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REVIEW

The small forest: a laboratory for sustainability and regenerative production

El bosque pequeño: un laboratorio de sostenibilidad y producción regenerativa

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ABSTRACT

El Bosque Pequeño is an innovative project located in Entre Ríos, Argentina, that integrates sustainability, regenerative and circular production, and nature-based solutions. This space, conceived as a sustainability laboratory, combines agricultural, educational and community practices to promote environmental conservation and harmonious coexistence between people and their environment. The proposal focuses on bioclimatic construction, efficient water management, the incorporation of native biodiversity, sustainable beekeeping and agricultural production, and the use of regenerative technologies such as composting and beneficial microorganisms. These practices not only mitigate environmental impact, but also generate applicable knowledge for rural and peri-urban development. From an educational approach, experiential, disruptive and continuous learning is promoted, which fosters cognitive and socioemotional skills, such as critical thinking and teamwork. This model combines cultural and sports activities, such as karate, to reinforce the values of coexistence and co-prosperity, while the preservation of a familiar historical legacy connects participants with their cultural context. El Bosque Pequeño represents an example of how participatory action research can transform a space into a sustainable model, combining education, production and conservation to address current social and environmental challenges.

Keywords: Sustainability; regenerative production; experiential learning; biodiversity; nature-based solutions.

RESUMEN

El Bosque Pequeño es un proyecto innovador ubicado en Entre Ríos, Argentina, que integra sostenibilidad, producción regenerativa y circular, y soluciones basadas en la naturaleza. Este espacio, concebido como un laboratorio de sostenibilidad, combina prácticas agrícolas, educativas y comunitarias para fomentar la conservación ambiental y la convivencia armónica entre las personas y su entorno. La propuesta se centra en la construcción bioclimática, la gestión eficiente del agua, la

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incorporación de biodiversidad nativa, la producción apícola y agrícola sostenible, y la utilización de tecnologías regenerativas como el compostaje y los microorganismos benéficos. Estas prácticas no solo mitigan el impacto ambiental, sino que también generan conocimiento aplicable para el desarrollo rural y periurbano. Desde un enfoque educativo, se promueve un aprendizaje experiencial, disruptivo y continuo, que fomenta habilidades cognitivas y socioemocionales, como el pensamiento crítico y el trabajo en equipo. Este modelo combina actividades culturales y deportivas, como el karate, para reforzar los valores de convivencia y coprosperidad, mientras que la preservación de un legado histórico familiar conecta a los participantes con su contexto cultural. El Bosque Pequeño representa un ejemplo de cómo la investigación-acción participativa puede transformar un espacio en un modelo sostenible, combinando educación, producción y conservación para abordar los retos sociales y ambientales actuales.

Palabras clave: Sostenibilidad; producción regenerativa; aprendizaje experiencial; biodiversidad; soluciones basadas en la naturaleza.

INTRODUCTION

El Bosque Pequeño is a project led by Master Environmental Engineer Fernando Carlos Raffo and Licensed Specialist Liliana Bonin, located in a three-hectare property in Colonia Hugues, Entre Ríos, Argentina. This personal, family, and professional venture focuses on sustainability and regenerative and circular production practices, integrating nature-based solutions, sustainable construction, and a focus on reducing carbon and water footprints and increasing biodiversity.

Figure 1 Native Forest

A forest of molles inspired the project's name near a rainwater course on the land when it was acquired and became the axis of conservation. It is also associated with the Shorin Ryu Karate style, whose translation means "Small Forest," part of the integral formation of Fernando, who has practiced and taught this discipline for more than 40 years.

This space is not only conceived as a productive area but also as a laboratory of experiences and sustainable solutions for peri-urban rural development. El Bosque Pequeño combines productive activities with urban professional life, offering an environment for reflection and the design of appropriate technologies that allow the application of environmental solutions in diverse contexts, from small to large scales.

This family project of sustainable living and production began in 2007 and is located in the rural town of Colonia Hugues, in the Department of Colón, Province of Entre Ríos. This enclave, founded in 1871 by Luis Hugues, is located a few meters from National Highway Route 14, which connects the Federal Capital

of the Argentine Republic with the Mesopotamia region. The nearest cities are Colón, 15 km to the northeast, and Concepción del Uruguay, 30 km to the south.
In its 3 hectares of land, Bosque Pequeño develops diverse activities that integrate daily life with sustainable, productive practices, always guided by its philosophy of positively impacting the environment and the surrounding communities.

Figure 2 Aerial view of the property

DEVELOPMENT

El Bosque Pequeño has been conceived as a comprehensive learning scenario, where the educational approach includes practical and natural experiences that allow participants to learn in direct contact with the environment. The project leaders, professionals committed to their social and community responsibility, have transformed this space into an open classroom and a scaled laboratory for experimentation and knowledge sharing.
This project fosters experiential learning by facilitating an environment where active, ubiquitous, and disruptive learning is promoted. Participants are encouraged to learn through inquiry and experimentation, asking questions and exploring answers through direct interaction with the ecosystem. This methodology is based on the idea that learning should not be a passive process but a continuous exercise that evolves with experience and reflection.

Figure 3 Technical visit activity.

The educational vision is based on the belief that knowledge expands when shared. Professional practice must include a commitment to autonomous learning and lifelong learning, an essential attitude for

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continuous improvement, and personal and professional development. Thus, they make their knowledge and skills available and open this space as a direct contribution to the community, facilitating inter-institutional and open days where the exchange of experiences is key.

Figure 4 Weekly practice activity.

El Bosque Pequeño integrates sports and cultural activities in its proposal, such as Karate and Kobudo, practiced in the natural context that transforms the landscape into a dojo. These activities promote physical health and reinforce a sense of community and personal commitment to continuous learning.
Another important project piece is the "Eduardo Raffo Educational Collection," a display of historical vehicles and documents from Industrias Mecánicas del Estado (IME), which is preserved as part of the family legacy and used in educational and productive tasks. This collection is incorporated as a didactic resource that connects the past with the present, reinforcing the project's focus on integral and contextualized learning.

SUSTAINABLE INFRASTRUCTURE

Based on sustainable construction criteria, the family housing and the productive infrastructure have been designed and built, as well as the improvement of the property, such as landscaping, use, and care against erosion. Concepts such as "from near to far" or "kilometer 0" have been the criteria for decision-making since its inception in 2008.

Figure 5 Strategy for reuse of plastic bottles as thermal insulator

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The housing, designed under bioclimatic criteria, incorporates local, low-impact construction and insulation materials, passive ventilation systems, and solar and photovoltaic energy to maintain a comfortable indoor temperature, reduce energy consumption, and ensure the comfort and connectivity of the family.
The productive infrastructure also integrates sustainable practices such as the construction of wetlands for water catchment and production, the incorporation of irrigation technology for the conscious use of water, attention to native and curtain forestation to reduce temperature and erosion, the use of reused material such as car covers and the use of strategies to ensure the coexistence of native species with productive activities.

Figure 6. View of the house

HYBRID ECOSYSTEMS. COEXISTENCE AND CO-PROSPERITY

Located in a semi-xerophilous forest environment, this space has become a refuge for a wide variety of species, including seven pre-existing native tree species with large specimens such as the centennial ñandubay, and more than 20 native species that shelter more than 100 species of birds.
Through the creation of hybrid ecosystems, a synergistic combination of native and exotic species has been achieved, maximizing environmental benefits. These ecosystems sequester carbon efficiently, promote biodiversity, and increase the system's resilience, providing natural space for the residence and reproduction of diverse native fauna species.
The project also focuses on the integral use of native plants of the spinal and gallery forest ecoregions of the Uruguay River. Through experiences and field trials, species such as satay, pasionaria, arazá, and pitanga are being revalued, exploring their reproduction and uses in food, natural products, and ecosystem restoration. Recovering traditional knowledge about these plants is essential to ensure their sustainable use.
Beekeeping plays a crucial role in biodiversity conservation and sustainable production. Beekeeping not only provides high-quality organic honey but also contributes to the pollination of crops and the preservation of local ecosystems, for which the availability of different types of flowers throughout the year is considered, particularly native species and productive species, with a focus on medicinal plants.
The shared table at El Bosque Pequeño is a ritual celebrating the connection between people and nature. The shared conscious consumption of healthy food, based on the idea of "from the garden to the table," recovers the perspective of shared time to improve quality of life.
This is an example of how agricultural production can be compatible with biodiversity conservation; by creating hybrid ecosystems, using sustainable practices, and valorizing natural resources, this project demonstrates that it is possible to build a more sustainable future for generations to come.

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Figure 7. Cardinalis cardinalis (Cardinalis cardinalis) on a branch of ñandubay (Prosopis affinis)

REGENERATIVE AND CIRCULAR PRODUCTION

The integration of appropriate technologies and production techniques that promote the sustainability and resilience of the ecosystem, such as soil care, biodiversity, and efficient water management, allows the framing of the scientific-technological proposal of El Bosque Pequeño in regenerative and circular production. This is currently reflected in the intensive cultivation of citrus fruits in coexistence with native species and the development of a trellis for the intensive planting of fruit trees, especially apples and raspberries, complemented with aromatic herbs and vegetables, cattle raising, beekeeping and poultry production and fish farming, as well as the processing of their products, creating a balanced system that protects the soil, water and preserves the local natural landscape.

Figure 8. Productive trellis

This productive trellis is an area of 2500 m^2 with 330 apple plants of three varieties combined with raspberries. This system has great potential for producing fresh and processed products such as vinegar and dried fruit. In addition, an apiary of 20 hives and a mobile hen house for 200 hens have been installed, optimizing pollination and pest control in a natural way.

Figure 9. Productive trellis

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The project also integrates raising cattle in rotational grazing and poultry in controlled grazing systems and aquaculture for ornamental and food fish using natural ponds. These methods improve soil health and pest control, generating more sustainable and healthier products.

NATURE-BASED SOLUTIONS

This project has implemented technological solutions that mimic natural processes, promoting sustainability and resource efficiency, such as water management and biomass composting cycles to improve soil and regenerative agricultural production.

One of the central axes of the project is integrated water management. This vital resource is optimized through a rainwater harvesting system in cisterns and lagoons for rainwater harvesting and irrigation with enriched water. This strategy reduces the overall water footprint in terms of good extraction. It makes it possible to reuse the captured water for irrigation, minimizing well water consumption and promoting sustainable agriculture.

In parallel, innovative water treatment solutions have been developed. Of particular note is the implementation of artificial wetlands, which act as natural biological filters, purifying the water and enriching the local biodiversity, using native and specific species that reproduce under controlled conditions. In addition, the pond, a chlorine-free system, promotes biodiversity in landscaping and contributes to water quality in recreational areas.

Integrating native plant species strengthens the soil structure and improves water retention capacity. This synergy between natural elements and technologies such as bioclimatic construction and photovoltaic solar energy significantly reduces the project's ecological footprint.

The circular production criterion includes productive activities such as fermentation to produce organic apple vinegar, distillation of musts and fruits, distillation of aromatic herbs for hydrolatum and oils, fruit drying, and production of preserves.

Figure 10. Artificial wetland landscaped with native species.

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THE COMPOSTING CYCLE

One of the key actions of regenerative production is the continuous improvement of available resources. The biomass produced by the various productive actions is composted in a natural process based on turning and inoculating effective microorganisms (EM®) to accelerate the composting process. This high-quality compost, rich in nutrients, enriches crop soils, improving their structure and fertility. At the same time, it acts as a natural biofertilizer, replacing chemicals and strengthening plant resistance to pests and diseases.

Figure 11. Chicken litter composting trial.

The application of EM® is not limited to composting but extends to all soil, water, and crop management. These microorganisms foster a healthy microbial environment in the soil, which is essential for optimal plant growth and long-term sustainability. In addition, this practice contributes to soil carbon sequestration, mitigating the effects of climate change.

Figure 12. Composting trial of camalote challenges from grazing poultry feed.

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CONCLUSIONS

El Bosque Pequeño has demonstrated that participatory action research is a powerful tool for fostering meaningful learning and social transformation. By involving different perspectives in all stages of the process, a space of co-creation has been created where people learn by doing, reflecting, and adapting to the needs of the context. This methodology, which combines quantitative and qualitative techniques, has made it possible to generate relevant and applicable knowledge, empowering participants and fostering a sense of belonging and responsibility towards the project.

The implementation of this methodology has favored the development of cognitive and socioemotional skills, such as critical thinking, problem-solving, teamwork, and decision-making, on the values of coexistence and co-prosperity. In addition, it has promoted a culture of continuous learning and adaptation to change, which is fundamental in an increasingly complex and dynamic world.

The proposal of El Bosque Pequeño, as a laboratory of sustainability and regenerative production, represents an innovative educational practice that promotes comprehensive training and ubiquitous and disruptive learning, obtaining evidence of a more sustainable model.

This personal, family, and professional venture focuses on sustainability and regenerative and circular production practices, integrating nature-based solutions, sustainable constructions, and a focus on reducing carbon and water footprints and increasing biodiversity.

The project leaders, professionals committed to their social and community responsibility, have transformed this space into an open classroom and a scaled laboratory for experimentation and knowledge sharing. The proposal represents an innovative educational practice that promotes comprehensive training and ubiquitous and disruptive learning, obtaining evidence of a more sustainable model.

The implementation of this methodology has favored the development of cognitive and socioemotional skills, such as critical thinking, problem-solving, teamwork, and decision-making, on the values of coexistence and co-prosperity (Higa, T. 1991). In addition, it has promoted a culture of continuous learning and adaptation to change, which is essential in an increasingly complex and dynamic world.

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FINANCING

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CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

Conceptualization: Liliana Bonin, Fernando Raffo.
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