nomination as protected area urgently.</p>
Estimation of the specific plants rare, endangered and/or endemic and potentially useful species			x	<p>The rare, endangered and endemic species were evaluated upon the Serbian Red Book of Flora and Flora of Serbia (vol. X). In total 26 rare and/or endemic species were identified, and 10 species were assessed as very endangered (especially referring to <i>Salsola soda</i> and <i>Suaeda pannonica</i> and <i>Acorellus pannonicus</i>), mainly caused by habitat destruction (meliorations, fish ponds construction, etc.) and overgrazing in case of some halophytes (e.g. <i>Camphorosma annua</i>, <i>Plantago schwarzenbergiana</i>)</p> <p>Estimation of possible useful plant species, such as medicinal and aromatic plants was performed upon the list of MAP for Serbia (e.g. monograph: "Medicinal plants of Serbia"). The total number of recorded</p>

				<p>medicinal plants was more than 50 (both halophytes and glicophytes – occurring on slightly salinised soils), out of only nine are salt tolerant (<i>Chamomilla recutita</i>, <i>Achillea millefolium</i>, <i>Mentha pulegium</i>, <i>Artemisia santonicum</i>, <i>Ononis spinosa</i>,)</p>
Analyses of the soil features and soil salinity			x	<p>During the field work, the soil samples were collected for laboratory analyses. Laboratory analyses of the soil (pH and EC – electric conductivity, using pH/EC conduct meters provided thanks to the this Rufford project) aiming at determination of the total salt content in the soil samples showed relatively variable values of the soil EC, ranging from 18 to 29 mS. The similar was with soil pH, which varied from 8.0 to 9.3. These results pointed out existence of soil diversity enabling occurrence of different types of halophytic communities, including those tolerant to high levels of the total soils and high ph (e.g. <i>Suaedetum maritimae</i>, <i>Salicornietum europaeae</i>) and grasslands whose species are sensitive to higher EC and pH values (e.g. <i>Trifolietum resupinati</i>).</p>
Recommendation of measures and practices for conservation of saline grasslands			x	<p>All selected sites were studies from the aspect of biodiversity analysis, soil features characterisation and current management practices. Each site is currently grazed, either by cattle or sheep or very often in mixed herds. In some cases, overgrazing was the key factor of habitat and species endangerment. All sites are no larger than 1 ha and often more than 100 animals were counted there. On the other hand, hydro-melioration measures were endangered the structure of the habitat, which was mainly true for Melenci site, were level of the salt lake increased and salinity level decreased, which resulted in depletion of population of <i>Salsola soda</i>, <i>Suaeda pannonica</i> and <i>S. maritima</i>. Screening of the presence of medicinal and aromatic plants could contribute to sustainable use of these grasslands (apart of grazing), in term of wild collecting at small scale.</p>

				The most important management measures definitely refer to adequate and proper grazing practices (number and type of animals upon site size, productivity and forage quality).
Dissemination of project results			x	Small brochure with appropriate illustrations (my original photographs) was published and prepared to serve for needs of local community and nature conservation authorities. Also, we prepared photo exhibition at the Faculty of Agriculture, University of Belgrade, as additional activity to represent most interesting halophytic plants photographed during the field work and to present results and achievements to the professional public.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

During the project activities we didn't have any unforeseen difficulties. The project was well prepared and planned and we have great chance to complete all proposed activities within 1 year. Photo exhibition was positive unforeseen activity that was not predicted in project proposal but it is very good performed to enhance visibility of the project. The only problem we have faced with was impossibility to find *Salsola soda*, the halophyte which was previously described several times for studied habitats/sites. Although we visited these sites several times during the project period, unfortunately we weren't able to find the species at none of the sites. Thus, this finding is our main concern and so far we don't have any hypothesis why the species maybe disappeared.

3. Briefly describe the three most important outcomes of your project.

Outcome 1. Detailed and complete assessment of biodiversity of flora and vegetation and soil types at the five selected saline habitats.

These five sites were surveyed during the September 2012 and June/July 2013. Inventory and monitoring of halophytic flora and vegetation have been done in 20 days fieldwork.

List of halophytic species, plant communities and soil type recorded at the selected sites:

1a. Site Rusanda:

Species: *Artemisia santonicum*, *Aster sedifolius* subsp. *sedifolius*, *Aster tripolium* subsp. *pannonicus*, *Bassia prostrata*, *Bassia sedoides*, *Beckmannia eruciformis*, *Crypsis aculeata*, *Euclidium syriacum*, *Heliotropium supinum*, *Limonium gmelinii* subsp. *hungaricum*, *Lythrum tribracteatum*, *Pholiurus pannonicus*, *Plantago schwarzenbergiana*, *Plantago tenuiflora*, *Salicornia europaea*, *Scilla autumnalis*, *Scirpus lacustris* subsp. *tabernaemontani*, *Scorzonera parviflora*, *Silene viscosa*, *Suaeda maritima*, *Suaeda pannonica*

Plant communities: *Suaedetum maritimae* Soo, *Suaedetum pannonicae* (Soó 1927) Wendelberger 1943, *Salsolietum sodae* Slavnić (1939) 1948, *Puccinellietum limosae* (Rapcs.1927) Wend. 1950 *Camphorosmetum annuae* (Rapcs.1916) Soo 1933, *Hordeetum hystricis* (Soo 1933) Wend. 1943, *Achilleo-festucetum pseudovinae* (Mag. 1928) Soo (1933)1945

Soil type: Sodic solonchak, **pH**- 9, **EC**- 21mS

1b. Site Okanj bara:

Species: *Achillea pannonica*, *Agrostis stolonifera*, *Aster tripolium* subsp. *Pannonicus*, *Carex otrubae*, *Cirsium arvense*, *Consolida orientalis*, *Gypsophila muralis*, *Juncus compressus*, *Juncus effusus*, *Lepidium ruderales*, *Lythrum virgatum*, *Oenanthe silaifolia*, *Plantago schwarzenbergiana*, *Scirpus lacustris*, *Scirpus maritimus*, *Scorzonera cana*, *Stachys palustris*, *Mentha aquatica*, *Plantago lanceolata*, *Poa trivialis*, *Potentilla argentea*, *Puccinellia limosa*

Plant communities: *Suaedetum maritimae* Soo, *Puccinellietum limosae* (Rapcs.1927) Wend. 1950, *Hordeetum hystricis* (Soo 1933) Wend. 1943, *Artemisio-festucetum pseudovinae* (Mag. 1928) Soo (1945)1964, *Achilleo-festucetum pseudovinae* (Mag. 1928) Soo (1933)1945, *Halo-agropyretum repentis* R.Vučk. 1985

Soil type: Sodni solončaci, **pH**- 9,1, **EC**- 27,4mS

2. Site Slano kopovo:

Species: *Salicornia europaea*, *Suaeda pannonica*, *Suaeda maritima*, *Plantago schwarzenbergiana*, *Aster pannonicus* (*A. tripolium* subsp. *pannonicus*), *Scilla autumnalis*, *Kochia prostrata*, *Crypsis aculeata*, *Spergularia media*, *Sonchus palustris*, *Puccinellia limosa*, *Artemisia maritima* subsp. *Monogyna*, *Statice gmelini* (*Limonium* g.), *Camphorosma annua*

Plant communities: *Agrosti-Beckmannietum* (Rapaics 1927) Soo 1933, *Suaedetum maritimae* Soo *Salicornietum europaea*, *Halo-Crypsidetum aculeatae* (Bojko 1932) Bodrog. 1977., *Acorelletum pannonicae* Soo (1939) 1947, *Puccinellietum limosae* (Rapcs.1927) Wend. 1950, *Camphorosmetum annuae* (Rapcs.1916) Soo 1933, *Hordeetum hystricis* (Soo 1933) Wend. 1943, *Artemisio-festucetum pseudovinae* (Mag. 1928) Soo (1945)1964, *Achilleo-festucetum pseudovinae* (Mag. 1928) Soo (1933)1945, *Poo-alopecurum pratensis halophyticum* R.Vučk. 1982, *Halo-agropyretum repentis* R.Vučk. 1985

Soil type: Chloride solonchak **pH**- 8,6, **EC**- 25,8mS

3. Site Bresnicic:

Species: *Lepidium draba*, *Salvia nemorosa*, *Lathyrus tuberosus*, *Centaurea solstitialis*, *Lactuca seriola*, *Xheranthemum annuum*, *Achillea nobilis*, *Bromus commutatus*, *Polygonum aviculare*, *Agropyron repens*, *Epilobium adantum*, *Inula britannica*, *Sanquisorba minor*, *Melilotus officinalis*, *Anagalis arvensis*, *Egilops cylindrica*, *Matricaria chamomila*, *Bromus commutatus*, *Lothus corniculatus*, *Trifolium patens*, *Carex distans*, *Bolboschenus maritimus*, *Juncus bufonius*, *Juncus compressus*, *Carex* sp.

Plant communities: *Halo-Crypsidetum aculeatae* (Bojko 1932) Bodrog. 1977., *Pholiuro-Plantaginetum tenuiflorae* Rapcs. 1927- Wend. 1943, *Hordeetum hystricis* (Soo 1933) Wend. 1943 *Bolboschoenetum maritimi* Soo (1945) 1947, *Agrosti-Caricetum distantis* (Rapaics 1927) Soo 1930 *Halo-agropyretum repentis* R.Vučk. 1985

Soil type: Solonetz **pH**- 8,9, **EC**- 18,7mS

4. Site Lalinacka slatina:

Species: *Sonchus asper*, *Trifolium lappaceum*, *Rumex patientia*, *Statice gemlinii*, *Bromus commutatus*, *Matricaria chamomile*, *Scorzonera cana*, *Atriplex hastata*, *Lepidium perfoliatum* *Bolboschoenus*

maritimus, Achillea critmifolia, Puccinellia limosa, Ornithogalum pyramidale, Muscari comosum, Camphorosma monspeliaca, Lactuca viminea, Pholiurus pannonicus, Picris echinoides, Agrostis alba, Stachys annua, Camphorosma monspeliaca, Juncus compressus, Carex divisa, Alopecurus pratensis Xheranthemum annuum, Alopecurus myosuroides, Bromus squarosus, Hordeum hystix, Centaurea solstitialis

Plant communities: *Camphorosmetum monspeliacae, Halo-Crypsidetum aculeatae* (Bojko 1932) Bodrog. 1977., *Pholiuro-Plantaginetum tenuiflorae* Rapcs. 1927- Wend. 1943, *Hordeetum hystricis* (Soo 1933) Wend. 1943 *Bolboschoenetum maritimi* Soo (1945) 1947, *Agrosti-Caricetum distantis* (Rapaics 1927) Soo 1930 *Halo-agropyretum repentis* R.Vučk. 1985

Soil type: Solonchak pH- 8,7 , EC- 24,5mS

5. Oblacinsko jezero: *Bromus commutatus, Lolium perene, Festuca pseudovina, Lothus corniculatus, Achillea nobilis, Plantago lanceolata, Galium verum, Helminthia echioides, Scorzonera cana, Festuca valesiaca, Euphorbia falcate, Elylops cylindrica, Trifolium patens, Sanguisorba minor, Lepidium perfoliatum, Elymus asper, Agropyrum cristatus, Lolium perene, Agrostis alba, Atriplex tataricum, Medicago falcate, Gypsophila muralis, Polygonum lapathifolium, Camphorosma annua, Matricaria chamomile, Polygonum aviculare Bolboschoenus maritimum, Picris hispidissima, Inula Britannica, Roripa silvestris, Salvia aetiopsis, Trifolium vesiculosum, Trifolium incarnatum*

Plant communities: *Camphorosmetum monspeliacae, Halo-Crypsidetum aculeatae* (Bojko 1932) Bodrog. 1977., *Pholiuro-Plantaginetum tenuiflorae* Rapcs. 1927- Wend. 1943, *Hordeetum hystricis* (Soo 1933) Wend. 1943 *Bolboschoenetum maritimi* Soo (1945) 1947, *Agrosti-Caricetum distantis* (Rapaics 1927) Soo 1930 *Halo-agropyretum repentis* R.Vučk. 1985

Soil type: Solonchak pH- 8,3 , EC- 19,8 mS

Outcome 2. Estimation of the specific plants rare, endangered and/or endemic, aromatic and medicinal and type of vegetation at the selected sites with recommendation measures and practices for conservation of saline grasslands

Most of saline habitats are not managed in sustainable way, despite a certain potential for sustainable utilisation (i.e. grazing, hay production, collecting of medicinal, aromatic and ornamental plants). Analysis of distribution and diversity of halophytic vegetation clearly indicated significant floristic and vegetation diversity, and a presence of some very fragile, specific and of priority halophytic communities and corresponding endemic (e.g. *Plantago schwarzenbergiana*), rare (e.g. *Salicornia europaea*) and critically endangered species (e.g. *Salsola soda* and *Suaeda pannonica*).

Conservation measures of these unique ecosystems, so far have not been sufficiently implemented, causing often vegetation succession and related biodiversity loss. Some of these habitats are very poor in species, but are of the high biodiversity importance, especially in term of presence of the rare obligate inland halophytes (e.g. *Suaeda maritima, Salicornia europea, Salsola soda, Camphorosma annua*, etc.). The most proper conservation measure for this type of habitats is strict control of use and management in term of nomination into the protected nature areas of the first priority. Two other groups of halophytic vegetation are currently used as pastures mainly, whereas no special management practices have been performed. Some of these halophytic habitats are overgrazed and thus quite degraded. A number of medicinal and aromatic plants were determined in these two clusters, including *Chamomila recutita, Mentha pulegium, Achillea collina, Taraxacum, serotinum, Artemisia santonicum*, etc. Set of recommendation measures gives basis for biodiversity conservation, sustainable management and use of halophytic grasslands, mainly in term of rotational and combined grazing and wild collecting of herbs at small scale.

Outcome 3. Brochure and photo exhibition for local community, conservation authorities and professional public where we represent project results and raise awareness and knowledge about importance of these type of habitat protection

After fieldwork and literature review, collecting and analysing data we prepared short brochure for wider public with a results of the project and recommendation measures for conservation and sustainable use of halophytic grasslands. Except that, results of the project were presented at the photo exhibition and at the meeting for local authorities at the Province Institute for nature conservation.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Local community was involved indirectly through the local conservation authorities that were informed about project results and spread brochures to the wider public. At the fieldwork we also had communication with local people who helped us to find locality precisely and talked with them how they use saline habitat, do they collect medicinal plants or what is their opinion about conservation of these ecosystems. We came up to the very positively answer from local people. We succeeded to agree with several local farmers (on their request), whose livestock grazes at sites we examined, to collect small quantity of milk to be further analysed at the Faculty of Agriculture. This will be the first results of possible effects of halophytic flora (and halophytic grasslands) on milk quality. The collecting of milk samples and related analyses of a milk quality are agreed for the next spring.

5. Are there any plans to continue this work?

During realization of the project activities referring the field studies of halophytic flora and vegetation of selected sites (Slano kopovo, Melenci-Rusanda, Okanj bara, Lalinac, Bresnicic, Oblacinsko jezero), we noticed some plots of salt affected soils and corresponding halophytic vegetation for which we had only scattered previous information from the old literature data. Such sites are located on the north-north-west ("Selevenske pustare", and "Svetozar Miletic" localities) of the region Backa, as well as sites spread in the valley of the river Tamis on the east, known as "Istocno Potamisje", of the region Banat. All these sites belong to the province Vojvodina, laying in the southern part of the Pannonian plain and on the north of the Republic of Serbia. Saline habitats of these sites have also a mosaic distribution within other soil types, undisturbed by presence of sodium salts. Nevertheless, habitats on both north-northwest and on the northeast haven't been so far studied in detail concerning analyses of flora, vegetation, soil features and former and current use. Thus, our intention is to perform botanical and pedological screening at mentioned sites in next vegetation season(s) to complete the picture of saline habitats in Vojvodina province aiming at their conservation and proposing the best management practices, in first the adequate grazing.

In addition, while studying some of very rare, geographically isolated and small, but very interesting saline habitats on the south of Serbia, we luckily found few so far unknown and completely not researched plots on the very south of the country, at the Serbia/Kosovo border, in the vicinity of Bujanovac. These habitats exhibit characteristics of some other halophytic habitats by presence of some typical moderately salt tolerant plants, such as *Beckmania eruciformis*, *Hordeum hystrix*, *Oenanthe silaifolia*, *Scorzonera cana*, *Inula brianica*, and *Achillea colina*. In difference to other studied saline habitats, including those on both north (e.g. Slano kopovo) and the south (region of

Bujanovac) of the country, it seems that there the salts other than sodium ones, could provoke their appearance. We got such impression by macroscopic view on the soil surface and specific crust of white-yellowish crystals. In addition, from local inhabitants we found out that the whole are is known by huge resources of underground mineral water. In opinion, it will be worthwhile studying the chemical composition of the soil, underground water, as well as botanical composition of halophytic vegetation distributed on these sites.

Finally, we also intend to analyse samples of soil and plant material we have collected during our field research to determine the total salt content and level of accumulation of key locations (Na^+ , K^+ , Ca^{2+}) and anions (Cl^- , SO_4^{2-} , CO_3^{2-}). Finally, in collaboration with colleagues from the Institute for Medicinal Plant Research “Dr Josif Pancic” there is preliminary agreement to evaluate quality of some collected medicinal plants (*Achillea collina*, *Artemisia santonicum* and *Mentha pulegium*).

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

The results of project will be shared by brochures, by website (website of the Faculty of Agriculture and NGO Environmental Ambassadors and Rufford website) and multiplicative effect through presentation we have prepared for target groups. Also, printed material such brochure we prepared and photo exhibition performed.

Also, we represent our work to the colleague that dealing with similar issue from our county and abroad, that we recommended Rufford Foundation to them. Colleague from Slovenia also applied for Rufford small grant where we borrow him our equipment bought from Rufford project.

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

For proposed set of activities the period of one year (started from September 2012 to September 2013) was enough time to complete all anticipated tasks in the project. We prolonged final report because of photo exhibition organizing.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Regional and local transportation (10 field trips x 100 £, calculated as transportation cost for 500km per trip/gasoline)	1000	940	60	Because of changes in fuel price we saved 60 £, that we can use for laboratory equipment
Accommodation (10 overnights x 3 persons x 30 £)	900	900	0	
Food (3 persons x 20 days x 10 £)	600	575	25	It wasn't possible to precisely predict cost of food expensive, and we also difference add to Laboratory equipment

Laboratory equipment (pH/EC laboratory conduct meter)	1030	1115	85	We added difference from the other activities where we had extra money
Data processing and project report preparation	500	500	0	
Brochure preparation and publishing (5 £ x 100 units)	500	500	0	
Photo exhibition (additional activity)		427	427	We financed from our own budget photo exhibition as added value for project
TOTAL	4530	4957	597	

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

It will be very important to perform comprehensive and multidisciplinary research on newly discovered saline habitats at the south of Serbia and to analyse possible similarities and differences between these habitats and saline habitats on the north (province Vojvodina). It will be very worthwhile to create a map of saline habitats of the country and to implement GIS on all collected data (vegetation – (phytocoenological records, soil features, management, etc.) aiming at assessment of the best conservation practices (proclamation of some habitats as nature protected area, recommendation of proper grazing practices, sustainable wild collection of some medicinal plants, strict conservation and special conservation measures for the most endangered species and habitats, promotion of eco-tourism, ex situ conservation of the most important genetic resources – obligate halophytes, endangered species, endemics, best forage species, medicinal and aromatic plants, etc.). The final step could be establishment of ecological network of all saline habitats in Serbia (and the region) to ensure their conservation by the best management and sustainable use practices.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

Logo of the RSGF was used in all materials produced in this project.

1. Brochure;
2. In the participant list;
3. Photo exhibition;
4. Website.

11. Any other comments?

It was pleasure to cooperate with your foundation, especially in the field of communication and project procedure. We would be very happy to continue cooperation with Rufford small grants foundation.