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Puerto Rico, Sustainable Agriculture

### **Strategies for Sustainable Agriculture and Food Security in Puerto Rico**

Puerto Rico has a population of around 3.2 million and has experienced a significant migration of its residents to urban centers, resulting in a high urbanization rate of 93.6% [1] [2]. Puerto Rico, as a Commonwealth of the United States, has its own constitution and locally elected governor and legislative assembly. Puerto Ricans are U.S. citizens, but cannot vote in U.S. presidential elections unless they live in one of the states [3]. The island's agricultural landscape has evolved, with about 21.9% of all land now used for farming. Today, plantains, bananas, coffee, and sugarcane are the primary crops. Puerto Rico's agricultural exports are led by coffee, plantains, bananas, and tropical fruits like mangoes and pineapples. Farming in Puerto Rico is known for its smaller-scale operations, typically with farms averaging around 65.0 cuerdas in size [4]. This is in stark contrast to the large agricultural lands commonly found in the continental U.S., with farms averaging 445 acres [5].

The climate in Puerto Rico is tropical marine, offering warm temperatures throughout the year, with it fluctuating between 73°F and 88°F [6]. The island's landscape includes mountains, coastal plains, and a prominent central mountain range, crowned by Cerro de Punta. A typical family in Puerto Rico consists of 2 to 3 members, with their diet being a fusion of rice, beans, plantains, and proteins like pork and seafood. Root vegetables and tropical fruits also feature prominently [7] [8].

Families typically source food from local supermarkets, neighborhood stores, and community-supported agriculture. Cooking is mainly done on gas stoves, with a growing trend towards using solar-powered appliances as a response to frequent power outages [9]. Employment here spans the service sector, manufacturing, and a growing tech industry. Jobs in education, healthcare, and tourism are common. However, the average weekly wage is at \$688 compared to \$1435 for the U.S. mainland [10].

In Puerto Rico, public education is free [11]. In terms of healthcare, Puerto Rico faces significant disadvantages compared to any U.S. state, heavily relying on public health initiatives such as community health centers, Medicaid, and Medicare. However, due to its status as a territory, Puerto Rico receives fewer federal funds and resources to support these programs than it would if it were a state [12]. Most families here have access to clean water, toilets, electricity, and telephones, with improvements ongoing since Hurricane Maria. Roads connect them to local markets, ensuring essential goods are within reach. However, rural areas may face challenges with consistent utility services.

Economic instability is a typical problem families face in Puerto Rico. Due to limited agricultural land and productivity challenges, the island imports over 85% of its food, including rice, wheat, and dairy products [13]. This heavy reliance on imports makes the island vulnerable to global market fluctuations and supply chain disruptions. It also contributes to increasing costs for local consumers and impacts food security.

The island's food security is currently in a delicate state. Hurricane Maria and its aftermath revealed the fragility of Puerto Rico's food system. It emphasized the immediate necessity for a stronger and independent farming industry. Attempts are being made to revitalize the production of local food, with a particular emphasis on sustainable methods to address issues related to climate change and limited natural resources. Despite attempts to address the issue, establishing a sustainable agricultural system remains difficult and complex. Land tenure problems and repairing infrastructure destroyed by previous

hurricanes are among the challenges. There is a significant demand for education and training in sustainable practices, particularly for marginalized communities who frequently do not have access to resources [14].

Hurricane Maria left Puerto Rico with approximately 480 million fallen trees, including high-value hardwoods like mahogany [15]. Despite this, the island has not fully capitalized on these resources, with much of the wood left to decay. This underutilization represents a missed economic opportunity, as these woods could be repurposed into valuable products that support both the local economy and environmental sustainability [16].

Puerto Rico's mahogany and other valuable hardwood reserves present considerable economic opportunities. These hardwoods, when saved and reused, have the potential to become valuable items such as furniture, musical instruments, and luxury goods, leading to significant profits [17]. The government can assist in this by providing incentives for local businesses to build processing facilities and by marketing these products in global markets. This strategy would improve the economy and also offer a sustainable solution for the downed trees, aiding in Puerto Rico's enduring strength.

Even though high-value hardwoods are great for economic gain, the large amount of low-value wood from fallen trees can play a key role in restoring the environment. This timber can be reused to create protective structures and infrastructure that aid agricultural activities, especially in regions prone to severe weather. These inexpensive wooden structures can form small environments that shield crops from excessive wind, rain, and intense sunlight. They are also able to assist in the development of shade-loving crops such as coffee, cocoa, and specific herbs, making the most of fallen trees while encouraging a more varied and robust farming method. This approach serves a dual purpose by safeguarding crops and promoting food security and agricultural sustainability.

Furthermore, the tactical application of this timber in construction goes beyond just farming areas. These materials can be used to build greenhouses, trellises for vine plants, or as bases for agroforestry systems with diverse plant species that mutually benefit each other. These formations offer protection, improve soil quality, and encourage biodiversity, all essential for sustainable farming.

While this is an innovative use of fallen trees, the USDA Caribbean Climate Hub workshop report highlighted several obstacles [18]. The issues included inadequate government support, funding problems, and difficulties with wood export permits and regulations. There was also a lack of a comprehensive waste management plan and infrastructure for handling large-scale organic matter. To address these issues and transform fallen trees into a sustainable solution, the following implementation plan is proposed.

Government funding and community engagement are pivotal in addressing the challenges posed by hurricane-generated wood waste. A task force with representatives from government agencies, NGOs and private sector needs to be established. This task force should focus on developing a policy framework to streamline permit processes, allocate funds for equipment acquisition, and create incentives for sustainable forestry practices. The development of a robust market place for wood products by organizing craft fairs, establishing partnerships with local furniture makers and construction companies is also essential. Implementing Windrow composting supports managing vegetative waste, providing valuable nutrients for agriculture and reforestation, and contributes to the long-term recovery and resilience of the island's ecological systems [19].

Agritourism that integrates native crops is an additional option to tackle food insecurity while protecting cultural heritage and stimulating economic growth. This method combines conventional farming techniques with contemporary tourism strategies. It provides unique experiences for tourists while also benefiting local farmers and communities. The agrotourism initiatives in Puerto Rico are built upon the

island's diverse agricultural history, which is deeply influenced by Taíno and other indigenous traditions [20]. By growing local plants like yuca, batata, and ají dulce, farmers can highlight the diversity of the island and its cooking customs. These crops have adapted well to the conditions in the area, needing less resources and showing strong resilience to the effects of climate change.

Agrotourism activities focused on native crops can come in different types, such as visits to farms, practical lessons, and dining with food straight from the farm. Visitors have the opportunity to discover traditional planting methods, like the Conuco system, where elevated mounds are made for growing crops [21]. This approach boosts soil quality, increases water retention, and enhances crop yield while reducing erosion. Combining agrotourism with eco-friendly farming methods is advantageous for both the environment and nearby communities. Farmers are able to expand their sources of income, therefore decreasing their economic vulnerability and encouraging the conservation of agricultural lands. This method also supports food sovereignty by promoting the growth and consumption of indigenous crops at a local level.

Collaboration is crucial for the successful implementation of agritourism initiatives. Offering training and resources to farmers who want to create agrotourism opportunities can help ensure high quality experiences for tourists. To appeal to eco-friendly travelers, social media marketing should showcase the distinct cultural and ecological features of Puerto Rico's native agriculture. Policymakers should consider creating rewards and frameworks that help growth of sustainable agritourism while also safeguarding natural resources and cultural heritage.

In conclusion, the provided solutions offer a comprehensive pathway to promote Puerto Rico's agricultural sustainability and long-term food security.

## References

1. U.S. Census Bureau. *Explore Census Data*. data.census.gov/profile/Puerto\_Rico?g=040XX00US72.
2. *Puerto Rico - the World Factbook*. [www.cia.gov/the-world-factbook/countries/puerto-rico](http://www.cia.gov/the-world-factbook/countries/puerto-rico).
3. *Who Can and Cannot Vote / USA Gov*. [www.usa.gov/who-can-vote](http://www.usa.gov/who-can-vote).
4. United States Department of Agriculture and National Agricultural Statistics Service. *Puerto Rico Agriculture*. 2022, [www.nass.usda.gov/Publications/Highlights/2024/Census-of-Ag-22\\_HL\\_PuertoRico.pdf](http://www.nass.usda.gov/Publications/Highlights/2024/Census-of-Ag-22_HL_PuertoRico.pdf).
5. “Number of US Farms Falls and Size Increases, Census Shows.” *US News*, 13 Feb. 2025, [www.usnews.com/news/top-news/articles/2024-02-13/number-of-us-farms-falls-and-size-increases-census-shows#:~:text=The%20average%20farm%20size%20rose,\(187%20hectares\)%20in%202022](http://www.usnews.com/news/top-news/articles/2024-02-13/number-of-us-farms-falls-and-size-increases-census-shows#:~:text=The%20average%20farm%20size%20rose,(187%20hectares)%20in%202022).
6. “The Climate and Geography of Puerto Rico.” *Moon Travel Guides*, 15 Mar. 2024, [www.moon.com/travel/planning/the-climate-and-geography-of-puerto-rico/#:~:text=Puerto%20Rico's%20climate%20is%20classified,%C2%B0F%20in%20the%20mountains](http://www.moon.com/travel/planning/the-climate-and-geography-of-puerto-rico/#:~:text=Puerto%20Rico's%20climate%20is%20classified,%C2%B0F%20in%20the%20mountains).
7. *Explore Census Data*. data.census.gov/table?q=Puerto%20Rico%20Families%20and%20Living%20Arrangements&g=040000U.
8. *Explore Flavorful Puerto Rican Cuisine*. [www.eatright.org/food/cultural-cuisines-and-traditions/central-and-south-american/puerto-rican-favorites-made-healthy](http://www.eatright.org/food/cultural-cuisines-and-traditions/central-and-south-american/puerto-rican-favorites-made-healthy).
9. “Renewing Growth in Puerto Rico: Evaluating the Island’s Transition to Distributed Solar Energy.” *Journal of Public and International Affairs*, [jpia.princeton.edu/news/renewing-growth-puerto-rico-evaluating-island%E2%80%99s-transition-distributed-solar-energy](http://jpia.princeton.edu/news/renewing-growth-puerto-rico-evaluating-island%E2%80%99s-transition-distributed-solar-energy).
10. “Municipio Employment and Wages in Puerto Rico — Fourth Quarter 2023.” *U.S Bureau of Labor Statistics*, 28 June 2024, [www.bls.gov/regions/northeast/news-release/countyemploymentandwages\\_puertorico.htm#QCEWPRTTable2.xlsx](http://www.bls.gov/regions/northeast/news-release/countyemploymentandwages_puertorico.htm#QCEWPRTTable2.xlsx). Accessed 1 Sept. 2024.
11. “Puerto Rico.” *LULAC*, [lulac.org/puertorico](http://lulac.org/puertorico).
12. *Hurricane Maria Worsened Puerto Rico Health Care Crisis*. 18 Dec. 2017, [www.commonwealthfund.org/publications/other-publication/2017/dec/how-hurricane-maria-worsened-puerto-ricos-health-care#:~:text=Puerto%20Rico%20is%20much%20poorer,the%20rest%20of%20the%20nation](http://www.commonwealthfund.org/publications/other-publication/2017/dec/how-hurricane-maria-worsened-puerto-ricos-health-care#:~:text=Puerto%20Rico%20is%20much%20poorer,the%20rest%20of%20the%20nation).
13. *How Much of Puerto Rico’s Food Is Imported?* [www.tendata.com/blogs/import/4644.html#:~:text=Over%2085%25%20of%20Food%20Is,United%20States%20and%20other%20countries](http://www.tendata.com/blogs/import/4644.html#:~:text=Over%2085%25%20of%20Food%20Is,United%20States%20and%20other%20countries).
14. Marrero, Abrania, et al. “Narrating Agricultural Resilience After Hurricane María: How Smallholder Farmers in Puerto Rico Leverage Self-sufficiency and Collaborative Agency in a Climate-Vulnerable Food System.” *Clark Digital Commons*, [commons.clarku.edu/faculty\\_idce/39](http://commons.clarku.edu/faculty_idce/39).
15. Simmons, Ann M. “Hurricane Maria Stripped Puerto Rico’s Forests Bare. Now Conservationists and Scientists Are Working to Replenish Them - Los Angeles Times.” *Los Angeles Times*, 3 Mar. 2018, [www.latimes.com/nation/la-na-puerto-rico-environment-20180226-story.html](http://www.latimes.com/nation/la-na-puerto-rico-environment-20180226-story.html).
16. “Saving Hurricane-felled Trees in Puerto Rico.” *The Ecologist*, 31 Oct. 2018, [theecologist.org/2018/oct/31/saving-hurricane-felled-trees-puerto-rico](http://theecologist.org/2018/oct/31/saving-hurricane-felled-trees-puerto-rico).
17. *Puerto Rico Hardwoods – Eye on the Rainforest*. [eyeontherainforest.org/puerto-rico-hardwoods](http://eyeontherainforest.org/puerto-rico-hardwoods).
18. *Workshop Reports and Assessments*. [caribbeanclimatehub.org/resources/publications/workshop-reports](http://caribbeanclimatehub.org/resources/publications/workshop-reports).
19. DENR. *GUIDANCE FOR COMPOSTING OF MASS MORTALITY FROM HURRICANE MATTHEW*. [ncdisaster.ces.ncsu.edu/wp-content/uploads/2016/10/GUIDANCE-FOR-COMPOSTING-OF-MASS-MORTALITY-FROM-HURRICANE-MATTHEW.pdf?fwd=no](http://ncdisaster.ces.ncsu.edu/wp-content/uploads/2016/10/GUIDANCE-FOR-COMPOSTING-OF-MASS-MORTALITY-FROM-HURRICANE-MATTHEW.pdf?fwd=no).
20. *The Taino: Can the Indigenous Agricultural Methods of Puerto Rico Feed the Island and Potentially Mitigate Climate Change? - SARE Grant Management System*. [projects.sare.org/sare\\_project/gs23-287](http://projects.sare.org/sare_project/gs23-287).

21. About the CONUCO — Traditional Center for Indigenous Knowledge and Healing. (n.d.).  
Traditional Center for Indigenous Knowledge and Healing. <https://www.tcikh.org/about-the-conuco>