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# Fostering Sustainable Communities and Resilient Cities Whilst Supporting ‘Life on Land’ Through a Colombian School’s Initiative

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## Abstract

‘Quality education’ features in the Sustainable Development Goals (SDGs) adopted in the United Nations declaration ‘Transforming our world: the 2030 Agenda for Sustainable Development’ (i.e. SDG 4). Furthermore, Education for Sustainable Development (ESD) can be interpreted as a thread that supports the potential achievement of all the other SDGs. For instance, schools based in cities could help making these more ‘inclusive, safe, resilient and sustainable’ (i.e. SDG 11) whilst supporting ‘life on land’ (i.e. SDG 15) on the school grounds. This paper presents an environmental project, which aims to foster the integration of ESD in the curriculum through a tangible conservation and restoration initiative of some of the 70 ha of natural reserve in the Eastern hills of the city of Bogotá, Colombia. First, the paper describes the project and its links to urban ecosystems in the context of city resilience. Second, it analyses empirical data from the project evaluation, which evidences the development of pupils’ competencies and impacts beyond school activity. Finally, it presents the challenges faced by educators when adjusting curricula for ESD, followed by some recommendations for the future of the project. The purposes of the paper

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are: to provide insights to improve the project, to evidence the valuable pedagogic outcomes of this kind of initiatives for ESD and to inform and promote the development of similar projects in the region and beyond.

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**Keywords**

Schools · Education for sustainable development · Urban ecosystem services  
Competencies · Curriculum

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## 1 Introduction

In cities, natural reserves of vegetation cover and forests influence the quantity of available water, urban temperature regulation, noise reduction, air purification, moderation of climate extremes, reduction of surface runoff, erosion control and wastewater pollution levels (Bolund and Hunhammar 1999; Gómez-Baggethum et al. 2013). The conservation of natural habitats in urban settings is also necessary for the survival of pollinators, pest regulation and seed dispersal (Gómez-Baggethum et al. 2013). There is also some evidence that urban ecosystems may provide aesthetic and psychological benefits like spiritual enrichment, cognitive development, reflection and aesthetic experience, and are crucial for people's well-being and for their role in supporting knowledge systems, social relations and aesthetic values (Gómez-Baggethum et al. 2013). Positive effects of functioning urban ecosystems on human health and well-being indicate that the benefits of nature should be used as a setting for other activities such as healing, wellness and learning (CBD 2012). Moreover, they enhance human health and contemplativeness by reducing stress and providing a sense of peacefulness and tranquillity (Kaplan 1983).

In fact, using the local community and the environment to teach may increase academic achievement and may enhance students' appreciation of the natural world whilst creating commitment to serve and to be contributing citizens (Lescure and Yaman 2014). This aligns with the goals of Education for Sustainable Development that aims to enhance the acquisition of the knowledge, skills, attitudes and values needed for a sustainable future (UNESCO 2005–2014). This has been promoted by the United Nations General Assembly (UNGA), who adopted a resolution to implement a United Nations Decade of Education for Sustainable Development (ESD) to integrate the principles, values and practices of SD into all aspects of education and learning (UNESCO 2005–2014). Consequently, schools based in cities can integrate ESD in the curriculum whilst involving the school community in the recovery and conservation of urban ecosystem services in the school grounds, contributing to city resilience and urban biodiversity conservation.

For instance, the Eastern Hills of Bogotá, Colombia, could offer schools in the region a valuable scenario to enhance the development of ESD competencies through interdisciplinary processes involving research and action. These Hills are a mountain belt or system that crosses the city along its Eastern border. Their altitude (2600–3650 m.a.s.l.) is suitable for the development of a variety of ecosystems (i.e. low and high Andean forest, subparamo and paramo) of crucial ecological importance for the region (CAR 2005; Florez 2014). This area was declared a forestry reserve in 1977 due to its environmental importance as a provider of a wide variety of ecosystem services, benefits provided by the biosphere and its ecosystems for human well-being (MEA 2005). These include air purification, habitat for plants and animals, carbon capture, climate, soil and water systems regulation, scenic beauty, sense of place (Wiesner 2006). The Hills are also recognised for their landscape and cultural heritage with viewpoints to appreciate the predominant savanna ecosystems of the region, and peaks with unique scenery (Wiesner 2006).

Despite its great value for the city and the region, this peri-urban area has experienced severe changes affecting its watersheds and contributing to the ecosystem's fragmentation. Issues including strong urbanisation pressures, the presence of considerable areas of non-native plant species in native forest fragments, urban settlements of different socio-economical levels and the presence of mines are threatening this natural and cultural heritage of the city and the region. The city has a few green areas in the urban core, and these cannot supply the same extent of services offered by the Eastern Hills. Consequently, this is an area of conservation priority for the city (Wiesner 2016). Furthermore, these mountains may support significant as yet untapped opportunities to develop ESD for Bogota's schools.

In addition, since 1994, the Colombian Ministry of Education has required that all schools develop Environmental Projects (EP) in order to involve their internal community in the solution of local environmental issues (Torres 1996). The EP is a platform that offers school community members (i.e. students, teachers, parents), time and support to implement strategies and learn whilst impacting positively the school social and ecological context. Despite the enormous potential of school EPs to conserve urban ecosystem services whilst enhancing ESD competencies, conservation and restoration of surrounding ecosystems is one of the least frequent activities of Bogota's private school's EPs (Secretaría de Educación Distrital 2010). Nevertheless, there have been some attempts of schools sharing the same territories (i.e. Bogota's wetland ecosystems) to link their EPs conservation and restoration initiatives and strengthen the local impact of their work.

In Latin America, the attempts to include environmental dimensions of SD in the curriculum have faced many challenges. These might be explained by issues including the rigidity of educational systems in the region, which are resistant to changes and whose focus remains on clearly defined disciplines (González Gaudiano 2007). Moreover, research suggests that despite the increase of programmes and experiences in Latin America, there are few papers that explore systematically their effectiveness in education (Arboleda and Paramo 2014).

Following the Colombian Ministry Education guidelines and the challenges discussed previously, an EP was developed to embed ESD into the curriculum whilst involving the school community in the research, recovery, conservation and enjoyment of a natural ecosystem located in the protected area of the Eastern Hills of the city of Bogotá, Colombia.

Through an empirical analysis of perceptions of different actors involved in the project, the research aims to enhance their role in the project and boost its development. The paper aims to present the project and evaluate which of its aspects are enhancing the development of Education for Sustainable Development (ESD) competencies and what are the opportunities and challenges to embed such competencies into the curriculum through the project. Its purpose is to evidence the valuable potential of this and similar initiatives to enhance ESD whilst supporting life on land in the school grounds. Also it can motivate other schools from the city and beyond to develop similar initiatives in order to foster urban ecology leadership in students.

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## 2 Methodology

In order to implement and evaluate the EP with teachers, students and parents (i.e. only mothers participated in the focus group) an action research project was created. Robson (2002) suggests that seeking to facilitate change, improvement and a participatory approach are key features of action research. In addition, he suggests that focusing on one unit of study, which in this case is one Colombian school, would be the main element of a case study approach. For this project, action research case study is an appropriate method due to the EP's purpose, which is mainly to influence ESD competencies in the schools' activities whilst using as a catalyst for this, ecological restoration in the Eastern Hills.

The sequencing suggested by Robson (2002) was adapted, but broadly followed the suggested action research cycle. Below the stages of the cycle (Robson 2002)

- I. Describe the situation
- II. Tackling a contradiction by introducing a change
- III. Monitoring the change
- IV. Define the inquiry
- V. Collect evaluative data and analyse it.
- VI. Analyse evaluative data about the change
- VII. Review the data and look for contradictions
- VIII. Review the change and decide what to do next.

### **3 A School Conservation and Restoration Initiative to Provide Quality Education Whilst Supporting Life on Land**

#### **3.1 Case Study Background**

The Gimnasio Femenino is a private school in Bogota, Colombia, with over 500 female students and about 50 teachers. The School campus includes a natural reserve of 70 ha in the Eastern hills of the city.

Following government's guidelines, the Gimnasio Femenino School developed an EP to explore how the students, staff and wider community (human and non-human) could find mutual benefits in the ecological, educational, cultural and social dimensions of its natural reserve in the Eastern Hills. The EP's main goal is to integrate ESD into the curriculum through an ecological restoration process to recover the ecosystem's functionality, which has been affected by the introduction of invasive non-native species. The project combines two different educational approaches. First, it aims to develop critical thinking skills in students to become autonomous agents (or learners) who can engage with environmental issues. Second, it promotes specific actions to contribute to the solution of previously identified issues.

#### **3.2 Overview of EP Initiative and Changes**

The ecological restoration process has encouraged the involvement in the project of all academic areas through disciplinary, transdisciplinary and interdisciplinary pedagogic practices contributing to the EP's integration to the curriculum. Such integration has increased thanks to the rise of teachers' participation in the EP over time. Additionally, the Environmental Committee (EC) or group of students elected by their classmates to be the classroom environmental leaders, has participated in the investigation and communication of the forest biodiversity using trail cameras, campaigns and contests.

In order to involve the local community in the restoration and conservation of the ecosystem, high school students participated in research projects to discover the history of the spatial' transformation to try fostering people's attachment to the territory, especially, to its natural ecosystems. Additionally, the school encouraged district institutions to coordinate social cartography activities and education programmes that seek to reinforce the engagement of community and increase participation.

Between 2015 and 2016, approximately 3 ha of non-native species were removed whilst about 4000 native plants were planted, and the recovery process of a watershed started (Figs. 1 and 2). Both processes involved the participation of students, parents, teachers, staff, neighbours and students from other schools. Other local and regional agencies were engaged providing financial and technical support: Fundación







**Fig. 2** Clearings inside the plantations, where several native species have been regenerating (Fundación Ecotrópico 2016)

**Table 1** Focus groups included individuals engaged in the project at different levels

Focus group	Participants	
1	EC primary school students	EC high school students
2	Not EC primary school students	Not EC high school students
3	Teachers engaged with the EP	Teachers not engaged with the EP
4	Parents of EC students	Parents of non EC students

groups was to analyse how the environmental school project has influenced people, directly or indirectly involved in the process, regarding their perceptions, practices and competencies.

The discussion of all focus groups was transcribed and the themes were created from the transcriptions using inductive thematic analysis (Marks and Yardley 2004) using NVivo 10. Limitations of the work and constraints of the paper include lack of resources which resulted in a smaller and less varied number of focus groups which could otherwise have added depth to the analysis. In addition, the scarce human resources forced the leader of the project to be the researcher which might have biased the results. However, three independent researchers were invited to participate and counteract the potential subjectivity in the analysis. Furthermore the focus groups and the analysis were led by researchers not involved in the EP.

## 4 Results and Analysis

Three main themes were developed from the data analysis to evaluate the impact of the EP and its pedagogic outcomes as understood by the various participants of the focus groups.

The ability to enhance environmental stewardship and the development of ESD competencies.

The EP's perceived impact regarding the adoption of lifestyles or actions that contribute to SD.

EP's perceived strengths and challenges

### 4.1 Environmental Stewardship and Development of ESD Competencies

- Behavioural changes and ESD Interpersonal competency

The main goal of ESD is to build a knowledge society that through a bottom-up participatory process considers possible changes and implements those that are necessary for SD (Varga et al. 2007). Competencies needed to achieve this goal are those leading to more sustainable life styles (Varga et al. 2007).

In focus group discussion, students and parents perceived they had changed their behaviours in their daily life, which might be a consequence of the development of ESD competencies, particularly in what constitutes appropriate knowledge of SD and awareness of the impact of decisions that do not support SD (UNESCO 2005–2014). Specifically, environmental leaders perceived their role to be promoting and encouraging, in explicit ways, environmental actions with their peers in and outside school.

One environmental leader said her role is to

... educate those girls who don't understand. To work as a team to recycle, to save water ... To do this reciprocally, I mean to start in order to give example. I think our role is to be spokeswomen, because many times you have that feeling that your friends have about something and that feeling will stick to you ... so let's turn off the lights and ... It is different if a teacher tells you to do something than if your close friend tells you, so I think that role of being spokeswoman is very useful for the others to really understand

This quote reflects the students' understanding of leadership not by telling others what to do but through teaching by her own actions. This is a realisation of the value of peer learning in terms of knowledge and action for ESD and is evidence for the development of interpersonal competency for ESD via communication skills and leadership as discussed by Wiek et al (2011).

Both mothers and students focus groups suggested that the students enact the ability to influence their family's life and behaviours towards SD. Learning



processes in parents could be the consequence of their daughter's SD behaviours and the rigour with which they ask their relatives to adopt SD practices. This may reinforce their leadership and their capacity to teach something in which they feel confident and have legitimacy. The mother of two; a School's student member of the EC and of a younger girl said

Because we were not taught with this consciousness, at least not me, then they are the ones who are always saying at home "no, you must recycle" or "[...] what about the water?", they are quite strict, both of them, I mean, they tell my husband and me off all the time.

- ESD Systems thinking competency and urban ecosystem services

Students also recognise the EP's impact in the forest and beyond. Students perceive the School forest as an important natural area not only for the school but also for the city evidencing elements of systems thinking in urban ecology and environmental stewardship

[...] to become aware that the forest also helps to remove pollution of the city, helps the water and with that, helps to create awareness about many other things, like by knowing about the forest, if you are already worried about one thing, you start being interested in other aspects, like saving water, turning off the T.V., turning off the lights, not wasting energy

Understanding the way complex nonlinear living systems and human societies function is important in helping people to make sustainable decisions (Kunsch et al. 2007). The previous quote suggests the project might have helped the students to identify some of the urban ecosystems provided by the School Forest, by relating natural system to human systems, and by recognising it as a part of a more complex system; the city.

ESD system thinking competency refers to the ability to analyse complex systems across different domains (i.e. society, environment, economy) and across different scales—local to global—(Wiek et al. 2011). A student referring to an ecological walk in the School Forest identifies the cultural services it provides and reflects systems thinking whilst connecting different systems domains (environment-society) and different scales (School Forest-Eastern Hills)

I told a friend to go and see, she came with her cousin, and it is also a way to exercise, and there is also a forest with waterfalls in "Rosales" [another forest in the Eastern Hills], walks help a lot, because the place is magical, there is a kind of peace, helps to create awareness so people realise that "Bogotá" has a forest, you think about Bogota only as a city, but it really has very beautiful places

Students are often unaware of the importance of urban ecosystems in which they live (Barnett 2011), lack the skills to understand how their actions affect local urban ecosystems, and how they can improve and change their city's ecosystems (Manzanal 1999). Contact with the natural world is a key to developing environmental literacy and a stewardship ethic, providing this experience in urban environments where many people believe nature only occurs "outside" the city can be challenging, but is nonetheless important (Johnson and Catley 2009). Once students

observe and learn about the plants and animals in their immediate environment, they will better understand and value biodiversity to make more ecologically informed decisions in the future (Johnson and Catley 2009).

## 4.2 The EP's Perceived Impact Regarding the Adoption of Lifestyles or Actions that Contribute to SD

- Impact at school

Focus groups perceive that the EP has had an impact in student's family life as well as in their engagement with peers. The impact is perceived by students at many different levels such as contact with nature, waste management, water saving, urban agriculture. Parents perceive these attitudes in their children but they find, it might be also a generational attribute.

Teachers believe students engage with the project beyond the classroom. One teacher said

You hear discussion on the topic in the halls, between friends.

Teachers who have been working at the school for a longer time remark that the project's impact has increased in terms of the girls' actions and environmental stewardship. Students perceive this too, emphasising that now they have a closer and more active approach to the project and a sense of appropriation of it

When I was in primary school, there were things about recycling, but it wasn't so focused, I knew we had a forest, but I didn't know about it and never understood, I mean they told me to take care of it but in a superficial way... They didn't tell me why they started to remove trees, about the species...they took me to the forest but to pick up little plants, but never to really do something for my forest

On the same subject, another teacher said

It is a topic that has generated big changes in terms of awareness and it is determining the school's identity, is like a stamp of the school

It is worth noting that the last quote suggests that the project also has been influential in terms of shaping the school's identity.

The project is perceived by teachers as a tool to witness how knowledge arises when students can interact with the forest and can see its changes. As teachers said, the presence of animal species in the forest that sometimes are seen from the classrooms has had a positive impact on the pedagogic processes.

We also have spaces for pedagogic activities like the garden, the waste management room; all this evidences a huge possibility to let the girls see what they learn in practice. For example when they see birds or squirrels arriving, that allows a real and tangible learning experience

When pedagogic practices consider natural and human interactions in the local context they can make learning more relevant to students by getting them involved

in their own communities, promoting the participation of adults and organisations that care about identifying and solving real problems (Martusewicz et al. 2015).

One student evidenced her attachment to the project

[...] and you see the girls much more interested, all of them say: my school has a forest, you can't imagine all the animals that you can see and there are very beautiful plants and we go to plant trees and we name them and one gets enthusiastic

The previous quote may also evidence that experiences of planting trees may have increased their interest in nature. Children who have had outdoor learning experiences have demonstrated higher levels of motivation and interest in learning about the environment (Drissner et al. 2010). Additionally, direct interaction with nature might influence a child regarding the development of positive attitudes concerning environmental issues that probably will last into adulthood (Ballantyne and Packer 2002).

- Impact beyond the school

Teachers and parents perceive students promote environmental actions and behaviours more than ideas or explanations. They do it with their friends at the school and beyond; this may reinforce teacher's perception of student's engagement with the project beyond the classroom.

One mother perceived a shift in how students create community and communicate in social networks about environmental stewardship

...For example, the use of the straw, which you mentioned: I have high school girls in Facebook and they all share to avoid using straws, all of them use social network for positive things. No disposables, in the lunchbox they don't let me send disposable forks

A new topic within the themes that appears in terms of promoting environmental stewardship is mothers promoting environmental stewardship to a third party, this is a new level of impact of the project. Before they were the children-school or children-family, but now children-mother-third party (i.e. dairy products corporation).

Last week I was in a meeting in a large corporation of dairy products, they want a yogurt for kids with straw, previously I bought for her that yogurt and after hers change, I didn't buy it again. And during that meeting I mentioned the situation and the girls from marketing chose another. Incredible, because corporations like that one must be prepared, they are not going to use straw, you have to start looking at other solutions for the products, otherwise sales will decrease

The school forest also has a positive impact outside the school, it is recognised as a positive feature of the school, mothers are proud of it, they say it is not only recognised by the school community, but also in external communities. Schools are an important actor among the institutions that should play a governance role in cities, if we define *governance* as the way to govern in which conditions of collective actions, decisions taken by people and power are shared and provided by institutions of social coordination (Folke 2015).

### 4.3 EP's Perceived Strengths and Challenges

- The project's approach

Some focus groups discussed positive aspects of the project by valuing good communication of the project, and its enjoyment and impact.

Students perceived the approach of the project to be engaging and appropriate. They enjoyed the activities and their own sense of environmental stewardship had developed accordingly

when you are forced a lot to do something, it seems you stop liking it, if they tried too hard to force you into taking care of the forest I wouldn't internalise it, but they never put it that explicit like that you have to take care of the forest, or that if you drop a paper you will die. It is really nice that through activities it all gets into you, but through nice things, they never force you [...] it is much nicer

They talk to you about nature and one learns to have affection, [...], then it does create a consciousness, and at least in my case I think I worry for nature and I have to be there, because I help the forest, I have to try to take care of it. And for example with the animals, like Mari was mentioning that many native animals came back, that fulfils you, that really excites you and that creates interest

The focus group of parents find the school's actions coherent with the SD discourse promoting lifestyles more aligned with SD in the community whilst avoiding a catastrophic view that frightens the children without being constructive. Parents perceive in their children feelings of grief and concern about the future, which is a difficult topic, psychologically and in practical terms

For that fear, I try not to open beyond, yes we must save water but it is not going to be over, to finish, not that string, because also hope, like then, What should I do? Why am I going to have kids? if there is not going to be water?

Young people seem to have a genuine concern for environmental issues and often they do things individually to minimise their ecological impact, nonetheless their general feeling is pessimistic and they feel powerlessness when it comes to dealing with these issues (Threadgold 2012).

There also seems to be a sense of community and democracy in relationship to the project

The projects are everyone's, everybody can participate in the projects, when they organize walks, it is not that only the EC leaders can go, everybody can go. When we go to plant tree, all the class goes

Focus groups suggest that the aims of the educational approaches that the EP combines might have been achieved to some extent. First, the development of critical thinking skills to become autonomous agents or learners that can engage with environmental issues was evidenced in some students (i.e. growing food or implementing waste management systems at home). Strategies to enhance student's innovation and technology skills might be effective to continue developing student's abilities to become and/or improve as autonomous SD agents. Second, the

EP has been effective whilst contributing to the involvement of students in the promotion of specific actions for the solution of previously identified environmental issues. Nonetheless this might not be the case of all the school students, but might be a consequence of their different interests and concerns.

- Perceived barriers

Some focus groups suggested challenges that could allow the project coordinator to design strategies to improve the EP.

For example, students and teachers agree that not all teachers engage at the same level with the project. For some teachers, the project is perceived to be linked with the curriculum more easily for those who have taught science. Therefore, it is important to provide teachers with support through resources or workshops to make links to other areas other than science.

One teacher noted

In English there is an easy relationship, it has been made for example with projects like the signs of the forest

However, another participant suggested that it is

... easier for those who have taught science

Another teacher reflected that there was a need for staff development

...to learn about the project's topics and to have the skills to link the project with our lessons

Students and teachers both emphasise that time constraints are barriers for engagement with the project.

In English they have let us time to work that, there are teachers that worry more about losing time, then for example when we go planting tree you notice that they are not happy about the activity and I understand obviously (student)

It is difficult to integrate the whole community because of time constraints (teacher)

The previous quote suggests that time constraints link to the rigidity of the system that forces teachers to approach specific content in specific ways. Besides teachers might have fear of outdoor learning experiences. Educators face several challenges to encourage students to approach nature: first, there are several obstacles to incorporate ESD in the classroom due to the educational system (Johnson and Catley 2009), second, sometimes teachers experience fears of losing control by taking students outside (Bunting 2006).

Many authors (Sterling 2012; Lozano 2010; Lidgren et al. 2006) have identified barriers to the integration of ESD in higher education including no motivation, no understanding of ESD, uncertainty of what is required, or ESD as a threat to their own credibility. These barriers seem to be very similar in primary and high school education, and teacher's perceptions evidence this partially, nonetheless further research in this area is required. Individual enthusiastic ESD educators are relatively

isolated, which results in difficulties sharing experiences and good practices that might support teachers who wish to strengthen ESD in their work but lack the skills and knowledge to do so (Roberts and Roberts 2008). Empowering practitioners of ESD to promote their sharing of successful pedagogic strategies involving the school EP might help to enhance staff development through participative and collaborative work.

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## 5 Conclusion

Students understand the relevance of the project for the city and are able to identify the urban ecosystem services this natural ecosystem provides. The project enhances the development of ESD competencies in the students and their engagement in the promotion of sustainable lifestyles inside and outside the school. Barriers for teachers in terms of integrating ESD into the curriculum include lack of time, lack of understanding and lack of motivation. These are the same as the ones found in the literature. Action research is recommended as a method to study the impact of similar pedagogic initiatives aiming to contribute to the enhancement of ESD.

Proposed developments include first, further in-depth analysis of students' and teachers' different levels of engagement in SD initiatives and to the design of strategies to counteract barriers and strengthen the embedding of ESD into the curriculum; second, evaluation of the EP's ecological impact on the conservation of biodiversity and the associated provision of urban ecosystem services; third, the consolidation of The Hills of Bogota School Network to promote schools EP's aiming to strengthen the functionality and conservation of Bogota's natural ecosystems and the promotion of similar initiatives in other schools in urban and rural settings worldwide.

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**Valeria Ruiz Vargas** is ESD Coordinator at Manchester Metropolitan University and she leads the Environmental Management System policy area on ESD (teaching and learning), which includes the approach to embedding ESD into the curriculum. Valeria has a multidisciplinary background and explores transdisciplinarity daily. She explores arts-based research, action research, autoethnography and case studies as methods to address ESD in different contexts.

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**Lina María Hoyos** is an Anthropologist with experience in problematics that involve landscape transformation, community organisation and urban ecology. She is project manager at the NGO Fundación Cerros de Bogota and her main role is to work collaboratively with the group of founder organisations in the coordination and planning of the activities of The Hills of Bogotá School Network.

**Alicia Prowse** is a Principal Lecturer in the Centre for Excellence in Learning and Teaching at Manchester Metropolitan University. Her background includes a Ph.D. in Plant Ecology, teaching in Higher Education (Biology and Research Methods), Teaching English to Speakers of Other Languages (TESOL), as well as having worked as an actor and collaborated with an artist. Her present role includes formal and informal academic staff development and her research interests include: Global Citizenship; Interdisciplinarity and Student Transition to Higher Education.