Diagnosis of Ecosystem Services **PINDAMONHANGABA Connections between Nature and Society**



Prefeitura de Pindamonhangaba



Diagnosis of Ecosystem Services

Ecosystem Services (ES) describe ecosystems' direct and indirect benefits for human well-being. They are perceived in the form of goods and services and can be divided into three groups:

Provisioning Regulating

Goods or products obtained from ecosystems, such as raw materials, food, water, and medicinal resources

Natural processes that regulate conditions maintaining environmental balance and quality of life on the planet, including climate regulation, water purification, pollination, and protection against erosion and floods.

Cultural

Benefits, often non-material, that people acquire from their relationships with the environment, such as leisure, relaxation, and improved health.

There are still **supporting** processes that help maintain other ecosystem services, including nutrient cycling, soil formation, and photosynthesis. However, there is a tendency to consider them as something other than **ecosystem services** since they do not provide immediate human benefits; instead, they serve as **ecosystem functions** that support natural processes, thus resulting in ecosystem services.

The Diagnosis of Ecosystem Services of Pindamonhangaba examines nature's contributions within the municipal territory. Regulating, provisioning, and cultural services are analyzed to provide a comprehensive understanding of the key benefits offered by local ecosystems.

The study was based on technical evidence and knowledge exchange with local stakeholders on the city's current scenario. The assessment contributes to creating efficient strategies to face the territory's challenges and encouraging sustainable, equitable, and resilient development actions.

Ecosystem Services

Provisioning and Regulating

Supply of food and raw materials

In Pindamonhangaba, crops such as **rice**, **corn**, **and beans** are prominent near Serra da Mantiqueira where climate and soil conditions enable diversified agricultural production. Other activities like **trout farming** and **beekeeping** have been strengthened, as has agroecological production. Furthermore, **livestock and milk production** stand out in the southern region of the municipality, where **forestry** has also been on the rise. There are also mining extraction areas for **obtaining sand** on the banks of the Paraíba do Sul River. The sustainable provision of these materials is crucial to human well-being and depends on ecosystems' health and balance.



Water availability and quality

Greatest contributions to water supply primarily comes from **Serra da Mantiqueira.** The region is home to the city's most preserved areas, which play an essential role in aquifer recharge and river flow regulation. This area also features the headwaters of several water bodies, including the **Piracuama River** and the **Ribeirão Grande**, ensuring water availability for the population and local ecosystems. **The Paraíba do Sul River and other tributaries** also cross the city. Floodplain forest areas filter pollutants and contribute to the soil's water retention capacity, influencing hydrological cycles and reducing the risks of water scarcity, erosion, and flooding.

Oclimate regulation

Natural environments, such as forests and floodplain forest areas, capture carbon dioxide (CO²) from the atmosphere, helping mitigate global climate change. The **remaining Atlantic Forest areas**, like the **Serra da Mantiqueira Environmental Protection Area**, play an essential role in this process while also improving air quality in the region. Additionally, in the most densely urbanized region, green spaces such as **Bosque da Princesa** (*Princess Woodland Park*), **Parque da Cidade** (*City Park*), and the Municipal Forest Nursery operate as natural microclimate regulators, reducing the impact of urban heat islands.

Ecosystem Services

Cultural



Health, recreation, and social relationships

Green areas offer several health benefits, such as tranquility and relaxation, while promoting a more active and healthy lifestyle. The **Parque da Cidade** *(City Park)* and the **Parque da Juventude** *(Youth Park)*, for example, are places that promote physical activities, visited by families and groups of friends, thus strengthening social interaction as well. The **Piracuama River** Beaches and the banks of the rivers that crisscross the city also provide different leisure and nature connection opportunities. The **Nova Gokula Farm** is another venue that offers outdoor recreation and encourages meditative practices, enabling a spiritual connection with nature.





Cultural heritage

The **Emperor's Fig Tree** is a natural and historical landmark in Pindamonhangaba, associated with the visit of Prince Regent Dom Pedro I. Located in the District of Moreira César, the tree serves as a living monument bearing witness to significant historical events. Its preservation highlights the importance of historical memory within the urban landscape. **The Quartel Square** in Pingamonhangaba's center evokes parts of the city's history while currently also serving as a venue for festivals and cultural activities, strengthening the community's emotional bond with its history and territory. There

are a few examples of how natural environments and biodiversity provide a sense of continuity and connection with past generations, shaping the city's identity and cultural landscape.





Educational values

In Pindamonhangaba, the educational values of nature are conveyed richly and diversely across various venues and initiatives that connect the population with the environment, promoting outdoor learning, and enhancing ecological awareness. For example, the **Bosque da Princesa** (*Princess Woodland Park*) is a green area that offers opportunities to learn about the local flora and fauna. In places like the **Citizenship Station**, the **Historical Museum**, and the **Dez de Julho Palace**, the city combines historical and environmental education with spaces that foster the development of skills, ecological knowledge, and cultural values.



Ecotourism

Experiences in contact with nature can raise awareness about the importance of conservation and socio-biodiversity. The **Trabiju Municipal Natural Park**, home to significant stretches of the Atlantic Forest, combines nature, adventure, and environmental education. The region of the **"Santa" Lookout or Mirante de Nossa Senhora de Auxiliadora**, near the **Eugênio Lefévre** train station, attracts nature and ecotourism enthusiasts by providing an experience that integrates history and culture. **Santa Isabel Power Plant** is another example since it combines the architecture of an old hydroelectric plant — a symbol of the city's industrial history — with the region's landscapes. The **Fish and Pay Ribeirão Grande** is also a popular tourist destination in the city, demonstrating tourism can create opportunities to strengthen local, nature-based development.



Fauna and flora of Pindamonhangaba

Twenty-three species — 11 fauna and 12 flora — that live in the region of Pindamonhangaba are depicted on the Diagnosis of Ecosystem Services' Map, highlighting their ecological and social relevance.

Located between the Serra da Mantiqueira and Serra do Mar mountains, the municipality stands out for its biodiversity, forests, rivers, and waterfalls. The predominant vegetation consists of altitude-varying remnants of the Atlantic Forest, contributing to the diversity of flora and fauna.

Among the dozens of tourist attractions spread across the rural areas, the Trabiju Municipal Natural Park stands out. The park houses different species of birds, such as the **Pavó** and the **Maria-Leque-do-Sudeste** — a vulnerable and exclusive to the Atlantic Forest species.

The **maned wolf** crosses the trails of dense forest areas, finding its home in the heart of Serra da Mantiqueira. The same is true for the discreet yet crucial presence of the **Red brocket** and the **White-lipped peccary**, constantly reminding us that we share our land with other species.

The municipality is home to Atlantic Forest native plant species, such as the *manacá-da-serra* (*Tibouchina mutabilis*) and *Paraná Pine* (*Araucaria angustifolia*), classified as vulnerable in the State of São Paulo and critically endangered in different regions of Brazil. The city also lodges the *embaúba tree*, typical of forest regeneration areas often found on forest edges.



Atlantic Royal Flycatcher Onychorhynchus swainsoni

After feeding the population for a long time with palm hearts, the now protected *juçara palm tree (Euterpe edulis)* guards the forest that is home to more than 70 species of Brazilian fauna. The *cambuci* is another threatened native species. Its once-familiar acidic flavor remains a living memory of the recently renewed connection with rural areas.

Native bees, such as **jataí**, have an essential role in the pollination of local plants, contributing to the maintenance of biodiversity and the Atlantic Forest's ecological networks.

In the rivers of the region, the *piabanha* fish stands out, endemic to the Paraíba do Sul river basin. Furthermore, the **rainbow trout** is present in breeding farms and fishing spots in the region and, although an exotic species, has adapted well to the cold climate of the higher lands.

The urban area is also home to various species that have quietly shaped the history of this place. The **yellow** *ipê* blossoms across the city's streets and gardens at the height of spring.

These plants and animals are a sample of the diversity of inhabitants of this territory. Like humans, they depend on the presence of water and fertile soil to live. With its squares and mountains, the city witnesses a coexistence that demands care and respect.



IUCN Red List of Threatened Species

Vulnerable species

Endangered species

Piabanha fish Brycon insignis Rainbow trout Oncorhynchus mykiss



EXOTIC SPECIES

(VU)

White-lipped Peccary Tayassu pecari





Pumpkin toadlet Brachycephalus ephippium

> **Manacá-da-serra** *Tibouchina mutabilis*

Paraná pineAraucaria angustifolia

Maned Wolf Chrysocyon brachyurus

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Golden trumpet tree Tibouchina mutabilis



Jataí bee Tetragonisca angustula **Jatobá tree** Hymenaea courbaril

utabilis

Red Brocket Mazama americana Palmeira imperial Roystonea oleracea

Jussara palm Euterpe edulis

Silverleaf Cecropia Cecropia hololeuca

Red-ruffed fruitcrow Pyroderus scutatus

> Cambuci tree Campomanesia phaea

Jequitibá tree Cariniana estrellensis



Painted Coral Snake Micrurus corallinus



Jararaca Bothrops jararaca Sibipiruna Caesalpinia peltophoroides

Diagnosis of Ecosystem Services

Connections between Nature and Society

Even in large urban centers, our daily lives are intrinsically connected to the surrounding nature — the water we consume, the air we breathe, and what we eat depend on the ecosystems and the biodiversity around us. Nature also influences how we work, our leisure options, and how we culturally express ourselves.

This map features the key results of the Diagnosis of Ecosystem Services of Pindamonhangaba, presenting information about the direct and indirect benefits of ecosystems — known as Ecosystem Services — to the local population. This study is an invitation to rediscover the commonly unseen but always powerful connection between nature and the people's daily lives, illustrating how ecosystems and nature support the city's health, well-being, and future.

Ecosystem Services: Benefits of nature to people

PROVISIONING Supply of food and raw materials PROVISIONING Water availability 0 and quality **CUITURAI** Health, recreation, and 0

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social relationships

CULTURAL



CULTURAL Educational values



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REGULATION **Climate regulation**



REGULATION Pollination





Important city venues

- Main Church
- Dez de Julho Palace Pindamonhangaba City Hall
- Galpão Theater
- João do Pulo Monument
- Flying club Cultural Center
- Maçaim Church (Santa Helena Farm)
- Nova Gokula Farm
- Pesque-Truta
- Santa Isabel Power Plant 11 Itapeva Peak
- 13. Búfalos e Oliveiras Waterfall
- 14. Piracuama river beaches

Urban and peri-urban green areas

- 15. Trabiju Natural Park
- 16. Bosque da Princesa (Princess Woodland Park)
- 17. Santana Square
- 18. Forum Square
- 19. Monsenhor Marcondes Square
- 20. Quartel Square 21. Emílio Ribas Square
- 22. Parque da Cidade (*City Park*)
- 23. Forest Nursery
- 24. Parque da Juventude (Youth Park)
- 25. Santa Lookout

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Agricultural area



A THREATS

INVASIVE ALIEN SPECIES



Sparse tree vegetation





Prefeitura de



ICLEI - Local Governments for Sustainability

A global network of more than 2,500 local and regional governments committed to sustainable urban development. Active in over 125 countries, in South America, the ICLEI network connects members in eight countries in the region to this global movement. We influence sustainability policies and drive local action for low-carbon, nature-based, equitable, resilient, and circular development.

Pindamonhangaba City Hall

The technical staff of Pindamonhangaba City Hall, primarily through the Municipal Environment Secretariat, contributed to developing the Diagnosis of Ecosystem Services of Pindamonhangaba.

Implementation:

SECRETARIA DE MEIO AMBIENTE SECRETARIA DE DESENVOLVIMENTO RURAL SUSTENTÁVEL E CLIMA



