

The Rufford Foundation

Final Report

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

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. 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. Please note that the information may be edited for clarity. 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	Lisbet Gonzalez Oliva
Project title	Invasive alien legume Inga punctata in Biosphere Reserve Sierra del Rosario (Cuba): assessment and initial actions for control and native forest restoration
RSG reference	14746-1
Reporting period	March 2014- March 2015
Amount of grant	£5997
Your email address	lgonzalez-oliva@ecologia.cu
Date of this report	March 6, 2015

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
Prospection of BRSR in order to document <i>Inga punctata</i> current distributional range and non-invaded native riparian forest			x	We also assessed western part of Sierra del Rosario mountain range, outside the Reserve, because during BRSR prospection we found western boundary seriously invaded by <i>Inga punctata</i> . In addition, were carried out several interviews to local old man and owners of infested patches in order to establish introduction date.
Conduction of and monitoring an experiment for <i>I. punctata</i> control			x	
Assessment of relative abundance of <i>I. punctata</i> on BRSR's riparian forest and its regeneration			x	
To perform characterization of riparian forest non-invaded by <i>Inga punctata</i>			x	Presence and transformer behavior of other alien plants considered as invasive in Cuba were also recorded. Besides, one of the trained students under my supervision performed a revision of allelopathy reports for these species.
Preparation of a report including invasion map of <i>I. punctata</i> and recommendations for its management taking into account the yielded information			x	Annex 1
<i>Inga punctata</i> identification guide with pictures at its different life stages and useful information for control, prevention and early detection			x	Annex 2. Was also prepared another issue for the Invasive Plants in Cuba Series, used by Cuban System of Protected Areas for promote invasive plants control and prevention, as well as public education (Annex 3).
Final workshop to present results and			x	We also present our results and management recommendations to other

to discuss about our recommendations for more effective management of <i>Inga punctata</i> and native forest				researchers, managers of other protected areas. I plan present results again this year, at Cuban Congress of Protected Areas and at 2015-Cuban Biodiversity Conservation Meeting.
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2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

N/A

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

1. Current distribution of the alien invasive tree *Inga punctata* as well as non-invaded areas in Sierra del Rosario mountain range.

Inga punctata has a more extensive distributional range than was initially suspected, going beyond BRSR. Current extent of invasion only compromise west and south sectors of Biosphere Reserve Sierra del Rosario (BRSR), but there are more than 200 km² at the middle of Sierra del Rosario mountain range completely invaded by *Inga punctata*. Most infested areas were found at riparian forest of tributaries and rivers San Cristóbal, Santiago and Manantiales, but also at river Bayate inside BRSR. Forest at both sides of some main ways is also extremely affected. Inside the non-invaded matrix were also located four small and middle size patches invaded by *Inga*, threaten two other main rivers San Juan and San Miguel, and one of the three conservation core areas of RBSR (El Salón).

2. Negative impact on native riparian forest by *Inga punctata* invasion as well as invasion pathways documented.

Non-invaded riparian forests of Sierra del Rosario harbour 135 native species. More than half are Caribbean endemics and 11 are endemic of Cuba, including 2 restricted to Sierra del Rosario: *Zanthoxylum ekmanii* and *Gonzalagunia sagraeana*. Three of these Cuban endemics are also threatened species: *Ardisia dentata* (EN), *Piresiella strephioides* (EN) and *Z. ekmanii* (CR). *Matayba apetala* (locally named macurije) emerged as dominant tree and other native species like the local endemic *Gonzalagunia sagraeana* and the endangered *Ardisia dentata* appears as common in the samples.

Although we presume a negative impact on riparian forest from *Inga punctata* invasion, never suspect its magnitude. The alien legume was recorded replacing *Matayba apetala* as dominant species in invaded forest, exceeding frequently the 35% of overall forest. Besides, the number of species sharing the habitat decrease, formerly common endemic and endangered species became rare, and others disappear.

Were also documented the primary dispersal vectors, invasion pathways and *Inga punctata* life traits that favour its rapid spread, quickly forest gap colonization, the high densities in regeneration and monospecific stands in riparian forest. Primary and major dispersal occurs by passive dropping from parental plants and by humans who like to eat *Inga punctata* seed

wrapping, the viable seeds are dropped anywhere after that. There is also secondary dispersal by water in the streams.

3. Recommendation for mechanical control management based on the experiment results.

After this control experiment, we strongly recommend double girdling and not tree cutting as control/eradication method for alien invasive *Inga punctata*. We found tree cutting promote re-invasion of the gaps after management, at least without parallel effective reforestation actions. Twelve months after experiment beginning, in the former gap the number of reproductive adults of this alien legume was increased 7 times and more than 80% of forest regeneration belongs to *Inga punctata*. In contrast, with double girdling was registered an abundance decrease of *Inga punctata* adults, together with a significant increase in number of native species in the regeneration, including endemics and threatened as *Ardisia dentanta* and *Gonzalagunia sagraeana*.

If tree cutting is used as management action, are needed simultaneously gaps reforestation for avoid re-infestation. For this reforestation purpose, we recommend based also in these research results the use of native's trees *Matayba apetala*, *Trophis racemosa*, *Trichospermum mexicanum*, *Calophyllum* spp and *Talipariti elatum*. That will be first step to restoration riparian forest.

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

We involve many members of local communities of several villages in interviews about introduction of *Inga punctata* in the near areas. We also carry out talks with potential communities leaders for control/prevention awareness and some local environmental educators were in technical workshop and should be acting as amplifiers of this knowledge. The popular issue produced for identification, awareness and management are now available for them, local schools and library, as well as Biological Stations. This issue can help in the Reserve education programs for children and for the sustainable agrobiodiversity farmers net.

However, local people are still far away to consider themselves benefitted by getting information for management of this invasive. Will be needed more awareness actions and probably incentives.

5. Are there any plans to continue this work?

I plan continue this work in three directions:

- (1) awareness work of the people of Sierra del Rosario of the importance of native ecosystems of this mountain region in attracting and water availability across western Cuba, the value of native and endemic local and *Inga punctata* threat to the conservation of these species, ecosystems, species and ecosystem services;
- (2) testing the management combination of gap reforestation/restoration and mechanical control, on pilot sites into RBSR and farms outside the Reserve. Also, perform propagation assays of *Trophis racemosa* and *Matayba apetala* currently without propagation guidelines available, in order to improve restoration actions

- (3) monitoring the diminish population of critical endangered and local endemic *Zanthoxylum ekmanii*, as well as endangered *Ardisia dentata* and *Piresiella strephioides*, and local endemic *Gonzalagunia sagraeana*. Also perform propagation assays of these species in order to reinforce its populations.

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

We are already beginning to share the results of this work. At the end of last February was carry out a technical workshop with the participation of all staff of Biosphere Reserve Sierra del Rosario and three other more restrictedly conservation status areas including inside BRSR.

I also shared the results with part of the Cuban botanical community in 5th Botanical Meeting last February. I plan also present the results in Congress of Protected Areas at Cuban Biodiversity Convention next July and Biodiversity Conservation Meeting-2015 next November.

Two papers are in preparation. The first is a short communication about invasion distributional range of *Inga punctata* in western Sierra del Rosario mountain range. The second focuses on documenting native biodiversity impact of this invasive tree with key information for management.

Two scientific-popular issues were also produced during the project and are now available or in press. One address to conservation professionals and educators of the whole country, the other produced for Sierra del Rosario local people with useful biology and invasion information and recommendations for control, prevention and early detection in more easy language.

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

The grant was used over 12 months from March 2014 to February 2015.

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
Transportation	250	250		
Lodging	715	429	286	During the work, we realize the need of prospection of western sector of Sierra del Rosario, outside Biosphere Reserve, in order to make a comprehensive documentation of <i>Inga punctata</i> infestation range. We used fewer amount for lodging (only 15 days) and difference was used for extra fuel and food supplies to perform this extended prospection.
Food supplies	1890	2000	-110	Due to extra days field prospection of western sector of

				Sierra del Rosario, outside Biosphere Reserve
Vehicle rental for first prospection trip	650	650		
Fuel	150	286	-136	Due to extra days field prospection of western sector of Sierra del Rosario, outside Biosphere Reserve
Salary	257	257		
Hiking boots	270	330	-60	Market prices change
Sleeping bags & backpacks	194	198	-4	Market prices change
Batteries	50	58	-8	Market prices change
Battery charger	24	19	5	Market prices change
Flagging tape	30	30		
GPS	220	170	50	Market prices change
Laptop	700	674	26	Market prices change
Camera	300	338	-38	Market prices change
Cardboard	47	42	5	Market prices change
Booklets printing	100	100		
Miscellaneous expenses (like local guide payment or workshop preparation)	150	150		
Total	5997	5981	16	local exchange rate to Cuban Convertible Pesos (CUC) was 1.4

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

For this particular alien invasive *Inga punctata*, next important steps will be test the combination of restoration and mechanical control, recommend here by us, on pilot sites into RBSR and farms outside. Design and implement a more effective awareness campaign for a responsible remaining seeds waste and new intentional propagation. And also monitoring the diminish population of critical endangered and local endemic *Zanthoxylum ekmanii*, as well as other threatened or local endemic species, performing propagation assays in order to reinforce their populations.

For the country, reproduce this kind of research by us or in collaboration with other management and research teams for many other alien invasive plants presumed among the most noxious. Also perform a compilation of available and unpublished information about distribution, impacts, invasion pathways and management for the most noxious alien plants in Cuba, and produce a beautiful and easy read publication also useful for management, increase awareness and promote more research.

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

RSGF logo was used in both scientific-popular issues produced during project, in technical workshop presentations and materials, in the report with information of distribution, impact and management recommendations presented to BRSR staff. RSGF receive publicity during the presentation of our

results in 5th Botanical Meeting, in published short communication about allelopathy reports for alien invasive registered on riparian forest, also on one poster about same subject presented in one international scientific meeting.