

PATHS TOWARD SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY

A Comparative Analysis of “Exceptionalist” Development Models in Costa Rica and Kerala, India

By Rohith A. Moolakatt

In working to overcome the greatest challenges of the century, populous societies and governments have not properly recognized how to improve social conditions within the limits of our biosphere. In search of paths toward sustainable development in the 21st century, I analyzed two case studies known for their remarkable development outcomes: Costa Rica and the Indian State of Kerala. Publicly available data was used to visualize their development and sustainability progress over time. My analysis reveals that Costa Rica serves as a model for sustainable development, although its egregious overuse of agrochemicals is generally overlooked and must be replaced with regenerative agriculture practices. Although the success of the Kerala model is evident in the data, Kerala should not be considered a model of sustainable development due to its rampant pollution, limited economic opportunities, and overreliance on remittances sourced from unsustainable economies. Instead, I call for a continued study of Kerala as the Indian state transitions from development to sustainable development. Based on my findings, the developmental state emerges as a viable path for states worldwide to engage in sustainable development.

I. Introduction

Following the COVID-19 pandemic and amidst worsening climate catastrophes worldwide, the political and economic world order has been fundamentally challenged by collective action problems. Despite our dependency on the planet, governments and populous societies have not properly conceptualized how to support communities and nations within the limits of our biosphere. Put forth by Johan Rockström et al. in 2009, the planetary boundaries framework aimed to describe the human impacts upon the planet, quantifying critical thresholds for safe human conditions on Earth. In its most recent update, the same researchers have demonstrated that more of the critical Earth system boundaries have been violated, signifying the dire necessity to reform our relationship with our planet.¹

I argue that the developmental state paradigm of international development literature should be considered as a path toward living within our planetary boundaries. At its core, the developmental state theory advocates for

1 Johan Rockström et al., “Safe and Just Earth System Boundaries,” *Nature* 619, no. 1 (2023), <https://doi.org/10.1038/s41586-023-06083-8>.

an empowered state government to intentionally guide its transition to national development.² Striving towards a solution, I analyze two “exceptionalist” case studies, the nation of Costa Rica and the state of Kerala in India, as established developmental states and potential models for sustainable development.

While the adjective “exceptionalist” is certain to raise eyebrows, the developmental successes of both Costa Rica and Kerala are remarkable. In a region of the world known for corruption, coups, and coffee, Costa Rica has maintained an extraordinarily stable democracy and active civil society for almost eighty years. The small Latin American country was one of the few in the world to successfully reverse critical trends of deforestation and instead became globally recognized for its ecotourism industry. With 98% of the nation’s electrical production coming from renewable energy, Costa Rica is in an enviable energy position as the world faces the need for electrification.³ The Organization for Economic Co-operation and Development (OECD) welcomed Costa Rica as its 38th member in 2021, with many arguing that Costa Rica should now be considered a developed nation.

Kerala’s “exceptionalism” within India followed the same path; with an incredible diversity to its large population, a strong “Malayalee” identity was formed in the state, based on the local language Malayalam. The state’s first election was a global anomaly: in 1957, Kerala hosted the first democratically elected communist leadership to the parliamentary majority. Although the state would vacillate between Marxist and moderate leadership, a strong Malayalee subnationalistic identity demanded the creation of long-lasting institutions of healthcare and education in the state. In time, Kerala began to draw worldwide attention for its unique human-centered, rather than economic, approach to development. The state became the first in India to become fully literate while maintaining health outcomes similar to developed nations. The “Kerala model” became a frequent subject of academic discourse, especially for Nobel laureate Amartya Sen. Today, Kerala’s development is still remarkable; in 2018 and 2019, Kerala topped all Indian states in progress on the UN Sustainable Development Goals.⁴

While being roughly the same size, there is a drastic difference in population and population density between the two. The most recent data reveals that Kerala’s population is over seven times greater than Costa Rica, with a population density over twelve times greater (see Appendix). Yet the nations share similar qualities in their histories and geographies; within their regions, both are tropical hubs of ecotourism and support strong agricultural economies. As former colonies of Western nations, both have taken deliberate state actions that separate them from similar states in their region. I argue that a comparison of these two model developmental states—despite disparities in their history and demographics—offers necessary insight into the potential of developmental states.

II. Background

A. Costa Rica

Costa Rica is located within Central America and shares many natural characteristics with its region and neighboring countries. Central America is geographically characterized by dramatic changes in elevation, while situated narrowly between the Pacific and Atlantic Oceans. Across the region, it sees a large gradient of temperatures, rainfall patterns, humidity, and wind.⁵ Like much of Central America, Costa Rica is historically prone to natural disasters such as hurricanes, floods, earthquakes, and volcanic eruptions.⁶ Despite this, the nation also supports the highest rates of biodiversity in the world, hosting more than 160 species of amphibians, 200

2 Devin K. Joshi, “Varieties of Developmental States: Three Non-Western Pathways to the Millennium Development Goals,” *Journal of Developing Societies* 28, no. 3 (2012), <https://doi.org/10.1177/0169796X12453783>.

3 Hannah Ritchie et al., “Energy,” *Our World in Data*, October 27, 2022, <https://ourworldindata.org/energy/country/costa-rica>.

4 Kerala State Planning Board, “Kerala Development Report: Initiatives, Achievements, and Challenges,” Government of Kerala, February 2021, <https://spb.kerala.gov.in/sites/default/files/inline-files/Kerala-Development-Report-2021.pdf>.

5 Ambarish V. Karmalkar et al., “Climate Change in Central America and Mexico: Regional Climate Model Validation and Climate Change Projections,” *Climate Dynamics* 37, no. 3 (2011): 605, <https://doi.org/10.1007/s00382-011-1099-9>.

6 Anthony Goebel McDermott, “Land and Climate: Natural Constraints and Socio-Environmental Transformations,” in *The Oxford Handbook of Central American History*, ed. Robert H. Holden (Oxford University Press, 2022), Google Books.

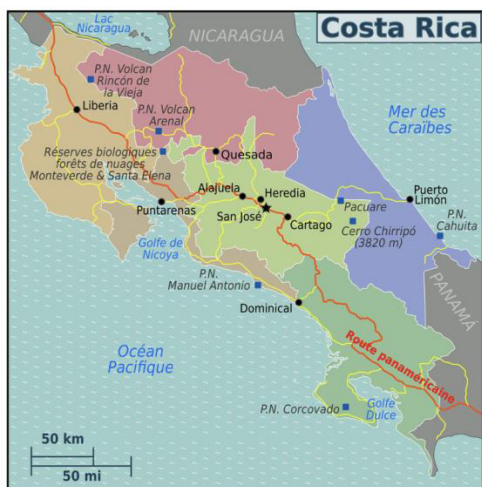


Figure 1. Map of Costa Rica with major cities. Vidiani, “Large Regions Map.”

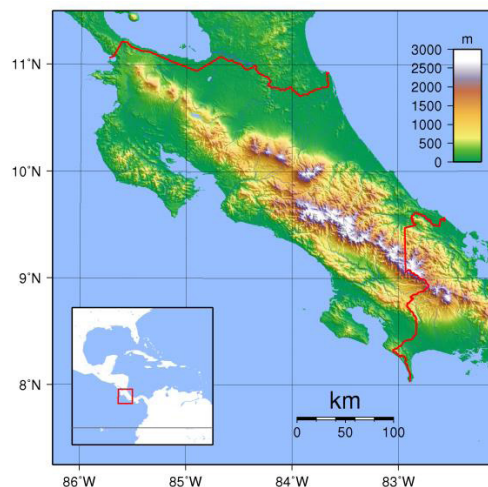


Figure 2. Topographic map of Costa Rica. Vidiani, “Large Topographical Map.”

species of reptiles, 200 species of mammals, and 800 species of birds in the country.⁷ The most recent estimates place Costa Rica as providing habitat for 6% of the world’s known species.⁸

In literature studying Latin American development, Costa Rica is often referred to as an “exceptionalist” case either implicitly or explicitly.^{9,10,11,12,13} Reasons cited for the state’s exceptionalism refer to its stable democracy, green image, healthcare outcomes, and even its more recent turn towards neoliberalism.¹⁴ The root of Costa Rica’s modern state comes from the six-week 1948 revolution (alternatively viewed as a coup d’état) in which the previous government was overthrown.¹⁵ Although the conflict originates in the charges of fraudulent elections between political factions, many allege the US’s role in supporting the revolution as a subtle, early Cold War intervention.¹⁶ Backing the argument of an international ideological struggle at play, the newly written 1949 Constitution explicitly outlawed communism.^{17,18} However, following the revolution in 1948, Costa Rica abolished its standing military, opening much more national spending for social services such as healthcare and education.¹⁹ This is the most decisive moment in state history in laying the foundation for modern-day Costa Rica. Without a military, Costa Rica was much less susceptible to coups or revolutions, as military leaders are often key actors in domestic political challenges. Thus, eliminating the military largely secured political stability

7 Erin Foley et al., *Costa Rica (Culture of the World)* (Cavendish Square Publishing, LLC, 2017).

8 Tania Bermúdez Rojas and Vilma Obando Acuña, “Biodiversidad en cifras: avances en el conocimiento de especies en Costa Rica,” *Biocenosis* 32, no. 2 (2021), <https://doi.org/10.22458/rb.v32i2.3899>.

9 Rafael Arias-Ramirez, “Structural Adjustment and Social Policy in Costa Rica: A Case of Heterodox Adjustment” (PhD diss., University of Minnesota, 2004), 41, ProQuest.

10 Lisa Campo-Engelstein and Karen Meagher, “Costa Rica’s ‘White Legend’: How Racial Narratives Undermine Its Health Care System,” *Developing World Bioethics* 11, no. 2 (2011), <https://doi.org/10.1111/j.1471-8847.2011.00301.x>.

11 Monica Flores Chacon, “Debunking the Pura Vida: Costa Rican Exceptionalism Is Under Threat” (Thesis, Monterey, CA; Naval Postgraduate School, 2021), <https://calhoun.nps.edu/handle/10945/67710>.

12 Kirk S. Bowman, “New Scholarship on Costa Rican Exceptionalism,” *Journal of Interamerican Studies and World Affairs* 41, no. 2 (1999), <https://doi.org/10.2307/166410>.

13 Marietta Morrissey, “Neoliberalism, Development, and the Costa Rican State,” *Latin American Policy* 8, no. 2 (2017): 289, <https://doi.org/10.1111/lamp.12124>.

14 Guntra A. Aistara et al., *The Ecolaboratory: Environmental Governance and Economic Development in Costa Rica* (University of Arizona Press, 2020), <https://muse.jhu.edu/book/73708>.

15 John A. Booth, “Democratic Development in Costa Rica,” *Democratization* 15, no. 4 (2008): 720, <https://doi.org/10.1080/13510340802191052>.

16 Marcia Olander, “Costa Rica in 1948: Cold War or Local War?,” *The Americas* 52, no. 4 (1996), <https://doi.org/10.2307/1008474>.

17 Chalene Helmuth, *Culture and Customs of Costa Rica* (Bloomsbury Publishing, 2000).

18 Olander, “Costa Rica in 1948.”

19 Aistara et al., *The Ecolaboratory*.

and left the administration without a powerful challenge outside of the current legal system.²⁰ By its constitution, Costa Rica cannot go to war, and thus Costa Rica has held an almost undisturbed peace conducive to gains in development.²¹ Trusting in international institutions, Costa Rica does not consider invasion to pose a grave threat, as the nation maintains favorable relationships with major powers.²²

The modern Costa Rican state can be noted for its absence of widespread corruption, despite corruption's pervasiveness in the nation in the first half of the 20th century.²³ Rotberg argues that expansions of long-standing policies against the corruption of public officials are responsible, beginning after the 1948 revolution and bolstered in the 2000s.²⁴ Culturally within the nation, corruption to any degree is detested, and Rotberg cites high literacy and an unusually free press to both closely monitor and crack down on emerging corruption scandals.²⁵ While many strikes within the nation have not been successful, movements to halt the privatization of Costa Rica's energy utility among others highlight the state's continued commitment to democratic and civic participation that scholars have deemed as exceptionalist.²⁶

In addition to a notably active civil society, Costa Rica's extensive welfare state and social policies are integral to its history and identity. The success of Costa Rica's golden age (1950s–1980s) has largely been attributed to the parallel usage of universal social policies and an activist role in its national production matters.²⁷ Costa Rica's social programs are composed of universal access to public education, healthcare, and social security. Costa Rica historically has lacked a populist opposition to welfare policies, thus allowing for a robust system to be maintained and strengthened over time. Implemented smoothly through existing social services, universal healthcare in Costa Rica is provided through a single national healthcare system, emphasizing health promotion and prevention for all people, including those traditionally excluded from the health sector.²⁸ Costa Rica's primary care approach has been widely lauded for its successful implementation of healthcare access, comprehensiveness, continuity, and coordination.²⁹ Initially provided through Costa Rica's Ministry of Health, the state shifted its healthcare provision to the Caja Costarricense de Seguridad Social (CCSS)—otherwise known as the Social Security of Costa Rica.³⁰ Today, Costa Rica boasts incredible health outcomes and holds the highest life expectancy in Latin America at over eighty years.³¹

Although Costa Rican education had been free and compulsory since 1869, the elimination of the standing military opened up significantly more funding that created the strong educational system present today.³² For

20 Anthony Goebel McDermott, "Interview: Environmental Development of Costa Rica," interview by Rohith A. Moolakatt, August 19, 2022.

21 Goebel McDermott, interview.

22 Goebel McDermott, interview.

23 Robert I. Rotberg, "The Corruption of Latin America," in *Corruption in Latin America: How Politicians and Corporations Steal from Citizens*, ed. Robert I. Rotberg (Springer Cham, 2019), 15, https://doi.org/10.1007/978-3-319-94057-1_1.

24 Rotberg, "Corruption of Latin America," 16.

25 Rotberg, "Corruption of Latin America."

26 Aistara et al., *The Ecolaboratory*.

27 Juliana Martínez Franzoni and Diego Sánchez-Ancochea, "Can Latin American Production Regimes Complement Universalistic Welfare Regimes?," *Latin American Research Review* 48, no. 2 (2013): 149, <https://doi.org/10.1353/lar.2013.0020>.

28 Fernando Montenegro Torres, *Costa Rica Case Study: Primary Health Care Achievements and Challenges within the Framework of the Social Health Insurance* (UNICO Studies Series, 2013), <https://hdl.handle.net/10986/13279>.

29 Madeline Pesec et al., "Primary Health Care That Works: The Costa Rican Experience," *Health Affairs* 36, no. 3 (March 2017), <https://doi.org/10.1377/hlthaff.2016.1319>.

30 Montenegro Torres, *Costa Rica Case Study*.

31 Mauricio Matus-López and Alexander Chaverri-Carvajal, "Progress Toward Long-Term Care Protection in Latin America: A National Long-Term Care System in Costa Rica," *Journal of the American Medical Directors Association* 23, no. 2 (2022), <https://doi.org/10.1016/j.jamda.2021.06.021>.

32 Susanne Müller-Using and Alicia Vargas Porras, "The Education System of Costa Rica," in *The Education Systems of the Americas*, ed. Sieglinde Jornitz and Marcelo Parreira do Amaral, (Springer Cham, 2021), https://doi.org/10.1007/978-3-030-41651-5_6.

each student, the government spends almost \$3,000 annually, not accounting for parental expenses.³³ With this, education is roughly 8% of Costa Rica's national spending, while other developed nations spend much lower, at rates closer to 4–6%.³⁴ Today, higher education is made up of a mix of the five well-regarded public universities in the country and twenty-four accredited private universities.³⁵ Such an investment into education has benefited the nation economically, generating a highly competent workforce and allowing for gains in industry and technology.³⁶

Within the state's golden era in the 1960s, the state dramatically expanded public services (road building, dam construction, water and electricity extension, and state agrarian agencies) due to economic growth and foreign aid.³⁷ In a critical move, the Costa Rican government began to fundraise and formulate the project known as Conservation Strategy for the Sustainable Development of Costa Rica (ECODES) in 1986, becoming a guiding mission for the country henceforth.³⁸ Although Costa Rica faced significant market pressures in the 1980s, it secured its social welfare system through earnings from tourism, textiles, financial services, technology, and non-traditional crop exports.³⁹ Payroll taxes are the main drivers of funding social services within Costa Rica; however, going forward the nation may need to shift toward a general tax as revenue generated from payroll taxes has been declining due to the growing use of an informal economy within Costa Rica.^{40,41}

Relating to its green image, Costa Rica is heralded primarily for its conservation and sustainable energy. In terms of renewable energy, Costa Rica outperforms most of the world; in 2018, 98.5% of the nation's energy was powered by renewable energy.⁴² The bulk of this energy production is through Costa Rica's extensive network of hydroelectric dams, which have produced over 70% of the nation's energy for decades.⁴³ As a tropical country with significant changes in elevation, Costa Rica has an increased potential for dam construction compared to many other nations and can therefore reap a significant amount of energy through its water.⁴⁴ It is important to note that because damming waterways can have a significant detrimental impact on ecosystems and existing communities, Costa Rica has also found other ways to produce sustainable power instead of solely expanding hydropower. Utilizing its volcanic activity, Costa Rica produces about 7% of its electricity through geothermal energy sources, with geothermal energy receiving even more attention in recent decades due to its sustainability.⁴⁵ Additionally, Costa Rica has emerged as a regional leader in wind energy, second only to Brazil in Latin America in terms of installed capacity when relative to size.^{46,47} Between 2011 and 2017, the installed capacity of Costa Rica tripled, with wind energy making up about 12% of the nation's energy production in 2017.⁴⁸ However,

-
- 33 Daniel Rodriguez-Segura, "Strengthening Early Literacy Skills through Social Promotion Policies? Intended and Unintended Consequences in Costa Rica," *International Journal of Educational Development* 77, no. 1 (2020), <https://doi.org/10.1016/j.ijedudev.2020.102243>.
- 34 *OECD Economic Surveys: Costa Rica 2018* (OECD, 2018), https://doi.org/10.1787/eco_surveys-cri-2018-en.
- 35 Müller-Using and Vargas Porras, "Education System of Costa Rica," 443.
- 36 Joshi, "Varieties of Developmental States."
- 37 Aistara et al., *The Ecolaboratory*.
- 38 Mauricio Herrera-Rodríguez, "Sustainable Development in Costa Rica: A Geographic Critique," *Journal of Latin American Geography* 12, no. 2 (2013).
- 39 Richard Sandbrook et al., *Social Democracy in the Global Periphery: Origins, Challenges, Prospects* (Cambridge University Press, 2007), <https://doi.org/10.1017/CBO9780511491139>.
- 40 Franzoni and Sánchez-Ancochea, "Latin American Production Regimes," 166–167.
- 41 Marietta Morrissey, "Neoliberalism, Development."
- 42 "Energy Resource Guide - Costa Rica," International Trade Administration, US Department of Commerce, 2021, <https://www.trade.gov/energy-resource-guide-renewable-energy-costa-rica>.
- 43 Alfredo Mainieri Protti, "Costa Rica Country Update Report" Costa Rica: Centro Servicios Recursos Geotérmicos Instituto Costarricense de Electricidad, 2005, <https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2005/0116.pdf>.
- 44 Elizabeth P. Anderson et al., "Transforming Tropical Rivers: An Environmental Perspective on Hydropower Development in Costa Rica," *Aquatic Conservation: Marine and Freshwater Ecosystems* 16, no. 7 (2006), <https://doi.org/10.1002/aqc.806>.
- 45 Jessica Arias et al., "Geothermal Energy: Current Situation in Costa Rica" Costa Rica: Instituto Costarricense de Electricidad, March 2014, <https://orkustofnun.is/gogn/unu-gtp-sc/UNU-GTP-SC-18-15.pdf>.
- 46 Moana Simas and Sergio Pacca, "Socio-Economic Benefits of Wind Power in Brazil," *Journal of Sustainable Development of Energy, Water and Environment Systems* 1, no. 1 (2013), <https://doi.org/10.13044/j.sdewes.2013.01.0003>.
- 47 Gustavo Richmond-Navarro et al., "Comparación de la Energía Eólica entre Costa Rica y el Resto del Mundo," *Tecnología en Marcha* 35, no. 7 (2022), <https://doi.org/10.18845/tm.v35i7.6330>.
- 48 Richmond-Navarro et al., "Comparación de la Energía Eólica."

during peak hours of energy usage, Costa Rica must rely on imported oil to make up the gap between renewable energy production and domestic energy demand.⁴⁹ Still, as Costa Rica continues to prioritize renewable energy development and research, Costa Rica is very close to becoming carbon neutral in its energy production.

Related to its sustainable energy production and conservation, ecotourism has become one of the nation's biggest industries; in 2017, Costa Rica received a total of 2.9 million tourists with 60% of the visitors describing ecotourism as the main goal.^{50,51} This boom in tourism in the last three decades is rooted in Costa Rica's successful branding as a green nation, cultivated under four essential components: 1) the extensive network of protected land through both private and public bodies, 2) the promotion of ecotourism as their primary revenue, 3) the heavy reliance on renewable energy, and 4) the creation of proactive programs to address climate change.^{52,53} Compounding this, Costa Rica scores the highest on an international metric known as the Happy Planet Index—measuring the ecological efficiency in which human well-being is achieved—further reinforcing its sustainability trademark.⁵⁴ Beyond vacationing, environmental education has been a primary attraction for foreign researchers, tourists, artists, conservationists, students, and NGO campaigners to the nation since the 1990s.⁵⁵ Through these efforts, Costa Rica has emerged as a stable economy utilizing its natural resources for ecotourism, agriculture, and its energy needs with success.

While the international perception of Costa Rica remains almost utopian, contemporary literature reveals challenges arising within the nation. Economically, Costa Rica has become more open in the last two decades with the introduction of the Central American–Dominican Republic Free Trade Agreement (CAFTA-DR).⁵⁶ Despite significant protests from grassroots efforts in the nation, CAFTA-DR passed in 2004, seeing the elimination of trade barriers between Central America and the United States. Within the nation, topics of rising domestic crime and violence, especially relating to drug trafficking, dominate, and many fear conditions are worsening. While Costa Rica still has rates of crime significantly below its neighbors, the homicide rate doubled in ten years when measured in 2017.⁵⁷ Still, much of the debate relating to crime is often imbued with stereotypes and misconceptions that foment panic, fear, and xenophobia within the nation.⁵⁸ Despite Costa Rica's high flow of tourists, its capital San Jose is not seen as a primary tourist destination. The city offers tourist appeal with ventures such as the Pre Columbian Gold Museum, but fears of crime may influence travelers to simply relegate the capital to be a transportation junction rather than an attraction itself. To address crime within the nation, Costa Rica maintains an active police force; however, police brutality is a well-known issue within the nation, decreasing citizen reporting of criminal behavior.⁵⁹

B. Kerala

Kerala is a small state in southern India, although hosting a population greater than most nations in the OECD. Like many other states in India, Kerala has a distinct culture and state language, Malayalam, with over 45 million

49 Shyam S. Nandwani, "Uses of Solar Energy in Costa Rica," *Renewable Energy* 31, no. 5 (2006), <https://doi.org/10.1016/j.renene.2005.08.008>.

50 OECD, *OECD Economic Surveys*.

51 Aistara et al., *The Ecolaboratory*.

52 OECD, *OECD Economic Surveys*.

53 Aistara et al., *The Ecolaboratory*.

54 Saamah Abdallah and Nic Marks, "Happy Planet Index," in *Encyclopedia of Quality of Life and Well-Being Research*, ed. Alex C. Michalos (Springer Dordrecht, 2014).

55 Nicole Blum, "Teaching Science or Cultivating Values? Conservation NGOs and Environmental Education in Costa Rica," *Environmental Education Research* 15, no. 6 (2009): 718, <https://doi.org/10.1080/13504620903420064>.

56 J. Calvo-Alvarado et al., "Deforestation and Forest Restoration in Guanacaste, Costa Rica: Putting Conservation Policies in Context," *Forest Ecology and Management* 258, no. 6 (2009), <https://doi.org/10.1016/j.foreco.2008.10.035>.

57 Gregorio Gimenez and Beatriz Barrado, "Exposure to Crime and Academic Achievement: A Case Study for Costa Rica Using PISA Data," *Studies in Educational Evaluation* 65, no. 1 (2020), <https://doi.org/10.1016/j.stueduc.2020.100867>.

58 Sebastian Huhn, "The Culture of Fear and Control in Costa Rica (II): The Talk of Crime and Social Changes," German Institute of Global and Area Studies (GIGA), 2009, <https://www.jstor.org/stable/resrep07535>.

59 Daniel W. Gingerich and Virginia Oliveros, "Police Violence and the Underreporting of Crime," *Economics & Politics* 30, no. 1 (2018), <https://doi.org/10.1111/ecpo.12102>.



Figure 3. Kerala in India.
Manakkadan et al., “Lineage Shift.”

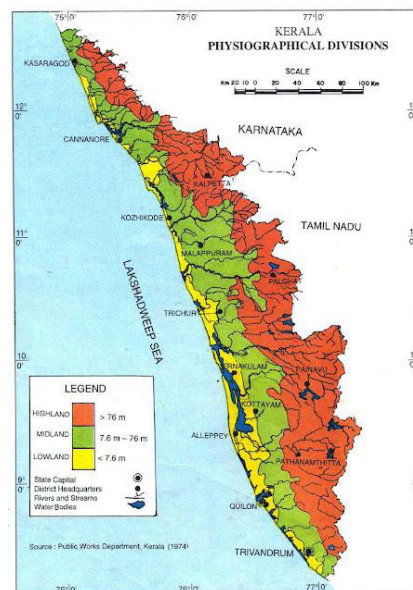


Figure 4. Physiographic divisions of Kerala.
Hemendra, “Physiographic Divisions.”

speakers worldwide known as Malayalees.⁶⁰ Geographically, Kerala makes up a small portion of the richly forested belt of the world with a tropical climate characterized as hot and humid, with separate monsoons affecting the southwest and northeast regions of the state.^{61,62} On its western end, Kerala holds coasts on the Arabian Sea, while its eastern end makes up the southern tip of the famous Indian mountain range known as the Western Ghats, seeing an elevation of 2,694 meters above sea level at its maximum. Kerala is divided into three physiographic zones: the lowlands (coastal region), the midlands, and the highlands.⁶³ The coastal zone has the highest population density of regions in Kerala—supporting over 2,000 people per square kilometer—and occupies about ten percent of the total land area.^{64,65}

Before the 1890s, Kerala was a highly segregated and isolated region, with a caste system considered to be the most orthodox and oppressive of all Indian States.⁶⁶ The state was dominated by non-Malayalee Brahmins; however, in the late 19th century, a subnationalist Malayalee identity between several distinct Malayalee communities (Nairs, Syrian Christians, Izhavas) formed antagonistically toward non-Malayalee elites.⁶⁷ Notably, this movement precipitated the 1891 Malayalee Memorial demanding that important positions in government be given to Malayalees without regard to caste or religion instead of the status quo of a Tamil Brahmin run government.⁶⁸ Critically, the academics cite the influence of Christian missionaries in fomenting resistance to the

60 Todd M. Johnson and Brian J. Grim, *The World's Religions in Figures: An Introduction to International Religious Demography*, 1st ed. (John Wiley & Sons, Ltd, 2013), 10, https://media.johnwiley.com.au/product_data/excerpt/47/04706745/0470674547-196.pdf.

61 K. V. Bhat, “Physical and Anatomical Characteristics of Some Less-Known Tree Species of Kerala,” Kerala Forest Research Institute, December 1994, <https://docs.kfri.res.in/KFRI-RR/KFRI-RR096.pdf>.

62 National Academy of Sciences, *Growing Populations, Changing Landscapes: Studies from India, China, and the United States* (The National Academies Press, 2001), 82, <https://doi.org/10.17226/10144>.

63 Srikumar Chattopadhyay and Richard W. Franke, *Striving for Sustainability: Environmental Stress and Democratic Initiatives in Kerala* (Concept Publishing Company, 2006), 110.

64 Chattopadhyay and Franke, *Striving for Sustainability*, 110.

65 National Academy of Sciences, *Growing Populations*.

66 Perna Singh, “We-Ness and Welfare: A Longitudinal Analysis of Social Development in Kerala, India,” *World Development* 39, no. 2 (2011), <https://doi.org/10.1016/j.worlddev.2009.11.025>.

67 Perna Singh, “Subnationalism and Social Development: A Comparative Analysis of Indian States,” *World Politics* 67, no. 3 (2015), <https://doi.org/10.1017/S0043887115000131>.

68 A. Shaji, “Elements of Caste and Communal Consciousness in the Malayali Memorial of Modern Travancore (1891),” *Shanlax International Journal of Arts, Science and Humanities* 5, no. 4 (2018), <https://docslib.org/doc/8365351/elements-of-caste-and-communal-consciousness-in-the-malayali-memorial-of-modern-travancore-1891>.

rigid caste hierarchy within 19th century Kerala.⁶⁹ Singh (2015) argues that this subnationalist movement, which drew on shared myths and common culture, was a political calculation to regain power among these Malayalee communities as challenger elites, but it transformed into a larger, more magnetic movement within the region.⁷⁰ The subnationalist identity absorbed the ideology that the well-being of all Malayalees had become a collective responsibility. This Malayalee movement created a strong coalition of upper castes and lower castes, who stood to benefit the most from these egalitarian ideals, and eventually resulted in the campaign for Kerala's creation, uniting British Malabar and the princely states of Cochin and Travancore in 1956.^{71,72}

At its formation, Kerala made up one of the poorest states in India; however, the population, despite its cultural and caste diversity, demanded the prioritization of education and health development stemming politically from the newly established sense of Malayalee collective responsibility.^{73,74} From its inception, Kerala's political left capitalized on this emerging subnational Malayalee identity, and communist leadership was elected into power soon after its formation in 1957.⁷⁵ This democratic election of communists into Kerala's government was the first of its kind in the post-colonial world and attracted significant global attention.⁷⁶ The state is unquestionably more politically left-wing than much of India, although its political history reflects a battle between the Communist Party and the Congress Party—a centrist left political party in India.⁷⁷ At this time, India had long engaged in import substitution industrialization and state-directed development; however, by 1991, India fell into an economic crisis and was forced to undertake massive economic liberalization to receive loans from the World Bank and IMF.⁷⁸ Following the liberalization, there were increased rates of foreign investment in Kerala, stimulating economic activity in the state. Kerala's economy is primarily made up of the service sector, agriculture, fishing, manufacturing, and remittances from outside the state. In Kerala's legislative assembly today, the Left Democratic Front (LDF) run by the Communist Party of India (Marxist) holds the most seats, although it still faces strong opposition from the centrist United Democratic Front (UDF) led by the Indian National Congress (INC) Party.⁷⁹

For decades, Kerala's unique success has drawn the attention of development scholars from around the world including Nobel laureate Amartya Sen.⁸⁰ Succinctly, Sen describes Kerala's progress in the social realm to be remarkable, while drastically needing to stimulate straightforward economic growth.⁸¹ Throughout the literature, however, Kerala's development when compared to other developmental states has focused on three key factors: 1) the attainment of higher standards of life compared to other poor states in India, 2) the lack of demonstrated growth in economic sectors, and 3) the heavy economic reliance of remittances from the large flow of migrants out of the state.⁸² With a comparable standard of living to many developed nations at a fraction of the cost, Kerala's development strategy has become enshrined as the Kerala development model or the "Kerala

69 Singh, "We-Ness and Welfare."

70 Singh, "Subnationalism and Social Development."

71 Singh, "We-Ness and Welfare."

72 J. Devika, "Egalitarian Developmentalism, Communist Mobilization, and the Question of Caste in Kerala State, India," *The Journal of Asian Studies* 69, no. 3 (2010), <https://doi.org/10.1017/S0021911810001506>.

73 Jayan Jose Thomas, "The Achievements and Challenges of the Kerala 'Model,'" *The India Forum*, June 27, 2021, <https://www.theindiaforum.in/article/achievements-challenges-kerala-model>.

74 Singh, "We-Ness and Welfare."

75 Devika, "Egalitarian Developmentalism."

76 Nissim Mannathukkaren, "The Rise of the National-Popular and Its Limits: Communism and the Cultural in Kerala," *Inter-Asia Cultural Studies* 14, no. 4 (2013), <https://doi.org/10.1080/14649373.2013.831160>.

77 Balakrishna Menon, "Interview: Balakrishna Menon: Sustainable Development In Kerala," interview by Rohith A. Moolakatt, Zoom, December 20, 2022.

78 Jørgen Dige Pedersen, "Explaining Economic Liberalization in India: State and Society Perspectives," *World Development* 28, no. 2 (2000), [https://doi.org/10.1016/S0305-750X\(99\)00132-1](https://doi.org/10.1016/S0305-750X(99)00132-1).

79 Jos Chathukulam and Joseph Tharamangalam, "The Kerala Model in the Time of COVID19: Rethinking State, Society and Democracy," *World Development* 137, no. 1 (2021), <https://doi.org/10.1016/j.worlddev.2020.105207>.

80 Mannathukkaren, "Rise of the National-Popular," 495.

81 Amartya Sen, "Radical Needs and Moderate Reforms," in *Indian Development: Selected Regional Perspectives*, ed. Jean Drèze and Amartya Sen (Clarendon Press, 1997): 3–4. <https://doi.org/10.1093/acprof:oso/9780198292043.003.0001>.

82 B. A. Prakash, *Kerala's Economic Development: Performance and Problems in the Post-Liberalization Period* (SAGE Publications, 2004).

model.” Parayil argued that despite its limitations, the Kerala model should be regarded as a possible idealization of sustainable development.⁸³ Baffling development scholars worldwide, the Kerala model demonstrated that major advancements in quality of life could be achieved without economic growth as the sole means to improve social conditions. While the Kerala model is rooted in modernization theory, its effort to carry development out physically and intellectually through programmable content and the ideological basis was internally mobilized.⁸⁴

Again, attracting global attention, Kerala was the first Indian state to be declared fully literate in 1990, seeing highly favorable outcomes for younger girls in both education and leadership in the state.^{85,86} In education, girls have been observed performing better than boys, and there is variation in outcomes based on class and religion; lower-caste Hindu and Muslim children tended to score lower than higher-caste Hindu and Christian children.⁸⁷ Because of the heavy investment in the education of its citizens, many Malayalees were among the first to migrate to opportunities available internationally—especially in the oil-rich Gulf countries.⁸⁸ Remittances received from Gulf nations account for 85.4% of the remittances in Kerala.⁸⁹ While other Indian states have higher rates of migration out of the state, Kerala’s economic reliance on remittances is abnormal, with remittances making up 36.3% of the state’s domestic product.⁹⁰ On average, the Kerala emigrants are among the highest educated in the state; the state’s inability to provide suitable jobs for these graduates is cited as a primary reason for the flow of youth out of the state.⁹¹ This pattern in Kerala is consistent with global trends; Schewel and Fransen highlight that while most young people do not want to leave their home country, young people with higher levels of education and employment are more likely to aspire to migrate.⁹² Because of the outflow of educated youth, there is an acute shortage of workers to take up low-skilled, low-value jobs in the state.⁹³ To make up for this, there is a sizable inter-state migration within India into Kerala, with the largest proportion of citizens coming from the neighboring state of Tamil Nadu.⁹⁴

Another critical component of the Kerala model was the outstanding public health outcomes, despite modest economic activity in the state.⁹⁵ Scholars have argued that Kerala’s successful healthcare system was a result of dedicating significant public funds toward instituting public medical institutions in each region, government-funded medical schools, and the encouragement of traditional medicines.⁹⁶ The development of robust healthcare systems was prioritized at the outset of Kerala’s development, allowing a planned distribution of hospitals across Kerala’s

83 Govindan Parayil, “The ‘Kerala Model’ of Development: Development and Sustainability in the Third World,” *Third World Quarterly* 17, no. 5 (1996): 941, <https://doi.org/10.1080/01436599615191>.

84 Parayil, “The ‘Kerala Model’ of Development,” 942.

85 K. Narayana Chandran, “Literacy in India and the Example of Kerala,” *Journal of Reading* 37, no. 6 (1994).

86 K. P. Kannan et al., “Kerala: A Unique Model of Development,” *Health for the Millions* 17, no. 5 (1991).

87 T. R. Dilip, “School Educational Attainment in Kerala : Trends and Differentials,” Centre for Development Studies, 2010, <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/3168>.

88 Thomas, “Achievements and Challenges.”

89 S. Irudaya Rajan and K. C. Zachariah, “Kerala Emigrants in the Gulf,” in *India’s Low-Skilled Migration to the Middle East: Policies, Politics and Challenges*, ed. S. Irudaya Rajan and Prem Saxena (Palgrave Macmillan Singapore, 2019), 200, https://doi.org/10.1007/978-981-13-9224-5_8.

90 Rajan and Zachariah, “Kerala Emigrants.”

91 K. C. Zachariah and S. Irudaya Rajan, “Kerala Migration Study 2014,” *Economic and Political Weekly* 51, no. 6 (2016).

92 Kerilyn Schewel and Sonja Fransen, “Who Prefers to Stay? Voluntary Immobility among Youth in Ethiopia, India, and Vietnam,” *Journal of Ethnic and Migration Studies* 48, no. 19 (2022): 4472, <https://doi.org/10.1080/1369183X.2022.2092085>.

93 S. Irudaya Rajan et al., “Impact of Demographic Transition in Kerala on Migration and Labour Force,” in *India Migration Report 2019*, ed. S. Irudaya Rajan (Routledge India, 2018).

94 Tijo George et al., “Nature and Composition of Inter-State Migration into Districts of Kerala: Some Evidence from Census of India, 2011,” *Journal of Social and Economic Development* 24, no. 2 (2022), <https://doi.org/10.1007/s40847-022-00188-y>.

95 Koji Nabae, “The Health Care System in Kerala - Its Past Accomplishments and New Challenges,” *Journal of the National Institute of Public Health* 52, no. 2 (2003): 140.

96 Slim Haddad et al., *Safeguarding the Health Sector in Times of Macroeconomic Instability: Policy Lessons for Low- and Middle-Income Countries* (Africa World Press, 2007): 203.

largely rural population.^{97,98} However, a deeper-rooted history of improved healthcare outcomes already existed due to the strong roles of traditional healing systems and Christian missionaries.⁹⁹ Today, the role of traditional healthcare is still prioritized through the three healthcare systems in Kerala: allopathy (western-style medicine), ayurveda (a South Asian-style medicine system), and homeopathy.¹⁰⁰ These three systems are further separated by a mixture of public, private, and cooperative healthcare for each, although allopathic care has become increasingly privatized due to fiscal pressures on public hospitals.¹⁰¹ In 2016, Kerala introduced a set of healthcare reforms, known as the Aardram mission, to renew public investment in the system and improve healthcare infrastructure and has been generally seen as a positive step by the state to support Kerala's medical system.¹⁰²

For decades, Kerala has had a declining population growth, a high average age of marriage, and much lower rates of mortality.¹⁰³ With declining mortality and a fertility rate now at replacement level, Kerala has been rapidly aging.¹⁰⁴ Thus, Kerala has been thrust into a more advanced demographic transition state, overturning the assumption that this stage could only be reached in wealthy communities.¹⁰⁵ Kerala's reduction in its population growth rate was considered even more relevant as its policy in expanding its citizens' rights was juxtaposed with China's more authoritarian "One Child Policy."¹⁰⁶ Following the outbreak of COVID-19, Kerala was initially lauded for flattening the curve of infections early on in the pandemic; however, it failed to contain the surge of the third wave, seeing a massive spike in infections across the state.¹⁰⁷ Kerala did not prove to be exceptional in its handling of COVID-19, to the dismay of many looking for state policies that granted a higher degree of resilience to the pandemic.

Although both states' development strategies have been analyzed for decades, there is a lack of literature directly comparing Kerala and Costa Rica and the ramifications of their development models in the 21st century. For the scope of my analysis, two main questions guide my work: 1) How have Costa Rica's and Kerala's historical development models affected their outcomes today? 2) What can the successes and failures of these models inform us regarding paths for sustainable development in the 21st century?

III. Theoretical framework

Within my analysis, sustainable development theory, the developmental state theory, and the planetary boundaries concept act as the backbone of my theoretical framework. Each of these theories has grown in their discourse since their introduction.

Sustainable development is often defined by its usage in the famous 1987 Brundtland Report, where it is described as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."¹⁰⁸ Sustainable development cannot be understood without a proper grasp of development alone. For this paper, development should be understood as a multidimensional process that involves major changes in social structures, attitudes, and institutions, as well as economic growth in the reduction of

97 Hari Sankar D. et al., "Of Primary Health Care Reforms and Pandemic Responses: Understanding Perspectives of Health System Actors in Kerala before and during COVID-19," *BMC Primary Care* 24, no. 1 (2023): 2, <https://doi.org/10.1186/s12875-023-02000-0>.

98 Nabae, "Health Care System," 141.

99 Kannan et al., "Kerala."

100 Nabae, "Health Care System," 141.

101 Nabae, "Health Care System," 141.

102 Sankar D. et al., "Primary Health Care Reforms," 2.

103 Kannan et al., "Kerala."

104 Haddad et al., *Safeguarding the Health Sector*, 201.

105 John A. Black, *Kerala's Demographic Transition: Determinants and Consequences* (BMJ, 1999), 1771, <https://doi.org/10.1136/bmj.318.7200.1771>.

106 Parayil, "The 'Kerala Model' of Development," 943.

107 Chathukulam and Tharamangalam, "The Kerala Model."

108 World Commission on the Environment and the Environment, *Report of the World Commission on Environment and Development: Our Common Future* (United Nations Economic and Social Council, 1987), <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>.

inequality and eradication of absolute poverty.¹⁰⁹ Major theories (modernization, dependency, world systems, and globalization) have been used to describe development and associated inequality around the world. Sustainable development in this analysis will be understood as the intentional paths in which local, regional, national, and international bodies promote economic and social development in environmentally sound ways.¹¹⁰

To measure human development, the Human Development Index (HDI) was introduced in 1990 and has since become a core tenet of UN data. HDI is calculated by taking the geometric mean of health, education, and income indices. The health index is measured by the life expectancy at birth; the education index is measured by the expected years of schooling of children and the mean years of adult education; and the income index is the Gross National Income (GNI) per capita. Nine years following the first Human Development Report, Ambuj Sagar and Adil Najam argued that HDI reports have become the flagship publication of the UN Development Programme (UNDP), attracting extensive coverage in the media, government, academia, and public discourse.¹¹¹ Another prominent index became the Gender Development Index (GDI); the GDI is a gender inequality-sensitive human development index that deducts from the HDI because of disparities between men and women in the education, health, and income indices.^{112,113} It was incorporated into HDR reports in 2000.¹¹⁴

Still, HDI as an indicator of human development has faced criticism on a multitude of fronts; Professor Tadashi Hirai sorts the critiques into seven categories: narrowness of scope, selection of variables, weighting of indices, standardization between nations, value of a composite index, and concern for data.¹¹⁵ As a result of this widespread and ongoing discourse, many changes have been incorporated into its calculation. To address concerns of substitutability and weighting, the HDI was formally changed from being an arithmetic mean (sum of values divided by the total) to a geometric mean (the n th root of all the n values multiplied) of its indices in 2010.¹¹⁶ By using a geometric mean, indices were less sensitive to extreme outliers through limiting the ability to achieve a high HDI solely through progress in one metric.¹¹⁷ Additionally, other indices were developed to either adjust or address a missing component of the HDI. The Inequality-Adjusted Human Development Index was proposed by researchers in 2005 and officially incorporated into UN reports in 2010.¹¹⁸

Discussions surrounding contemporary sustainable development have been present for centuries with Thomas Robert Malthus's insight into our exponentially rising population on a finite Earth, published in 1789.¹¹⁹ However, it was not until 1974 in the Coyoc Seminars hosted by the UN Environment Programme that previously divergent strands of development were combined to prioritize the empowerment of people within the confines of the Earth's limits.¹²⁰ Sustainable development has since been brought to the limelight in international conferences, most notably the eleven international conferences on sustainability-related topics known as the Rio Cluster.¹²¹ Today, sustainable development as a concept has been largely adopted by institutions of development, aiming to reform the destructive impacts of globalized capitalism rather than abandon it altogether. The United Nations championed sustainable development in its 2015 update to the Millennium Development Goals, dubbed the 17

-
- 109 Justice Mensah, "Sustainable Development: Meaning, History, Principles, Pillars, and Implications for Human Action: Literature Review," *Cogent Social Sciences* 5, no. 1 (2019), <https://doi.org/10.1080/23311886.2019.1653531>.
- 110 Keith Pezzoli, "Sustainable Development: A Transdisciplinary Overview of the Literature," *Journal of Environmental Planning and Management* 40, no. 5 (1997), <https://doi.org/10.1080/09640569711949>.
- 111 Ambuj D. Sagar and Adil Najam, "Shaping Human Development: Which Way Next?," *Third World Quarterly* 20, no. 4 (1999): 743. <https://doi.org/10.1080/01436599913532>.
- 112 Stephan Klasen, "UNDP's Gender-related Measures: Some Conceptual Problems and Possible Solutions," *Journal of Human Development* 7, no. 2 (2006), <https://doi.org/10.1080/14649880600768595>.
- 113 Bastian Herre et al., "The Human Development Index and Related Indices: What They Are and What We Can Learn from Them," *Our World in Data*, November 1, 2023, <https://ourworldindata.org/human-development-index>.
- 114 Herre et al., "Human Development Index."
- 115 Tadashi Hirai, *The Creation of the Human Development Approach* (Palgrave Macmillan Cham, 2017), 74, https://doi.org/10.1007/978-3-319-51568-7_4.
- 116 Hirai, "Human Development Approach," 94.
- 117 Hirai, "Human Development Approach."
- 118 Herre et al., "Human Development Index."
- 119 Mensah, "Sustainable Development."
- 120 Pezzoli, "Sustainable Development."
- 121 Pezzoli, "Sustainable Development."

Sustainable Development Goals. Much of the ambiguity around the term “sustainable development” arises from the term “sustainability” itself. Often, sustainability and sustainable development are used interchangeably; however, in his analysis Justice Mensah argues that sustainability is the state of having a healthy relationship with our environment and communities, while sustainable development should be understood as the process in which we reach sustainability as an end goal.¹²²

Perhaps one of the most well-known theories for recognizing our relationship with the planet is the planetary boundaries (PB) framework put forth by Rockström and his colleagues.¹²³ The framework delineates our dependent relationship to the environment based on nine boundaries to stay within. Since its conception, this framework has become useful on an international scale and continues to be updated, especially on sections (novel entities) that could not be properly quantified at the PB framework’s conception. The most recent update was published in 2023, indicating that six of the nine boundaries—novel entities, climate change, biosphere integrity, land system change, freshwater change, and biogeochemical flows—have been completely transgressed, while ocean acidification remains on the precipice.¹²⁴ This framework is not without its critiques; it focuses on the sustainable use of natural resources rather than developing a restorative relationship with the planet. Addressing these concerns, Rockström et al. released a related justice-sensitive boundaries concept known as the Earth System Boundaries, incorporating the level of harm imposed on vulnerable populations around the world.¹²⁵ While this PB framework provides a theoretical model for conceptualizing sustainability, theories in the realm of development have had more of a tangible impact on national policies across the world.

The theory of the developmental state has been one of the most influential theories of state development. While not entirely antithetical to neoliberal development theory, the developmental state theory is separate. I argue, following Antonio Gramsci’s theory of hegemony, that it has become part of the *senso comune* of developmental discourse: so commonplace that it is tacitly incorporated into any theoretical understanding of development theory today.¹²⁶ In other words, the developmental state theory is so fundamental to contemporary development that its presence and influence have gone largely unnoticed and unacknowledged. The developmental state theory—most used to conceptualize the success of East Asian nations in development—argues for the role of an empowered state in directing development.¹²⁷ While rising to prominence following Professor Chalmers Johnson’s 1982 study of Japan, other scholars have pointed out that developmental states have been established for centuries, far before being recognized by academics as such.¹²⁸ While still prioritizing economic development in its scope, the developmental state divorces itself from neoliberal thought by promoting the role of a central government instead of minimizing it. Rather than any set of initiatives, Devin Joshi argues that it is the policy orientation of a state that makes it a developmental state, focusing on how a state can capitalize on its comparative advantage for more comprehensive national development.¹²⁹ Both Costa Rica and Kerala have been described as developmental states, with developmental state theory as the basis of arguments surrounding the “Kerala Model” and Costa Rican exceptionalism.

In this paper, I aim to explore how states can sustainably develop in the 21st century, analyzing the case studies of Costa Rica and Kerala to draw insight. Given the extensive literature surrounding both developmental states, I hypothesized that both Costa Rica and Kerala would act as excellent models for sustainable development, especially for other states in the Global South. By conducting a direct comparison between the two states, I draw answers to the developmental success of each state, the degree of sustainability within each state, and the degree of replicability for other states in sustainable development.

122 Mensah, “Sustainable Development.”

123 Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature* 461, no. 1 (2009), <https://doi.org/10.1038/461472a>.

124 Katherine Richardson et al., “Earth beyond Six of Nine Planetary Boundaries,” *Science Advances* 9, no. 37 (2023), <https://doi.org/10.1126/sciadv.adh2458>.

125 Rockström et al., “Earth System Boundaries.”

126 Peter Ives, “Gramsci’s Common Sense: Inequality and Its Narratives,” *Contemporary Political Theory* 17, no. 1 (2018), <https://doi.org/10.1057/s41296-017-0107-1>.

127 Joshi, “Varieties of Developmental States,” 357.

128 Amiya Kumar Bagchi, “The Past and the Future of the Developmental State,” *Journal of World-Systems Research* 6, no. 2 (2000), <https://doi.org/10.5195/jwsr.2000.216>.

129 Joshi, “Varieties of Developmental States,” 358.

IV. Data and methods

To guide the direct comparison of Costa Rica and Kerala's development, I used publicly available data to track the developmental success and sustainability of each state over time. Primarily, I used the Global Data Lab to collect the United Nations Human Development Index (HDI), Gender Development Index (GDI), and their components—economic, health, and education indices—at a subnational level since 1990. Subnational data combats the issue of generalizing development metrics within a nation, given the sharp disparities between subnational regions.¹³⁰ The data is an aggregate of large household survey data collected by UNICEF, Demographic and Health Surveys (DHS), the UNDP, and other international data institutions.¹³¹ The primary regions of analysis in my study are Kerala and Costa Rica, although data from India is often used to provide context to Kerala. The state and demographic data were collected from the India Census and the World Bank.

Unlike with subnational human development indicators, there was not any centralized database to collect sustainability metrics. For Costa Rica, national sustainability metrics were sourced from Our World in Data, the World Bank, and the UN Food and Agriculture Organization (FAO). As Kerala is a subnational state, most data was collected from national and state government reports. Although these reports are widely used in India and Kerala, diverging data sources for Kerala and Costa Rica introduces an unavoidable limitation for direct comparison in this analysis. Availability of safe drinking water was sourced from the India Ministry of Home Affairs and the World Health Organization. For Costa Rica and India, forestry data was collected from the World Bank and verified by identical FAO data, while Kerala's forestry data was collected from the Forest Statistic reports produced annually by the Kerala Forestry Department. Pesticide usage was sourced from the India Ministry of Agriculture and Farmers Welfare and the FAO. Energy consumption was sourced from Kerala's State Council for Science, Technology, and the Environment, while Costa Rica's energy consumption was sourced from the World Bank. Regarding carbon emissions, Costa Rica's metrics are sourced from Our World in Data, while Kerala's were sourced from an estimation of carbon emissions based on fuel consumption at the state level.¹³² Although coming from different sources, the methodology used to estimate carbon emissions of Kerala and Costa Rica are the same: bottom-up approaches summing emissions from historic usage of fuels, cement production, and gas flarings.^{133,134} This methodology is consistent with widely accepted historic estimations of national contributions to carbon emissions.¹³⁵

Human development data was visualized through Stata, while state, demographic, and sustainability-related metrics were visualized using Microsoft Excel.

V. Results

Initial comparisons of the HDI reveal somewhat similar trends between Costa Rica and Kerala since 1990. Figures 5 and 6 start with a direct comparison between Costa Rica and Kerala's HDI.

Since 1990, there has been a consistent positive trend in Costa Rica's HDI, although it is important to underscore the HDI decline beginning in 2020. Kerala's HDI demonstrates a similar positive trend, although there is a decline beginning earlier in 2018. While Kerala's HDI is 0.1 below Costa Rica's HDI in 1990, by 2021, the gap has shrunk to a difference of about 0.05. To contextualize Kerala's HDI to other Indian states, Figures 7 and 8 capture HDI in India.

130 Jeroen Smits and Iñaki Permanyer, "The Subnational Human Development Database," *Scientific Data* 6, no. 1 (2019), <https://doi.org/10.1038/sdata.2019.38>.

131 "Data Sources," Global Data Lab, accessed March 6, 2023, <https://globaldatalab.org/areadata/sources/>.

132 Tapas Ghoshal and Ranajoy Bhattacharyya, "Carbon Dioxide Emissions of Indian States: An Update," *SSRN* (2012), <https://doi.org/10.2139/ssrn.2166900>.

133 Hannah Ritchie and Max Roser, "CO₂ Emissions," *Our World in Data*, January 22, 2024, <https://ourworldindata.org/co2-emissions>.

134 Ghoshal and Bhattacharyya, "Carbon Dioxide Emissions."

135 Matthew W. Jones et al., "National Contributions to Climate Change Due to Historical Emissions of Carbon Dioxide, Methane, and Nitrous Oxide since 1850," *Scientific Data* 10, no. 1 (2023): 155, <https://doi.org/10.1038/s41597-023-02041-1>.

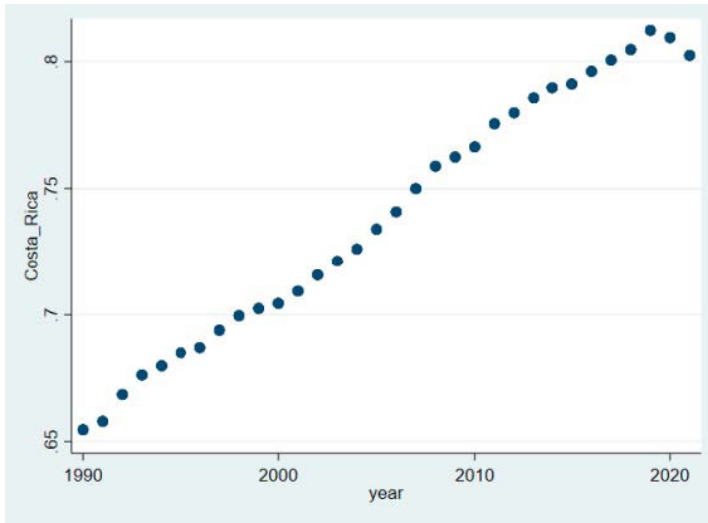


Figure 5. Costa Rica national HDI.

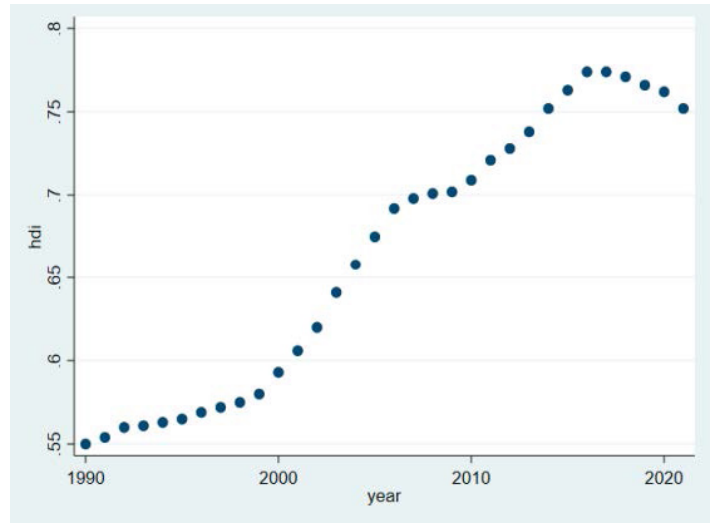


Figure 6. Kerala HDI.

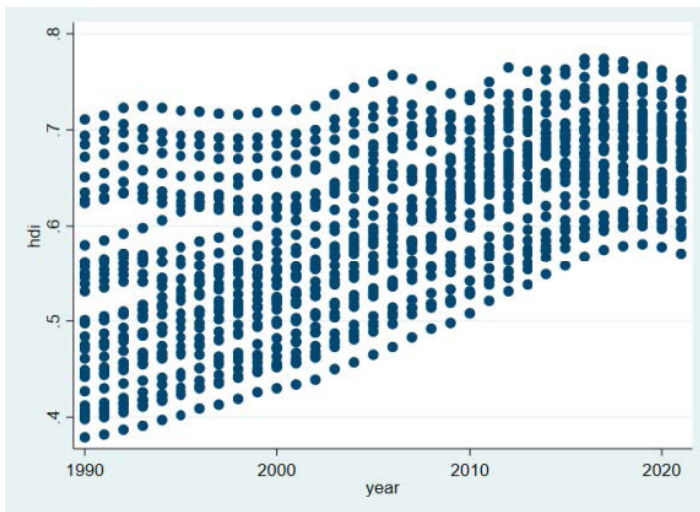


Figure 7. Indian states HDI by year.

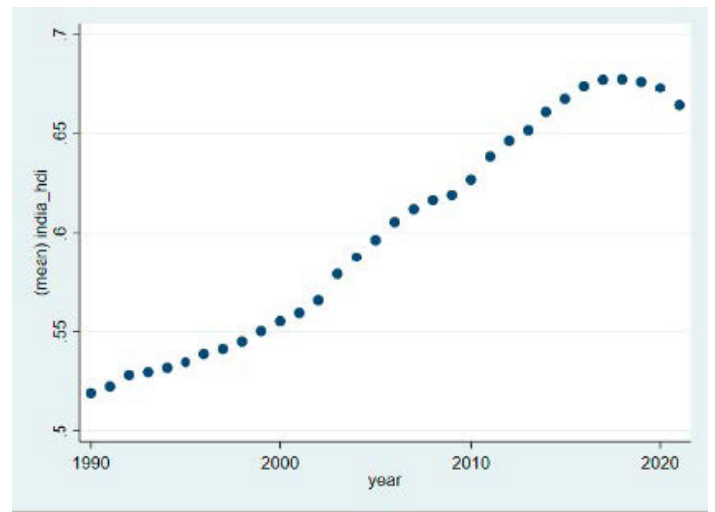


Figure 8. Average national HDI in India.

Figure 7 shows the HDI across all thirty-six states and Union Territories of India. Although there is a positive trend visible in the graph, there is a huge variance in HDI between Indian states, especially from 1990 to 2010. Figure 8 gives a simplified visualization of India’s average HDI over time. Like Kerala’s decline in HDI, there is a common negative trend beginning close to 2018. Table 1 shows the summary statistics of HDI in Costa Rica and India across four decades.

Table 1. National Human Development Index summary statistics.

Variable	Region	Year	Observations	Mean	Std. Dev.	Minimum	Maximum
HDI	Costa Rica	1991	7	0.658	0.02331666	0.628	0.689
HDI	Costa Rica	2001	7	0.70928571	0.02527657	0.677	0.743
HDI	Costa Rica	2011	7	0.77557143	0.02698059	0.741	0.812
HDI	Costa Rica	2021	7	0.8024286	0.0234866	0.767	0.836
HDI	India	1991	36	0.5226944	0.0947317	0.382	0.715
HDI	India	2001	36	0.5594444	0.0755144	0.434	0.721
HDI	India	2011	36	0.6383333	0.0612335	0.521	0.75

Costa Rica’s HDI shows steady and consistent growth across all of its provinces, as demonstrated by its positive trend and small standard deviation. Contrasting with this, India shows a comparatively large gap within its

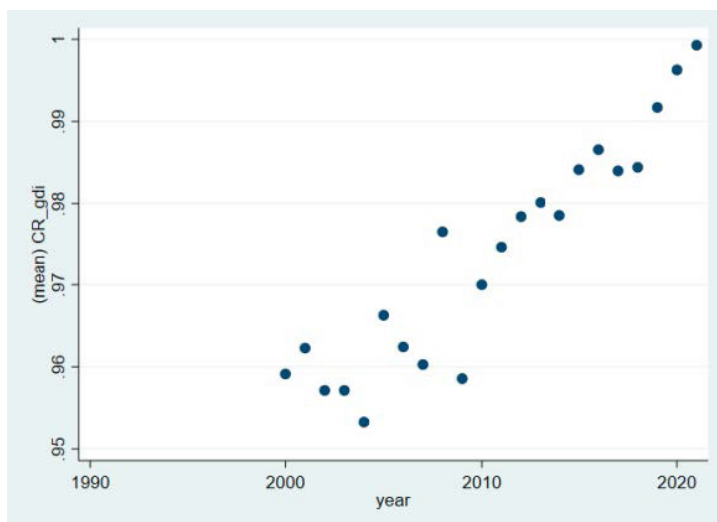


Figure 9. Costa Rica GDI.

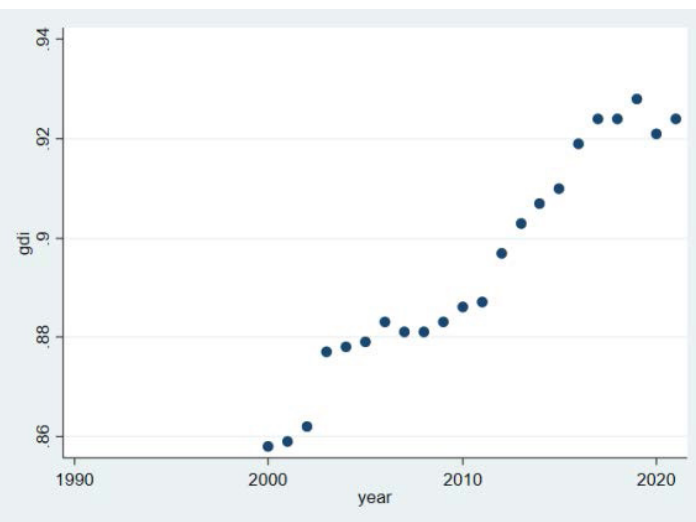


Figure 10. Kerala GDI.

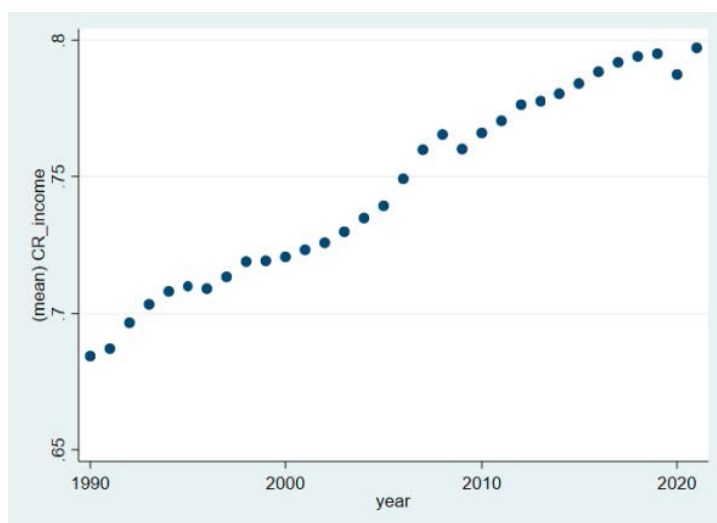


Figure 11. Costa Rica Income Index.

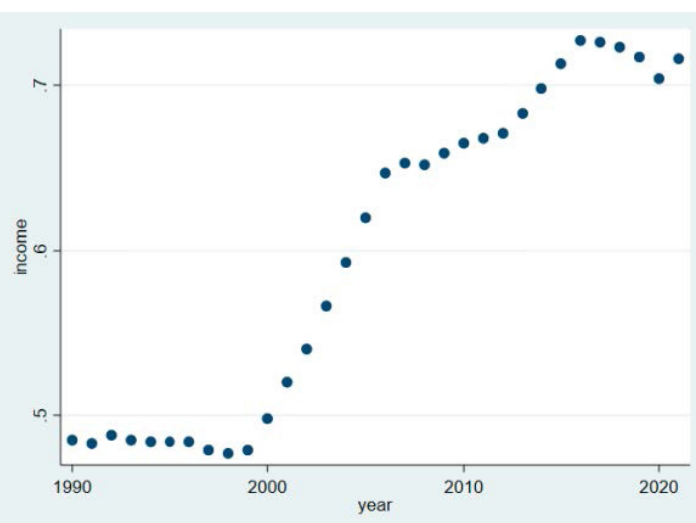


Figure 12. Kerala Income Index.

thirty-six states and territories, showing four times the standard deviation in 1991. In 2021, the standard deviation of India's HDI is more than double that of Costa Rica's, indicating a much higher degree of variation in HDI in the Indian states. Still, India's gap closes significantly each decade with states showing gains in HDI overall. Important to note, Kerala only surpasses the average HDI of India in 2011 but then starts to make up among India's highest values. By 2021, Kerala makes up the highest HDI value of 0.752.

Figures 9 and 10 show the GDI of Costa Rica and Kerala, respectively. Costa Rica shows an extraordinarily high GDI since the inception of the metric's collection in 2000 and continues demonstrating a positive trend over time. While not demonstrating as high of a GDI as Costa Rica, Kerala likewise shows a relatively high GDI since the metric's inception. Kerala shows a positive trend until about 2017.

Shown in Table 2, the average GDI of Costa Rica's provinces in 2021 was 0.999, indicating a near-perfect GDI. Table 2 also highlights the GDI in India across the same period. Kerala's value is consistently very close to the maximum recorded GDI for India across the three decades, and it holds the highest GDI in 2021. Again, there is much greater variation between the states of India than the provinces of Costa Rica.

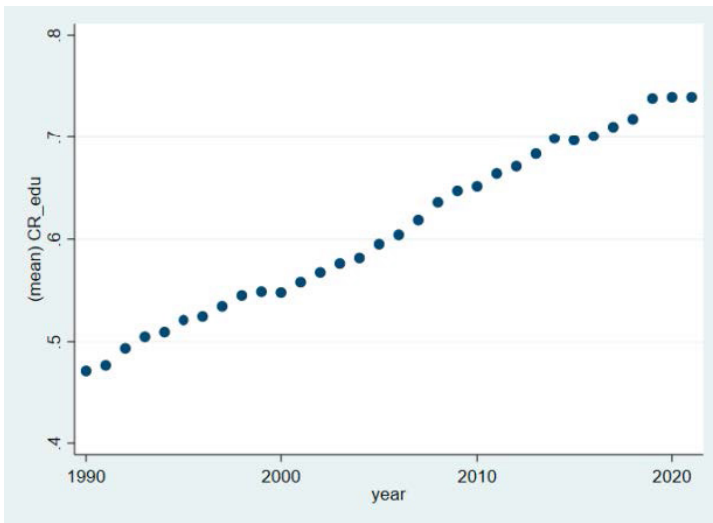


Figure 13. Costa Rica Education Index.

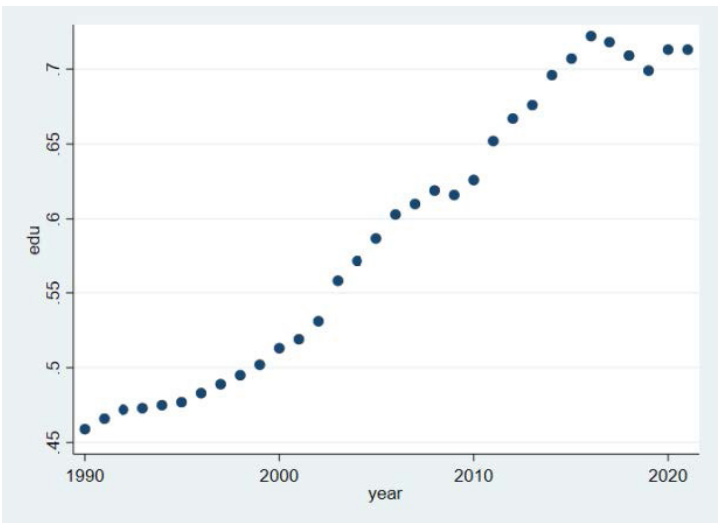


Figure 14. Kerala Education Index.

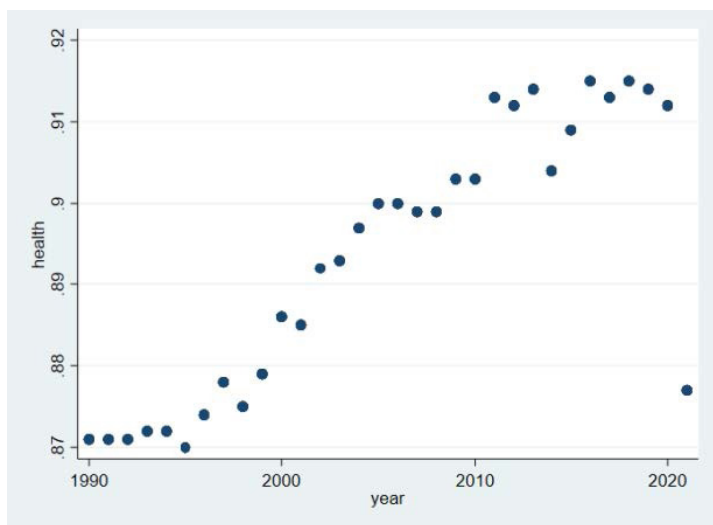


Figure 15. Costa Rica Health Index.

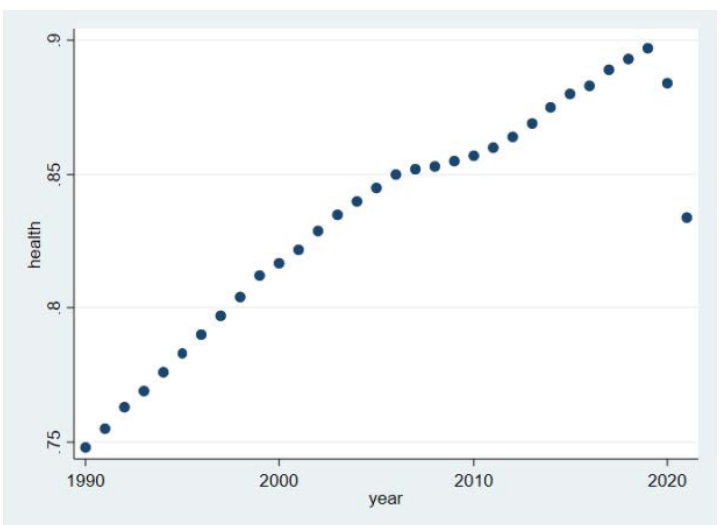


Figure 16. Kerala Health Index.

Table 2. National Gender Development Index summary statistics.

Variable	Region	Year	Observations	Mean	Std. Dev.	Minimum	Maximum
GDI	Costa Rica	2001	7	0.96228571	0.00884523	0.95	0.972
GDI	Costa Rica	2011	7	0.97471429	0.00893895	0.962	0.985
GDI	Costa Rica	2021	7	0.9992857	0.0076314	0.989	1.011
GDI	India	1991	36	0.79586111	0.0462664	0.684	0.867
GDI	India	2001	36	0.83716667	0.03450673	0.758	0.896
GDI	India	2011	36	0.8685	0.0298994	0.82	0.924

Shown in Figures 11 and 12 is Costa Rica and Kerala’s income index (representative of GNI per capita) over time. Costa Rica shows consistent growth in its GNI per capita, reaching close to an index value of 0.8 in 2021. Kerala’s growth is more erratic, although positive overall, Kerala’s index remains below 0.5 until 2000 when it enters about sixteen years of sharp growth. Although there is a short negative trend following this rise, Kerala’s income index remains around 0.71 in 2021.

Figures 13 and 14 show the education index of Costa Rica and Kerala over time, respectively. Costa Rica shows a strong positive trend for its education index; starting at an average of 0.47 in 1990, Costa Rica’s index jumps more than 56% in thirty years to 0.74 in 2021. Kerala’s education index similarly shows a strong positive trend. Mirroring Kerala’s income index, there is a slight decrease in the education index starting around 2016, before recovering in 2020. Since 1990, Kerala’s education index rose 55% to 0.71 in 2021.

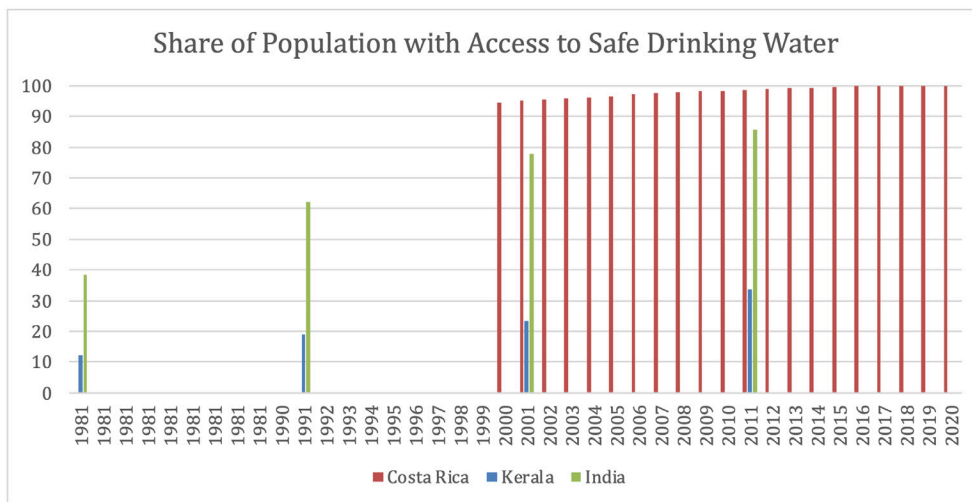


Figure 17. Access to safe drinking water as a percentage of population.

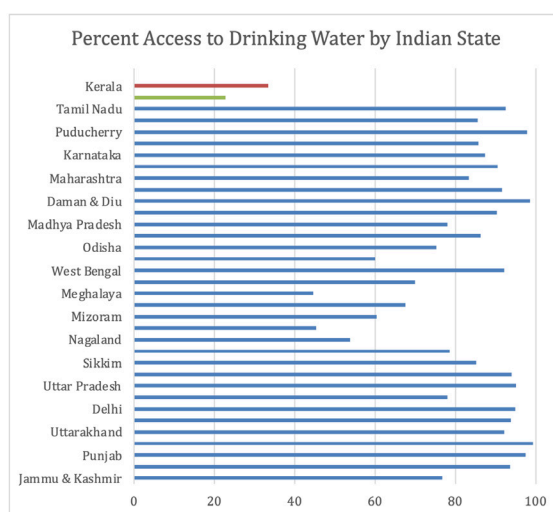


Figure 18. Percentage access to drinking water across Indian states and union territories in 2011.

Figures 15 and 16 depict Costa Rica and Kerala’s health indices. Both states show a positive trend over time. In 1990, Costa Rica already held a high health index, above 0.87, and saw moderate growth to where it stood above 0.91 by 2019. Kerala began at a lower index of around 0.75 but rose close to 0.9 in 2019. Both states saw massive declines in the health index beginning in 2020.

Analysis of sustainable development indicators begins with Figure 17, depicting a stark disparity between Costa Rica and Kerala in terms of access to safe drinking water.

Since data from Kerala and India are sourced from the national census, the data is available on a decadal basis, compared to Costa Rica’s annual data beginning in 2000. Since 2000, an incredibly high percentage of the Costa Rican population has had access to drinking water, at 94.65%. In the following two decades, Costa Rica sees a positive trend in access to drinking water, and in 2017, Costa Rica reaches complete access to drinking water for its population.

Kerala reveals contrasting results: in 1981, less than 13% of the Malayalee people in the state had access to safe drinking water. Although there is a positive trend over time, in 2011, only 33.5% of the population had access to safe drinking water. To put this in perspective, India’s average percent access to drinking availability is also visualized in grey. Although showing low rates in 1981, India’s national share of its population to safe drinking water is more than 40 percentage points higher than Kerala’s between 1991 and 2011. This disparity is elaborated in Figure 18.

Kerala (visualized in red) maintains the lowest access to drinking safe water across all Indian states. When adding Union Territories into the analysis, only the Lakshadweep archipelago (visualized in green) has a lower percentage of access to drinking water at 22.8% in 2011. Of the thirty-five states and territories analyzed above,

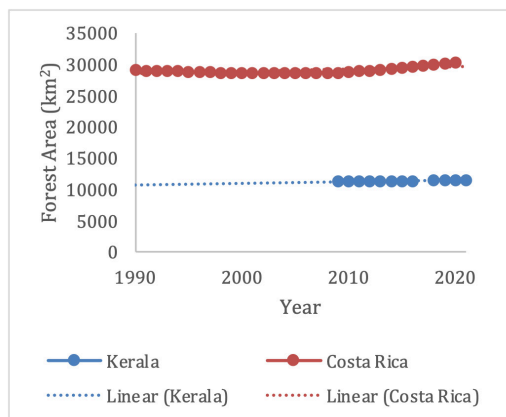


Figure 19. Total forest area.

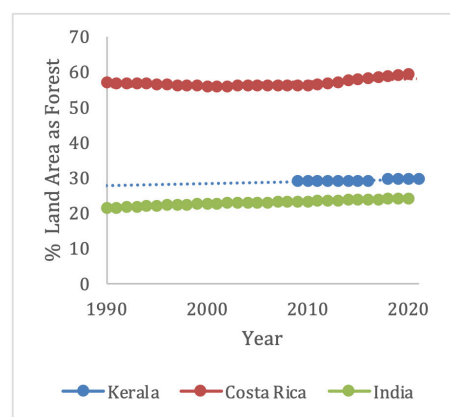


Figure 20. Forest area as percent of land cover.

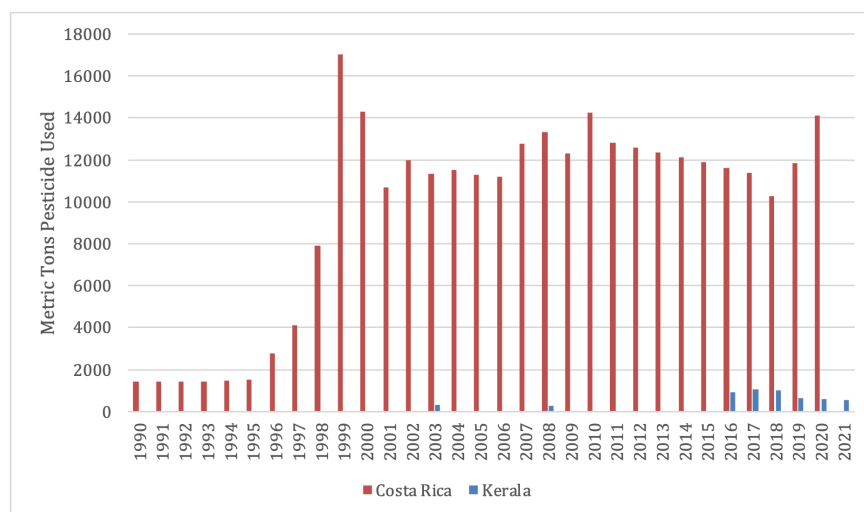


Figure 21. Chemical pesticide usage in metric tons.

twenty-six states have exceeded a share of 70% in access to safe drinking water. Although Kerala is not the only state in India to have relatively low rates of access to drinking water, Kerala is greater than 52 percentage points below the median access to drinking water in India.

Figure 19 shows a direct comparison of the total forest area of Kerala and Costa Rica. Over time, neither Costa Rica nor Kerala shows a significant growth or decline in forest area. Among the years present, Costa Rica holds about 2.5 times the amount of total forest area of Kerala. Due to the varying sizes of the states, Figure 20 highlights the forest area as a percentage of the total land area to demonstrate another point of reference. Figure 20 highlights that Costa Rica has approximately twice as much forest area per square kilometer of the state. India was excluded due to its size in Figure 19; however, in Figure 20, it is shown that Kerala holds about 1.2 times as much forest per land area as India on average.

Shown above in Figure 21 is a comparison of chemical pesticide usage in Costa Rica and Kerala. Using Kerala’s earliest available data in 2003 and 2008, Costa Rica uses 35 times and 45 times more pesticides than Kerala respectively. Since 2016, however, Costa Rica has used between 10 and 24 times more pesticides than Kerala. It is important to note that Costa Rica’s usage of pesticides follows exponential growth for a period of about five years beginning in 1995, before reaching the absolute maximum pesticide usage in 1999 at about 17,000 metric tons of pesticides. Since 1999, however, usage in Costa Rica dropped closer to about 12,000 metric tons where it has varied by about 2,000 tons in the last twenty years. Dwarfed in comparison, Kerala has seen declining rates of pesticide usage since its peak in usage in 2017. In 2021, Kerala cut its usage of pesticides by about half in four years.

Shown in Figure 22 is a comparison between Costa Rica and Kerala in terms of energy consumption. Both Costa Rica and Kerala show a positive trend over time. Kerala has consumed more energy over all the

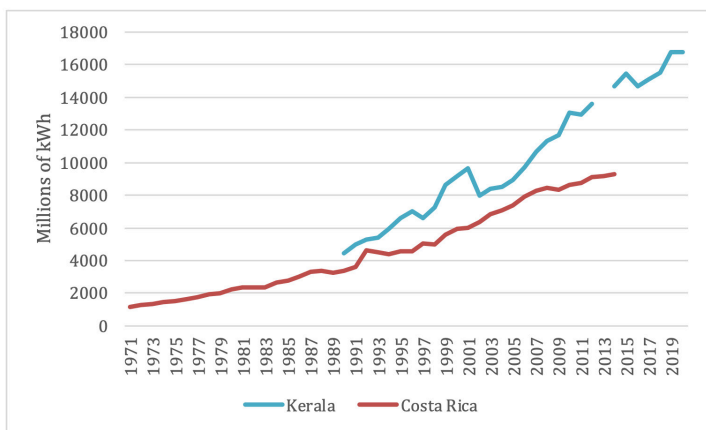


Figure 22. Energy consumption in kilowatt-hours.

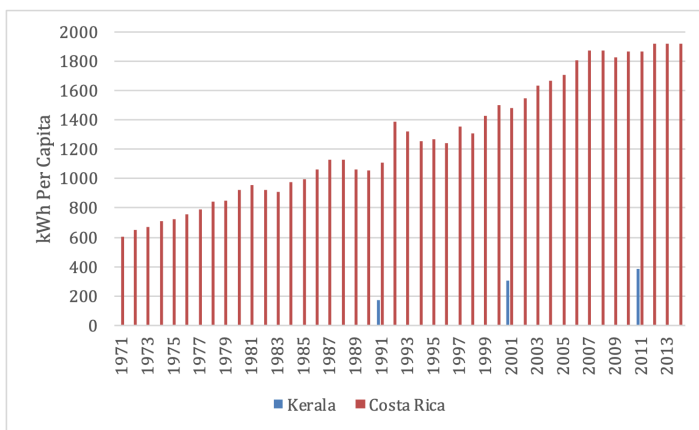


Figure 23. Energy consumption per capita.

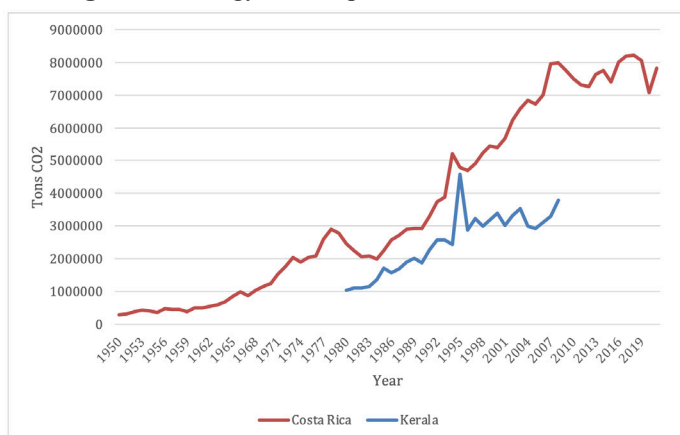


Figure 24. Carbon emissions of each state.

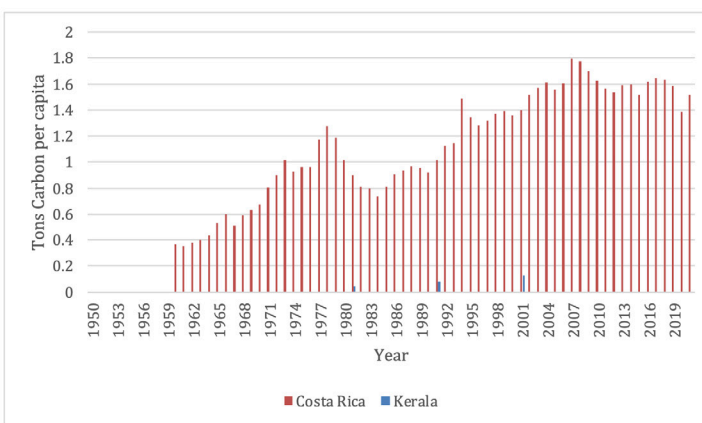


Figure 25. Carbon emissions per capita.

years present, and beginning around 2007, there is a widening gap between Kerala and Costa Rica in energy consumption.

Although the raw energy consumption between Costa Rica and Kerala is visualized in Figure 22, the energy consumption per capita shown above in Figure 23 indicates a stronger comparison given the sheer disparity in population between the two. Given that population data for Kerala is only available on a decadal basis, Kerala can only have three points of comparison (visualized in blue). Starting in 1991, Costa Rica consumes approximately 6.5 times the amount of energy that Kerala uses per capita. However, by 2001, Costa Rica used 4.8 times the energy per capita of Kerala, and this remained constant until 2011.

Figure 24 depicts a comparison of the estimated carbon emissions in metric tons of carbon dioxide. While Kerala and Costa Rica had similar carbon emissions in the early 1980s, Costa Rica outpaces Kerala significantly in carbon emissions after 1995. Kerala has shown a positive trend over time, however, Kerala’s carbon emissions fluctuated more dramatically, especially from 1990–2009. Costa Rica also demonstrates a positive trend in carbon emissions over time, although the country’s emissions plateau in 2007 where it has fluctuated slightly from eight million metric tons emitted for about fifteen years now.

Again, as there are extreme differences in population between Costa Rica and Kerala, Figure 25 captures the carbon emissions per person in each state. Only three points of data are available for Kerala’s carbon emissions due to the limitations of both the decadal population data and the limited window of estimated carbon emissions for Kerala. Figure 25 clearly depicts that the per capita emissions of Costa Rica have historically outstripped Kerala’s carbon emissions. In 1981, Costa Rica’s per capita carbon emissions were over twenty times that of Kerala. Ten years later, however, Costa Rica’s per capita carbon was reduced to thirteen times higher, and by 2001, the magnitude was ten times higher.

VI. Discussion

The purpose of this study was to gain perspective into how states should engage in sustainable development in the 21st century. In my analysis of Costa Rica and Kerala, I aimed to draw insight into their histories, public policies, and developmental strategies. Through this paper, I visualized the developmental outcomes of Costa Rica and Kerala since 1990 and various metrics of sustainable relationships to the environment. I find that the most important difference between the models of development is the simplest: population (see Appendix). Despite being roughly similar in size, the population of Kerala is so much higher that every interpretation of their comparative sustainable development must be viewed through this lens. This distinction was felt in site visits to each state: Costa Rica is made up of small towns with significant forest areas between each community, while Kerala, especially in its lowlands, is almost continuously packed with urban areas or rural villages intermixed within dense vegetation. Within India, this level of population density embedded in the ecosystem has been denoted as a “rurban cluster.” A rurban cluster is a cluster of geographically contiguous villages with a population of 15,000 to 30,000 in the plains or coastal areas.¹³⁶ In a desert, hilly, or tribal area, a rurban cluster can be made up of 5,000 to 15,000.¹³⁷

Regarding development as a means to improve the living conditions of a state’s population, both Costa Rica and Kerala are rightfully considered outstanding models. Consistently across the development indices, Costa Rica scored better than Kerala; however, on the health and education indices, the gap was much smaller. Important to note, both states score remarkably well on the Gender Development Index (GDI). Costa Rica in 2021 has a GDI of 0.999, indicating near-perfect equality between women and men on the HDI indicators. While incredible, this result is unsurprising; Costa Rica has a long-rooted history of empowering women and electing female leaders. While Kerala does not score nearly as high as Costa Rica, Kerala makes up the highest GDI in India. Similarly, Kerala is well known for its empowerment of women, especially in education in which girls often outperform boys in their age group. Kerala faces more nuanced cultural challenges of gender equality, but its progress must be noted, especially within its national context.

Importantly, the disparity between Costa Rica and Kerala at an economic level is large. Although both states have made significant progress, Kerala’s economic index in 1990 was much lower than Costa Rica’s. Although, today the economic index shows a similar gap to the education index, the historic economic gap created a significant disparity in wealth that is more visible in lasting institutions and infrastructure. Significant brain drain within Kerala further cripples the limited economic progress, and emigration from Kerala has steadily been on the rise since 1998.¹³⁸ Flocks of educated young professionals are leaving for more industrialized nations, especially in the Gulf states, with the state economically reliant on the remittances sent home.¹³⁹ Not only is this financial reliance a failing of the state economically, but it reveals an embarrassing dependency on highly unsustainable and extractive economies.

When comparing sustainability between the case studies, the comparative success of the states was mixed, with each outshining the other in different metrics. While access to safe drinking water potentially blurs the line between development and sustainable development, Costa Rica entirely outperforms Kerala. As depicted in Figure 17, Costa Rica reached a notable achievement in 2017, with 100% of its population having access to an improved water source, although the nation had already consistently held extremely high levels of clean water access. Across India, about 6% of all deaths were attributed to unsafe drinking water in 2019.¹⁴⁰ Kerala, however, scores abysmally, making up the Indian state with the worst access to clean water, with 33.5% of the population having access to clean drinking water in 2011. Due to increased urbanization in the state, Kerala’s public waterways are

136 Ministry of Rural Development, “Rurban Cluster,” Shyama Prasad Mukherji Rurban Mission, accessed April 22, 2023, https://rurban.gov.in/index.php/Public_home/rurban_cluster#gsc.tab=0.

137 Ministry of Rural Development, “Rurban Cluster.”

138 Zachariah and Rajan, “Kerala Migration Study.”

139 Zachariah and Rajan, “Kerala Migration Study.”

140 Hannah Ritchie et al., “Clean Water and Sanitation,” *Our World in Data*, July 1, 2021, <https://ourworldindata.org/water-access>.

becoming more heavily polluted with industrial and domestic waste, pesticides, and heavy metals.¹⁴¹ Additionally, the state estimates about 90% of wells in India are contaminated with fecal matter, incredibly dangerous for the 60% of the population that relies on groundwater for drinking.¹⁴² In 2020, the Kerala government attempted to mitigate this enduring health disaster with a public ordinance limiting the maximum price of retailed bottled water to 13 rupees.¹⁴³ As of October 2024, 13 Indian rupees is equivalent to 15 cents in the US. Although India has struggled with clean water access for decades, Kerala has not shown the same degree in improving clean water access as the rest of India, a distinct failure of the Kerala model and government.

Although total forest area is not a strong indicator of ecological sustainability, the stark difference between the two states is remarkable. Costa Rica is no doubt able to support forests on more than 60% of its land due to the much smaller population. While much of the lowlands are inhabited by rural clusters in Kerala, Costa Rica is able to have greater swaths of land protected under conservation. This comparative advantage in access to protected ecosystems has allowed Costa Rica to intentionally cultivate its environmental image in tandem with a thriving ecotourism industry. As the state has intentionally utilized this comparative advantage, I argue that the burgeoning ecotourism in Costa Rica should be considered another success of its developmental state. In recent years, Kerala has been utilizing its natural beauty for ecotourism. Especially in the highlands, the Western Ghats, and Kerala's beaches, there has been a growth in sustainability-oriented attractions and "ecolodges." However, Costa Rica's reputation for sustainability and ecotourism is known internationally, while Kerala's reputation is best known for attracting other Indians to the state on vacation. Within the context of India, this makes sense as Kerala's more unique tropical ecosystem also maintains 20% more forest area as compared to the rest of India.

Even still, Kerala faces significant challenges in replicating the ecological success of Costa Rica. Across the Indian state, toxic pollution is extremely common, even beyond the urban areas. Citing insufficient treatment facilities, cities and sea vessels discharge high volumes of sewage into the waters.¹⁴⁴ Along the Kerala coasts, plastic pollution causes significant harm to the marine ecosystem with coastal birds suffering acutely.¹⁴⁵ Despite this, Kerala has acted more proactively than other Indian states in developing its governmental accounting for biodiversity following India's Biodiversity Act in 2002.¹⁴⁶ The Kerala State Biodiversity Board has acted at both regional and local levels, with local municipalities documenting all of the species within the region to develop the People's Biodiversity Register in Kerala.¹⁴⁷ With Kerala's bold efforts in biodiversity and conservation in the last decade, it is possible that ecotourism may become much larger as a non-extractive source of economic revenue within the state.¹⁴⁸ Although Kerala does not nearly match Costa Rica in terms of sustainable income through ecotourism, the natural beauty the state holds would allow for ecotourism to thrive, given proper state mitigation of pollution and continued support for biodiversity. Both Costa Rica and Kerala have a comparative advantage regarding their potential for ecotourism within the world, but Costa Rica's state-sponsored path toward centering it within the economy should be embraced by Kerala's state government as well.

As shown in Figure 21, Costa Rica far exceeds Kerala in chemical pesticide usage. While both states rely heavily on agriculture, Costa Rica is responsible for 10 to 24 times the amount of pesticide used in Kerala. Despite using a significantly smaller amount of pesticides, Kerala's population has been calling for the end of pesticide usage; however, the state has become more supportive of the use of biopesticides, known to be significantly

141 "Pollution: Water – Status of Environment Related Issues: Kerala ENVIS Centre," India Ministry of Environment and Forests, February 3, 2023, http://kerenvis.nic.in/database/waterpollution_834.aspx.

142 India Ministry of Environment and Forests, "Pollution."

143 P. S. Gopikrishnan Unnithan, "Kerala Caps Bottled Water at RS 13 per Litre," *India Today*, March 4, 2020, <https://www.indiatoday.in/india/story/kerala-bottled-water-1652252-2020-03-04>.

144 G. V. Jinu, "Coastal Pollution and Eco Problems in Kerala," *Shanlax International Journal of Arts, Science and Humanities* 6, no. 2 (2018): 42, <https://doi.org/10.5281/zenodo.1472680>.

145 H. P. Nisanth and A. Biju Kumar, "Observations on the Entanglement of Plastic Debris in Seabirds along the Kerala Coast, India," *Journal of Aquatic Biology & Fisheries* 7, no. 1 (2019).

146 Oommen V. Oommen, "Interview: Dr. Oommen V. Oommen Kerala Biodiversity," interview by Rohith A. Moolakatt, Zoom, December 14, 2022.

147 "People's Biodiversity Register – KSBB," Kerala State Biodiversity Board, March 28, 2023, <https://keralabiodiversity.org/peoples-biodiversity-register-2/>.

148 Oommen, interview.

less toxic and harmful to the environment.^{149,150} Costa Rica's usage of pesticides is not only considered extreme when compared to Kerala. Costa Rica imports the largest amount of pesticide within Central America, and uses among the highest rates of pesticides in the world.¹⁵¹ As Costa Rica's economy relies significantly on exports of its agricultural products, this disparity may seem logical; however, domestic crops have been found to use more pesticides in the nation, with usage more correlated to crop variety than market orientation.¹⁵² Although there are emerging movements within the country to move towards more organic and environmental agricultural practices, Costa Rica's unsustainable use of agrochemicals has been an issue for decades. Following the planetary boundaries concept, Costa Rica's agriculture is far exceeding the planetary limits for biogeochemical flows. Currently an active area of research, these agrochemicals are detrimental to both terrestrial and aquatic ecosystems in the nation, with fungicides, pesticides, and herbicides all making their way into the Costa Rican watershed and negatively affecting dams.^{153,154} This sore point in Costa Rica's sustainable development is often overlooked, especially in Costa Rica's public perception of sustainability. I argue that Costa Rica's outstanding conservation efforts are significantly propped up by the increased productivity of its agricultural sector; with less efficient farming practices, conserved land would need to be converted to agricultural land to meet national demand. As ecological and indigenous farming practices are increasingly being implemented, perhaps Costa Rica may be able to maintain high agricultural productivity, while shifting away from heavy agrochemical usage.

In terms of energy consumption, Kerala has consumed more energy than Costa Rica both historically and presently. However, considering the disparity in population between the two, Figure 23 demonstrates that Kerala uses far less energy per person than Costa Rica. This discrepancy highlights the difference in lifestyle between the two states. With much higher rates of energy consumption, Costa Rica should be viewed similarly to many nations in the developed world, and I concur with the categorization of Costa Rica as a developed nation following its induction into the OECD in 2021. Although health and education development indices are similar between Costa Rica and Kerala, the disparity in energy consumption can likely be attributed to the gap in their economies. Historically, sparse energy access within Kerala has significantly limited economic growth and social progress. Often utilities resorted to power outages and load shedding.¹⁵⁵ Going forward, the state aims to prioritize the development of more hydroelectric, solar, and wind power in the state, especially given the underutilized capacity for solar energy in the state.¹⁵⁶ Following this, the state converted the Cochin International Airport to be powered solely by solar energy. The Cochin Airport is the first international airport powered by only solar energy, with economic and environmental analyses confirming the functioning of a clean and green airport.¹⁵⁷ Given Costa Rica's near complete reliance on renewable energy, Costa Rica's energy usage does not pose an issue in terms of carbon emissions, which is excellent given the complete access and ubiquity of electricity within the nation. Despite their clean energy production, Costa Rica still faces the tremendous challenge of electrifying its

-
- 149 Ajay Kanth, "1,037 Tonnes of Pesticides Consumed by Kerala in 1 Year," *The New Indian Express*, January 3, 2020, <https://www.newindianexpress.com/states/kerala/2020/jan/04/1037-tonnes-of-pesticides-consumed-by-kerala-in-1-year-2084715.html>.
- 150 Dennis Ndolo et al., "Research and Development of Biopesticides: Challenges and Prospects," *Outlooks on Pest Management* 30, no. 6 (2019), https://doi.org/10.1564/v30_dec_08.
- 151 Viria Bravo et al., "Monitoring Pesticide Use and Associated Health Hazards in Central America," *International Journal of Occupational and Environmental Health* 17, no. 3 (2011), <https://doi.org/10.1179/107735211799041896>.
- 152 Ryan E. Galt, "Pesticides in Export and Domestic Agriculture: Reconsidering Market Orientation and Pesticide Use in Costa Rica," *Geoforum* 39, no. 3 (2008), <https://doi.org/10.1016/j.geoforum.2007.12.003>.
- 153 Noël J. Diepens et al., "Effect of Pesticides Used in Banana and Pineapple Plantations on Aquatic Ecosystems in Costa Rica," *Journal of Environmental Biology* 35, no. 1 (2014).
- 154 S. Echeverría-Sáenz et al., "Environmental Hazards of Pesticides from Pineapple Crop Production in the Río Jiménez Watershed (Caribbean Coast, Costa Rica)," *Science of The Total Environment* 440, no. 1 (2012), <https://doi.org/10.1016/j.scitotenv.2012.07.092>.
- 155 D. Parameswara Sharma et al., "Demand for Commercial Energy in the State of Kerala, India: An Econometric Analysis with Medium-Range Projections," *Energy Policy* 30, no. 9 (2002), [https://doi.org/10.1016/S0301-4215\(01\)00138-0](https://doi.org/10.1016/S0301-4215(01)00138-0).
- 156 V. K. Damodaran and Parvathy Krishnan, "Energy and Climate Change in Kerala," in *Climate Change and Urban Environment: Issues, Potentials and Sustainable Development Opportunities*, ed. Vinod T. R., T. Sabu, and Babu Ambat (Centre for Environment and Development Thiruvananthapuram, 2015).
- 157 Sreenath Sukumaran and K. Sudhakar, "Fully Solar Powered Airport: A Case Study of Cochin International Airport," *Journal of Air Transport Management* 62, no. 1 (2017), <https://doi.org/10.1016/j.jairtraman.2017.04.004>.

transportation industry. One of the state's biggest imports is refined petroleum—ranging in oils such as gasoline and petroleum—which makes up another highly unsustainable segment of its economy.¹⁵⁸

Direct carbon emissions were depicted in Figures 24 and 25, although the results would benefit from an international context. In 2021, the per capita carbon emissions of the United States were 14.1 tons, while the Gulf States saw rates of over 20 tons per capita.¹⁵⁹ Thus, Costa Rica's emissions (1.5 tons per capita in 2021) are extraordinarily low worldwide, with Kerala as an even more extreme outlier of low carbon emissions. However, this dynamic may be reversed as Kerala's population gains access to more luxurious, carbon-intensive lifestyles, previously limited to the developed world. With the last data available regarding carbon emissions in 2011, it would not be surprising that the per capita emissions gap between the two nations has closed significantly in thirteen years. Without investments to shift away from energy based on fossil fuels, Kerala will inevitably have a much greater carbon footprint than Costa Rica with increasing industrialization. Lastly, the lack of publicly available data regarding carbon emissions represents a failing of Kerala in sustainability. In comparing Costa Rica and Kerala's carbon emissions, Kerala's emissions needed to be drawn from a larger study of the estimated carbon emissions of Indian states. Kerala must prioritize giving clear and consistent data on sustainability metrics such as carbon emissions.

Through my findings, I argue Costa Rica is rightfully considered a model for sustainable development. Its outcomes in terms of development are outstanding, due to its strong civil society that demanded lasting social programs that have improved the lives of its citizens over time. The availability of funding for these lauded social programs is largely predicated on the abolition of their standing military. Additionally, in almost every metric of sustainability, Costa Rica did extraordinarily well, with agrochemical usage being its most unsustainable component. Despite this, I argue that Costa Rica can transition away from its heavy reliance on agrochemicals in favor of indigenous and more environmental agricultural practices. While the state may see losses in productivity, the status quo of its agricultural sector is the only facet of the state that completely violates the planetary boundaries framework. However, Costa Rica's sustainability is balanced precariously within its liberal capitalist system, which has taken increasingly neoliberal shifts in the last three decades. The population and government must be cognizant of shifts in economic forces that may favor the destruction of conserved land for cattle grazing or mining.¹⁶⁰ Overall, however, Costa Rica has developed a nation that has sustainably utilized its natural resources while improving the lives of its citizens in the fields of renewable energy, conservation, and ecotourism.

Contrastingly, I argue that Kerala is not a strong model of sustainable development, although I concur with the vast literature supporting Kerala as a model of development. Especially, given the extreme poverty of the state at its formation in the 1950s, Kerala has improved the living standard of its population to success far beyond its peers in India and the developing world. Similar to Costa Rica, Kerala's health and education outcomes are exemplary, and I concur with arguments highlighting the state's priority on both to receive compounding outcomes.¹⁶¹ Despite this, Kerala's weakness economically contributes to its lack of sustainability. With a significant portion of its economy generated through out-of-state remittances, it brings into question the economic future of the state. Kerala is economically reliant on the economic productivity of other nations, especially the Gulf nations where most of Kerala's remittances are sourced. The Gulf nations have the highest carbon emissions per capita in the world due to their dependence on fossil fuels.¹⁶² Lastly, the level of pollution in the environment is incredibly unhealthy for its population and ecology. Related to this, Kerala's abysmal access to clean water is incredibly unsustainable and should be considered a colossal failure of the government, despite its mitigation efforts with plastic bottles. These failures limit the ability of the state to successfully utilize its natural beauty for sustainable state revenue through ecotourism. While Kerala should not currently be considered a model of

158 Francisco Monge-Ariño, "Costa Rica: Trade Opening, FDI Attraction and Global Production Sharing," WTO Staff Working Paper, 2011, 6, <https://doi.org/10.30875/31a0c76d-en>.

159 Hannah Ritchie et al., "CO₂ and Greenhouse Gas Emissions," *Our World in Data*, May 11, 2020, <https://ourworldindata.org/co2-and-greenhouse-gas-emissions>.

160 Calvo-Alvarado et al., "Deforestation and Forest Restoration."

161 John C. Caldwell, "Routes to Low Mortality in Poor Countries," *Population and Development Review* 12, no. 2 (1986), <https://doi.org/10.2307/1973108>.

162 Ritchie et al., "CO₂ and Greenhouse Gas Emissions."

sustainable development, I argue that the state is moving quickly in the right direction, with increased state support for clean energy and conservation. Highlighting Kerala's halving of pesticide usage since 2017, I argue that Kerala has very recently shifted significantly in terms of cultural perception towards sustainability. Going forward, I call for a continual analysis of the state as it transitions from development to prioritizing sustainable development.

VII. Conclusion

I aimed to compare the sustainable development of Costa Rica and Kerala to find paths toward sustainable development for states in the 21st century. Although neither state is perfect, both offer policy options that would drastically improve other states around the world, although the replicability of these options varies. From Costa Rica, I argue that the most critical component to its developmental success was the abolishment of its standing military. Unfortunately, this abolishment of the military is not universally replicable, as Costa Rica does not hold intense, long-standing military tensions with other nations for the most part. Thus, I argue that the abolition of the military should be applied among nations with a comparatively small military obligation. Despite its success, I argue that the label of "exceptionalist" to describe Costa Rica is academically irresponsible. While it is true that Costa Rica exceeds its Latin American peers in many metrics of sustainable development, the absence of significant international intervention in its history, especially by the United States, allowed for stability, development, and social capital to flourish. Often when describing Costa Rica as an "exceptionalist" nation, academics overlook the favorable relationships it holds with the world's military and economic powers.

Costa Rica and Kerala share many policy similarities that have precipitated high development outcomes. I argue that Joshi's identification of Costa Rica's comparative advantage in social capital regarding social cooperation and cross-class collaboration is shared with Kerala.¹⁶³ Both developmental states saw significant investments in health and education because of broad public demand and support, and these investments improved the health and living conditions in both nations. In Costa Rica, the educated youth became an asset through the production of a highly skilled workforce that attracted foreign investment and the expansion of national industries. In Kerala, however, the lack of opportunities drove citizens to leave, granting the state revenue through remittances. Costa Rica (and Kerala to a smaller extent) has capitalized on its natural beauty to support a strong tourism industry while utilizing their natural resources for energy production relevant to its geography.

While this paper has conducted a high-level overview of comparing sustainable development between Costa Rica and Kerala, specific research beyond the scope of this paper would be critical. Further analysis into the agriculture and land use between the two states would be beneficial, given the similarities in climate and crops grown, yet vastly different strategies of farming. In a similar vein, a deeper analysis of the conservation and tourism economies of both states would also yield intriguing findings. Lastly, as a critical component of sustainable development in the 21st century, an analysis of the state-sponsored climate adaptation and resilience efforts would be fruitful, given the similar vulnerabilities to climate hazards like flooding. Going forward, I believe a comparison between Kerala and Cuba, as an authoritarian model of a social developmental state, might yield insight, especially in a political lens due to the prominence of Marxism in both states.

Through examining the case studies of Costa Rica and Kerala, I have gleaned a few key insights into paths for sustainable development. While conservation may seem ideologically opposed to economic uses of land, a profitable mutualism between conservation and ecotourism can be intentionally cultivated, marking a strong path towards a sustainable economy. Through my analysis of both case studies, I argue in support of the developmental state: that a central government has significant agency to implement sustainable development, especially with public support. Universal state-sponsored policies such as universal healthcare and education have been especially effective. While finding paths towards sustainability must be encouraged from many strategies, I argue that the developmental state can provide an effective path for sustainable development in the Global South and North. Internationally, no state has radically embraced a fully sustainable relationship with the environment. Thus, sustainable development must be understood as a priority for all communities of the world. As we continue

to explore paths towards sustainability through paths of anarchism, liberalism, and socialism, the developmental state must be considered a viable path toward sustainable development and achieving sustainability.

VIII. Appendix

Kerala and Costa Rica are both tropical states of roughly the same size, and each is often compared to mid-sized US states such as West Virginia or Maine. Figure 26 demonstrates the gap in total land area, with Costa Rica being about 1.3 times the size of Kerala.

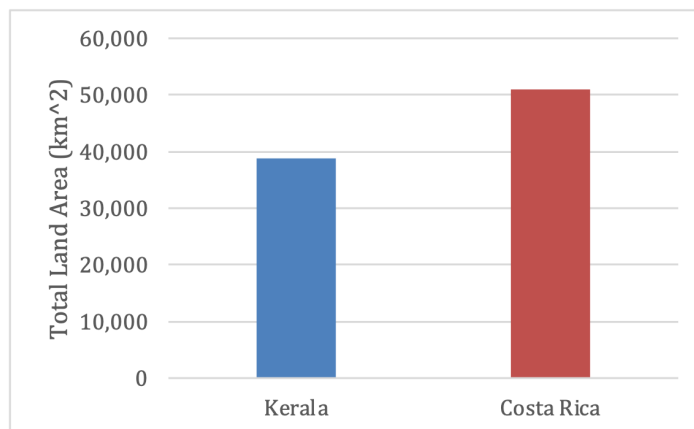


Figure 26. Comparative total land area.

Despite holding a similar amount of land, there is a stark disparity in terms of population: Kerala supports a population magnitudes larger than Costa Rica's population. This is visualized in Figures 27 and 28.

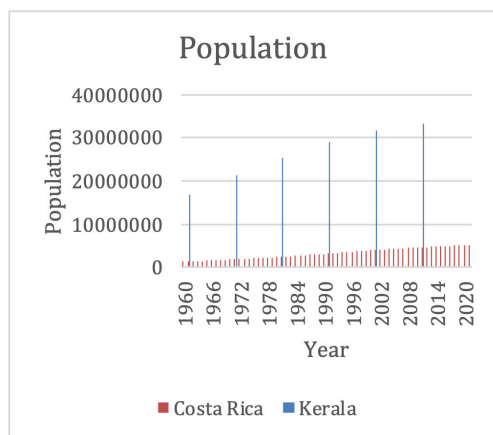


Figure 27. Comparative population.

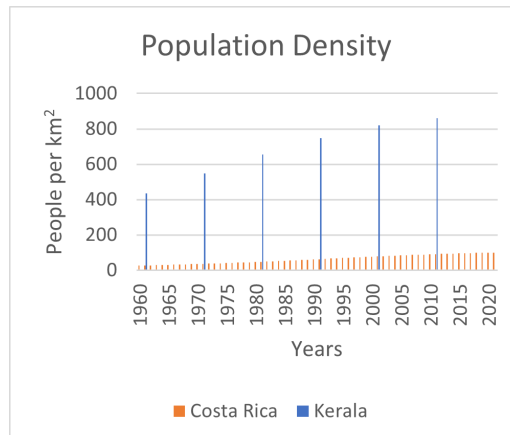


Figure 28. Comparative population density.

At the first point of comparison in 1961, Kerala's population was twelve times greater than the population of Costa Rica. In the most recent comparison in 2011, Kerala's population still exceeds Costa Rica's, with the latter making up one-seventh of Kerala's population. This wide gap in population creates a dramatic difference in population density between the regions. Similar to the population, the magnitude of disparity has shrunk over time but still remains large; in 1961, Kerala's population density was over sixteen times Costa Rica's equivalent, while in 2011 the gap was a magnitude of nine.

IX. Bibliography

Abdallah, Saamah, and Nic Marks. "Happy Planet Index." In *Encyclopedia of Quality of Life and Well-Being Research*, edited by Alex C. Michalos. Springer Dordrecht, 2014.

- Aistara, Guntra A., Brian Dowd-Urbe, and Robert Fletcher. *The Ecolaboratory: Environmental Governance and Economic Development in Costa Rica*. University of Arizona Press, 2020. <https://muse.jhu.edu/book/73708>.
- Anderson, Elizabeth P., Catherine M. Pringle, and Manrique Rojas. "Transforming Tropical Rivers: An Environmental Perspective on Hydropower Development in Costa Rica." *Aquatic Conservation: Marine and Freshwater Ecosystems* 16, no. 7 (2006): 679–93. <https://doi.org/10.1002/aqc.806>.
- Arias, Jessica, Dione Barahona, and Lizeth Valverde. "Geothermal Energy: Current Situation in Costa Rica." Instituto Costarricense de Electricidad, March, 2014. <https://orkustofnun.is/gogn/unu-gtp-sc/UNU-GTP-SC-18-15.pdf>.
- Arias-Ramirez, Rafael. "Structural Adjustment and Social Policy in Costa Rica: A Case of Heterodox Adjustment." PhD diss., University of Minnesota, 2004. <https://www.proquest.com/docview/305156888/abstract/69ED210C4B25436BPQ/1>.
- Bagchi, Amiya Kumar. "The Past and the Future of the Developmental State." *Journal of World-Systems Research* 6, no. 2 (2000): 398–442. <https://doi.org/10.5195/jwsr.2000.216>.
- Bermúdez Rojas, Tania, and Vilma Obando Acuña. "Biodiversidad en cifras: avances en el conocimiento de especies en Costa Rica." *Biocenosis* 32, no. 2 (2021). <https://doi.org/10.22458/rb.v32i2.3899>.
- Bhat, K. V. "Physical and Anatomical Characteristics of Some Less-Known Tree Species of Kerala." Kerala Forest Research Institute, December 1994. <https://docs.kfri.res.in/KFRI-RR/KFRI-RR096.pdf>.
- Black, John A. *Kerala's Demographic Transition: Determinants and Consequences*. BMJ, 1999. <https://doi.org/10.1136/bmj.318.7200.1771>.
- Blum, Nicole. "Teaching Science or Cultivating Values? Conservation NGOs and Environmental Education in Costa Rica." *Environmental Education Research* 15, no. 6 (2009): 715–29. <https://doi.org/10.1080/13504620903420064>.
- Booth, John A. "Democratic Development in Costa Rica." *Democratization* 15, no. 4 (2008): 714–32. <https://doi.org/10.1080/13510340802191052>.
- Bowman, Kirk S. "New Scholarship on Costa Rican Exceptionalism." *Journal of Interamerican Studies and World Affairs* 41, no. 2 (1999): 123–30. <https://doi.org/10.2307/166410>.
- Bravo, Viria, Teresa Rodríguez, Berna van Wendel de Joode, et al. "Monitoring Pesticide Use and Associated Health Hazards in Central America." *International Journal of Occupational and Environmental Health* 17, no. 3 (2011): 258–69. <https://doi.org/10.1179/107735211799041896>.
- Caldwell, John C. "Routes to Low Mortality in Poor Countries." *Population and Development Review* 12, no. 2 (1986): 171–220. <https://doi.org/10.2307/1973108>.
- Calvo-Alvarado, J., B. McLennan, A. Sánchez-Azofeifa, and T. Garvin. "Deforestation and Forest Restoration in Guanacaste, Costa Rica: Putting Conservation Policies in Context." *Forest Ecology and Management* 258, no. 6 (2009): 931–40. <https://doi.org/10.1016/j.foreco.2008.10.035>.

- Campo-Engelstein, Lisa, and Karen Meagher. "Costa Rica's 'White Legend': How Racial Narratives Undermine Its Health Care System." *Developing World Bioethics* 11, no. 2 (2011): 99–107. <https://doi.org/10.1111/j.1471-8847.2011.00301.x>.
- Chandran, K. Narayana. "Literacy in India and the Example of Kerala." *Journal of Reading* 37, no. 6 (1994): 514–17.
- Chathukulam, Jos, and Joseph Tharamangalam. "The Kerala Model in the Time of COVID19: Rethinking State, Society and Democracy." *World Development* 137, no. 1 (2021). <https://doi.org/10.1016/j.worlddev.2020.105207>.
- Chattopadhyay, Srikumar, and Richard W. Franke. *Striving for Sustainability: Environmental Stress and Democratic Initiatives in Kerala*. Concept Publishing Company, 2006.
- Damodaran, V. K., and Parvathy Krishnan. "Energy and Climate Change in Kerala." In *Climate Change and Urban Environment: Issues, Potentials and Sustainable Development Opportunities*, edited by Vinod T. R., T. Sabu, and Babu Ambat. Centre for Environment and Development Thiruvananthapuram, 2015.
- Devika, J. "Egalitarian Developmentalism, Communist Mobilization, and the Question of Caste in Kerala State, India." *The Journal of Asian Studies* 69, no. 3 (August 2010): 799–820. <https://doi.org/10.1017/S0021911810001506>.
- Diepens, Noël J., Sascha Pfennig, Paul J. Van den Brink, Jonas S. Gunnarsson, Clemens Ruepert, and Luisa E. Castillo. "Effect of Pesticides Used in Banana and Pineapple Plantations on Aquatic Ecosystems in Costa Rica." *Journal of Environmental Biology* 35, no. 1 (2014): 73–84.
- Dilip, T. R. "School Educational Attainment in Kerala : Trends and Differentials." Centre for Development Studies, 2010. <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/3168>.
- Echeverría-Sáenz, S., F. Mena, M. Pinnock, et al. "Environmental Hazards of Pesticides from Pineapple Crop Production in the Río Jiménez Watershed (Caribbean Coast, Costa Rica)." *Science of The Total Environment* 440, no. 1 (2012): 106–14. <https://doi.org/10.1016/j.scitotenv.2012.07.092>.
- Flores Chacon, Monica. "Debunking the Pura Vida: Costa Rican Exceptionalism Is Under Threat." Thesis, Monterey, CA; Naval Postgraduate School, 2021. <https://calhoun.nps.edu/handle/10945/67710>.
- Foley, Erin, Barbara Cooke, and Tatiana Ryckman. *Costa Rica (Culture of the World)*. Cavendish Square Publishing, 2017.
- Franzoni, Juliana Martínez, and Diego Sánchez-Ancochea. "Can Latin American Production Regimes Complement Universalistic Welfare Regimes?" *Latin American Research Review* 48, no. 2 (2013): 148–73. <https://doi.org/10.1353/lar.2013.0020>.
- Galt, Ryan E. "Pesticides in Export and Domestic Agriculture: Reconsidering Market Orientation and Pesticide Use in Costa Rica." *Geoforum* 39, no. 3 (2008): 1378–92. <https://doi.org/10.1016/j.geoforum.2007.12.003>.
- George, Tijo, Mala Ramanathan, and Udaya Shankar Mishra. "Nature and Composition of Inter-State Migration into Districts of Kerala: Some Evidence from Census of India, 2011." *Journal of Social and Economic Development* 24, no. 2 (2022): 379–403. <https://doi.org/10.1007/s40847-022-00188-y>.

- Ghoshal, Tapas, and Ranajoy Bhattacharyya. "Carbon Dioxide Emissions of Indian States: An Update." *SSRN* (2012). <https://doi.org/10.2139/ssrn.2166900>.
- Gimenez, Gregorio, and Beatriz Barrado. "Exposure to Crime and Academic Achievement: A Case Study for Costa Rica Using PISA Data." *Studies in Educational Evaluation* 65, no. 1 (2020). <https://doi.org/10.1016/j.stueduc.2020.100867>.
- Gingerich, Daniel W., and Virginia Oliveros. "Police Violence and the Underreporting of Crime." *Economics & Politics* 30, no. 1 (2018): 78–105. <https://doi.org/10.1111/ecpo.12102>.
- Global Data Lab. "Data Sources." Accessed March 6, 2023. <https://globaldatalab.org/areadata/sources/>.
- Goebel McDermott, Anthony. "Interview: Environmental Development of Costa Rica." Interview by Rohith A. Moolakatt. August 19, 2022.
- Goebel McDermott, Anthony. "Land and Climate: Natural Constraints and Socio-Environmental Transformations." In *The Oxford Handbook of Central American History*, edited by Robert H. Holden. Oxford University Press, 2022. https://books.google.co.cr/books?id=jUNuEAAAQBAJ&printsec=front-cover&hl=es&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false.
- Haddad, Slim, Enis Baris, and D. Narayana. *Safeguarding the Health Sector in Times of Macroeconomic Instability: Policy Lessons for Low- and Middle-Income Countries*. Africa World Press, 2007.
- Helmuth, Chalene. *Culture and Customs of Costa Rica*. Bloomsbury Publishing, 2000.
- Hemendra. "Physiographic Divisions of Kerala (Geography of Kerala)." ExamBoard, August 8, 2019. <https://www.examboard.in/2019/08/physiographic-divisions-of-kerala.html>.
- Herre, Bastian, Pablo Arriagada, and Max Roser. "The Human Development Index and Related Indices: What They Are and What We Can Learn from Them." *Our World in Data*, November 1, 2023. <https://ourworldindata.org/human-development-index>.
- Herrera-Rodríguez, Mauricio. "Sustainable Development in Costa Rica: A Geographic Critique." *Journal of Latin American Geography* 12, no. 2 (2013): 193–219.
- Hirai, Tadashi. *The Creation of the Human Development Approach*. Palgrave Macmillan Cham, 2017. <https://doi.org/10.1007/978-3-319-51568-7>.
- Huhn, Sebastian. "The Culture of Fear and Control in Costa Rica (II): The Talk of Crime and Social Changes." German Institute of Global and Area Studies (GIGA), 2009. <https://www.jstor.org/stable/resrep07535>.
- India Ministry of Environment and Forests. "Pollution: Water – Status of Environment Related Issues: Kerala ENVIS Centre," February 3, 2023. http://kerenvis.nic.in/database/waterpollution_834.aspx.
- International Trade Administration. "Energy Resource Guide - Renewable Energy - Costa Rica." U.S. Department of Commerce, 2021. <https://www.trade.gov/energy-resource-guide-renewable-energy-costa-rica>.

- Ives, Peter. "Gramsci's Common Sense: Inequality and Its Narratives." *Contemporary Political Theory* 17, no. 1 (2018): 22–25. <https://doi.org/10.1057/s41296-017-0107-1>.
- Jinu, G. V. "Coastal Pollution and Eco Problems in Kerala." *Shanlax International Journal of Arts, Science and Humanities* 6, no. 2 (2018): 41–44. <https://doi.org/10.5281/zenodo.1472680>.
- Johnson, Todd M., and Brian J. Grim. *The World's Religions in Figures: An Introduction to International Religious Demography*. 1st ed. John Wiley & Sons, Ltd, 2013. https://media.johnwiley.com.au/product_data/excerpt/47/04706745/0470674547-196.pdf.
- Jones, Matthew W., Glen P. Peters, Thomas Gasser, et al. "National Contributions to Climate Change Due to Historical Emissions of Carbon Dioxide, Methane, and Nitrous Oxide since 1850." *Scientific Data* 10, no. 1 (2023). <https://doi.org/10.1038/s41597-023-02041-1>.
- Joshi, Devin K. "Varieties of Developmental States: Three Non-Western Pathways to the Millennium Development Goals." *Journal of Developing Societies* 28, no. 3 (2012): 355–78. <https://doi.org/10.1177/0169796X12453783>.
- Kannan, K. P., K. R. Thankappan, V. Ramankutty, and K. P. Aravindan. "Kerala: A Unique Model of Development." *Health for the Millions* 17, no. 5 (1991): 30–33.
- Kanth, Ajay. "1,037 Tonnes of Pesticides Consumed by Kerala in 1 Year." *The New Indian Express*, January 3, 2020. <https://www.newindianexpress.com/states/kerala/2020/jan/04/1037-tonnes-of-pesticides-consumed-by-kerala-in-1-year-2084715.html>.
- Karmalkar, Ambarish V., Raymond S. Bradley, and Henry F. Diaz. "Climate Change in Central America and Mexico: Regional Climate Model Validation and Climate Change Projections." *Climate Dynamics* 37, no. 3 (2011): 605–29. <https://doi.org/10.1007/s00382-011-1099-9>.
- Kerala State Biodiversity Board. "People's Biodiversity Register – KSBB." March 28, 2023. <https://keralabiodiversity.org/peoples-biodiverity-register-2/>.
- Kerala State Planning Board. "Kerala Development Report: Initiatives, Achievements, and Challenges." Government of Kerala, February, 2021. <https://spb.kerala.gov.in/sites/default/files/inline-files/Kerala-Development-Report-2021.pdf>.
- Klasen, Stephan. "UNDP's Gender-related Measures: Some Conceptual Problems and Possible Solutions." *Journal of Human Development* 7, no. 2 (2006): 243–74. <https://doi.org/10.1080/14649880600768595>.
- Mainieri Protti, Alfredo. "Costa Rica Country Update Report." Centro Servicios Recursos Geotérmicos Instituto Costarricense de Electricidad (ICE), 2005. <https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2005/0116.pdf>.
- Manakkadan, Anoop, Iype Joseph, Raji Rajendran Prasanna, Riaz Ismail Kunju, Lalitha Kailas, and Sreekumar Eswaran. "Lineage Shift in Indian Strains of Dengue Virus Serotype-3 (Genotype III), Evidenced by Detection of Lineage IV Strains in Clinical Cases from Kerala." *Virology Journal* 10, no. 1 (2013). <https://doi.org/10.1186/1743-422X-10-37>.

- Mannathukkaren, Nissim. “The Rise of the National-Popular and Its Limits: Communism and the Cultural in Kerala.” *Inter-Asia Cultural Studies* 14, no. 4 (2013): 494–518. <https://doi.org/10.1080/14649373.2013.831160>.
- Matus-López, Mauricio, and Alexander Chaverri-Carvajal. “Progress Toward Long-Term Care Protection in Latin America: A National Long-Term Care System in Costa Rica.” *Journal of the American Medical Directors Association* 23, no. 2 (February 1, 2022): 266–71. <https://doi.org/10.1016/j.jamda.2021.06.021>.
- Menon, Balakrishna. “Interview: Balakrishna Menon: Sustainable Development In Kerala.” Interview by Rohith A. Moolakatt. Zoom, December 20, 2022.
- Mensah, Justice. “Sustainable Development: Meaning, History, Principles, Pillars, and Implications for Human Action: Literature Review.” *Cogent Social Sciences* 5, no. 1 (2019). <https://doi.org/10.1080/23311886.2019.1653531>.
- Ministry of Rural Development. “Rurban Cluster.” Shyama Prasad Mukherji Rurban Mission. Accessed April 22, 2023. https://rurban.gov.in/index.php/Public_home/rurban_cluster#gsc.tab=0.
- Monge-Ariño, Francisco. “Costa Rica: Trade Opening, FDI Attraction and Global Production Sharing.” *WTO Staff Working Paper*, 2011. <https://doi.org/10.30875/31a0c76d-en>.
- Montenegro Torres, Fernando. *Costa Rica Case Study: Primary Health Care Achievements and Challenges within the Framework of the Social Health Insurance*. UNICO Studies Series, 2013. <https://hdl.handle.net/10986/13279>.
- Morrissey, Marietta. “Neoliberalism, Development, and the Costa Rican State.” *Latin American Policy* 8, no. 2 (2017): 278–94. <https://doi.org/10.1111/lamp.12124>.
- Müller-Using, Susanne, and Alicia Vargas Porrás. “The Education System of Costa Rica.” In *The Education Systems of the Americas*, edited by Sieglinde Jorntitz and Marcelo Parreira do Amaral. Springer Cham, 2021. https://doi.org/10.1007/978-3-030-41651-5_6.
- Nabae, Koji. “The Health Care System in Kerala - Its Past Accomplishments and New Challenges.” *Journal of the National Institute of Public Health* 52, no. 2 (2003): 140–45.
- Nandwani, Shyam S. “Uses of Solar Energy in Costa Rica.” *Renewable Energy* 31, no. 5 (2006): 689–701. <https://doi.org/10.1016/j.renene.2005.08.008>.
- National Academy of Sciences. *Growing Populations, Changing Landscapes: Studies from India, China, and the United States*. National Academy Press, 2001. <https://doi.org/10.17226/10144>.
- Ndolo, Dennis, Elizabeth Njuguna, Charles Oluwaseun Adetunji, et al. “Research and Development of Biopesticides: Challenges and Prospects.” *Outlooks on Pest Management* 30, no. 6 (2019): 267–76. https://doi.org/10.1564/v30_dec_08.
- Nisanth, H. P., and A. Biju Kumar. “Observations on the Entanglement of Plastic Debris in Seabirds along the Kerala Coast, India.” *Journal of Aquatic Biology & Fisheries* 7, no. 1 (2019): 115–19.

- Organisation for Economic Co-operation and Development (OECD). *OECD Economic Surveys: Costa Rica 2018*. 2018. https://doi.org/10.1787/eco_surveys-cri-2018-en.
- Olander, Marcia. "Costa Rica in 1948: Cold War or Local War?" *The Americas* 52, no. 4 (1996): 465–93. <https://doi.org/10.2307/1008474>.
- Oommen, Oommen V. "Interview: Dr. Oommen V. Oommen Kerala Biodiversity." Interview by Rohith A. Moolakatt. Zoom, December 14, 2022.
- Parayil, Govindan. "The 'Kerala Model' of Development: Development and Sustainability in the Third World." *Third World Quarterly* 17, no. 5 (1996): 941–58. <https://doi.org/10.1080/01436599615191>.
- Pedersen, Jørgen Dige. "Explaining Economic Liberalization in India: State and Society Perspectives." *World Development* 28, no. 2 (2000): 265–82. [https://doi.org/10.1016/S0305-750X\(99\)00132-1](https://doi.org/10.1016/S0305-750X(99)00132-1).
- Pesec, Madeline, Hannah L. Ratcliffe, Ami Karlage, Lisa R. Hirschhorn, Atul Gawande, and Asaf Bitton. "Primary Health Care That Works: The Costa Rican Experience." *Health Affairs* 36, no. 3 (2017): 531–38. <https://doi.org/10.1377/hlthaff.2016.1319>.
- Pezzoli, Keith. "Sustainable Development: A Transdisciplinary Overview of the Literature." *Journal of Environmental Planning and Management* 40, no. 5 (1997): 549–74. <https://doi.org/10.1080/09640569711949>.
- Prakash, B. A. *Kerala's Economic Development: Performance and Problems in the Post-Liberalization Period*. SAGE Publications, 2004.
- Rajan, S. Irudaya, Benoy Peter, Udaya S. Mishra, and Vishnu Narendran. "Impact of Demographic Transition in Kerala on Migration and Labour Force." In *India Migration Report 2019*, edited by S. Irudaya Rajan. Routledge India, 2018.
- Rajan, S. Irudaya, and K. C. Zachariah. "Kerala Emigrants in the Gulf." In *India's Low-Skilled Migration to the Middle East: Policies, Politics and Challenges*, edited by S. Irudaya Rajan and Prem Saxena. Palgrave Macmillan Singapore, 2019. https://doi.org/10.1007/978-981-13-9224-5_8.
- Richardson, Katherine, Will Steffen, Wolfgang Lucht, et al. "Earth beyond Six of Nine Planetary Boundaries." *Science Advances* 9, no. 37 (2023). <https://doi.org/10.1126/sciadv.adh2458>.
- Richmond-Navarro, Gustavo, Esteban Jiménez-Quesada, Valeria Guerrero-Bonilla, Pedro Casanova-Treto, and Monge-Camacho Henry. "Comparación de la Energía Eólica entre Costa Rica y el Resto del Mundo." *Tecnología en Marcha* 35, no. 7 (2022): 19–32. <https://doi.org/10.18845/tm.v35i7.6330>.
- Ritchie, Hannah, and Max Roser. "CO₂ Emissions." *Our World in Data*, January 22, 2024. <https://ourworldindata.org/co2-emissions>.
- Ritchie, Hannah, Fiona Spooner, and Max Roser. "Clean Water and Sanitation." *Our World in Data*, July 1, 2021. <https://ourworldindata.org/water-access>.
- Ritchie, Hannah, Pablo Rosado, and Max Roser. "CO₂ and Greenhouse Gas Emissions." *Our World in Data*, May 11, 2020. <https://ourworldindata.org/co2-and-greenhouse-gas-emissions>.

- Ritchie, Hannah, Pablo Rosado, and Max Roser. "Energy." *Our World in Data*, October 27, 2022. <https://ourworldindata.org/energy/country/costa-rica>.
- Rockström, Johan, Joyeeta Gupta, Dahe Qin, et al. "Safe and Just Earth System Boundaries." *Nature* 619, no. 1 (2023): 102–11. <https://doi.org/10.1038/s41586-023-06083-8>.
- Rockström, Johan, Will Steffen, Kevin Noone, et al. "A Safe Operating Space for Humanity." *Nature* 461, no. 1 (2009): 472–75. <https://doi.org/10.1038/461472a>.
- Rodriguez-Segura, Daniel. "Strengthening Early Literacy Skills through Social Promotion Policies? Intended and Unintended Consequences in Costa Rica." *International Journal of Educational Development* 77, no. 1 (2020). <https://doi.org/10.1016/j.ijedudev.2020.102243>.
- Rotberg, Robert I. "The Corruption of Latin America." In *Corruption in Latin America: How Politicians and Corporations Steal from Citizens*, edited by Robert I. Rotberg. Springer Cham, 2019. https://doi.org/10.1007/978-3-319-94057-1_1.
- Sagar, Ambuj D., and Adil Najam. "Shaping Human Development: Which Way Next?" *Third World Quarterly* 20, no. 4 (1999): 743–51. <https://doi.org/10.1080/01436599913532>.
- Sandbrook, Richard, Marc Edelman, Patrick Heller, and Judith Teichman. *Social Democracy in the Global Periphery: Origins, Challenges, Prospects*. Cambridge University Press, 2007. <https://doi.org/10.1017/CBO9780511491139>.
- Sankar D., Hari, Jaison Joseph, Gloria Benny, and Devaki Nambiar. "Of Primary Health Care Reforms and Pandemic Responses: Understanding Perspectives of Health System Actors in Kerala before and during COVID-19." *BMC Primary Care* 24, no. 1 (2023). <https://doi.org/10.1186/s12875-023-02000-0>.
- Schewel, Kerilyn, and Sonja Fransen. "Who Prefers to Stay? Voluntary Immobility among Youth in Ethiopia, India, and Vietnam." *Journal of Ethnic and Migration Studies* 48, no. 19 (2022): 4457–84. <https://doi.org/10.1080/1369183X.2022.2092085>.
- Sen, Amartya. "Radical Needs and Moderate Reforms." In *Indian Development: Selected Regional Perspectives*, edited by Jean Drèze and Amartya Sen. Clarendon Press, 1997. <https://doi.org/10.1093/acprof:oso/9780198292043.003.0001>.
- Shaji, A. "Elements of Caste and Communal Consciousness in the Malayali Memorial of Modern Travancore (1891)." *Shanlax International Journal of Arts, Science and Humanities* 5, no. 4 (2018): 73–83. <https://docslib.org/doc/8365351/elements-of-caste-and-communal-consciousness-in-the-malayali-memorial-of-modern-travancore-1891>.
- Sharma, D. Parameswara, P. S. Chandramohan Nair, and R. Balasubramanian. "Demand for Commercial Energy in the State of Kerala, India: An Econometric Analysis with Medium-Range Projections." *Energy Policy* 30, no. 9 (2002): 781–91. [https://doi.org/10.1016/S0301-4215\(01\)00138-0](https://doi.org/10.1016/S0301-4215(01)00138-0).
- Simas, Moana, and Sergio Pacca. "Socio-Economic Benefits of Wind Power in Brazil." *Journal of Sustainable Development of Energy, Water and Environment Systems* 1, no. 1 (2013): 27–40. <https://doi.org/10.13044/j.sdewes.2013.01.0003>.

- Singh, Perna. "Subnationalism and Social Development: A Comparative Analysis of Indian States." *World Politics* 67, no. 3 (2015): 533–536. <https://doi.org/10.1017/S0043887115000131>.
- Singh, Perna. "We-Ness and Welfare: A Longitudinal Analysis of Social Development in Kerala, India." *World Development* 39, no. 2 (2011): 282–93. <https://doi.org/10.1016/j.worlddev.2009.11.025>.
- Smits, Jeroen, and Iñaki Permanyer. "The Subnational Human Development Database." *Scientific Data* 6, no. 1 (2019). <https://doi.org/10.1038/sdata.2019.38>.
- Sukumaran, Sreenath, and K. Sudhakar. "Fully Solar Powered Airport: A Case Study of Cochin International Airport." *Journal of Air Transport Management* 62, no. 1 (2017): 176–88. <https://doi.org/10.1016/j.jairtraman.2017.04.004>.
- Thomas, Jayan Jose. "The Achievements and Challenges of the Kerala 'Model.'" *The India Forum*, June 27, 2021. <https://www.theindiaforum.in/article/achievements-challenges-kerala-model>.
- Vidiani. "Large Regions Map of Costa Rica." 2011. <http://www.vidiani.com/large-regions-map-of-costa-rica/>.
- Vidiani. "Large Topographical Map of Costa Rica." 2011. <http://www.vidiani.com/large-topographical-map-of-costa-rica/>.
- Unnithan, P. S. Gopikrishnan. "Kerala Caps Bottled Water at RS 13 per Litre." *India Today*, March 4, 2020. <https://www.indiatoday.in/india/story/kerala-bottled-water-1652252-2020-03-04>.
- World Commission on the Environment and the Environment. *Report of the World Commission on Environment and Development: Our Common Future*. United Nations Economic and Social Council, 1987. <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>.
- Zachariah, K. C., and S. Irudaya Rajan. "Kerala Migration Study 2014." *Economic and Political Weekly* 51, no. 6 (2016): 66–71.