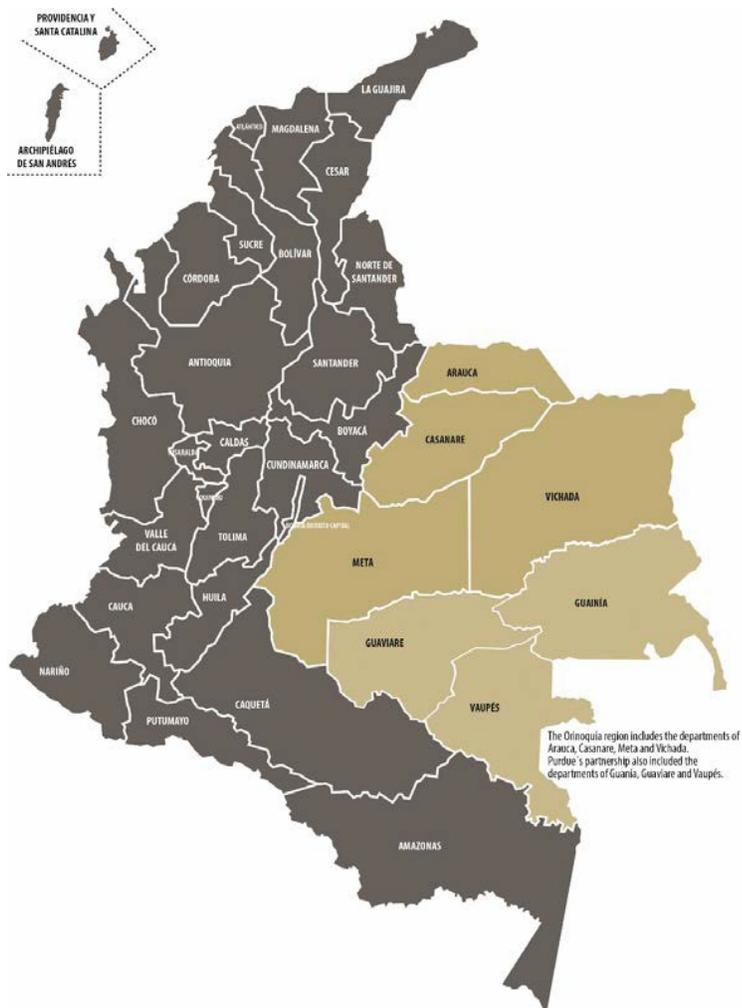


A Science-Driven Approach to Sustainable Development of the Orinoquía Region*

Purdue University's Orinoquía Initiative – Context, Vision and Goals



* Based on a proposal generated by Purdue in October 2015 in response to an opportunity to create a Master Plan for the Orinoquia

A SCIENCE-DRIVEN APPROACH TO SUSTAINABLE DEVELOPMENT OF THE ORINOQUÍA REGION

INTRODUCTION

The Orinoco River watershed of eastern Colombia is known as the Orinoquía. Located just north of the equator, the region is characterized by tropical savannahs, forested areas along rivers and sparse population. It is isolated by the Andes Mountains to the west, Venezuela to the north and the Amazon Basin to the east and south. At least since independence from Spain in the early 19th century, Colombians have believed that the area had the potential to become prosperous, but various development schemes have met with little overall success. Internal insurgency and unrest have largely undermined progress. The modest development that has occurred around certain natural resource-based industries (such as petroleum, cattle ranching, oil palm and rice) has generated concerns over environmental degradation and inequality of opportunity among citizens.

Purdue University's initiative, in partnership with Colombian government, educational and private institutions, paves the way for a master plan by examining the Orinoquía from a scientific perspective, including economic and social opportunities, physical resources, environmental needs and equity considerations. Purdue is pleased to engage in this effort based on 150 years of supporting economic, social and technological development in the state of Indiana, and its years of development and capacity-building experience worldwide. Using existing information, including 200 studies funded by Corpes Orinoquía and data available through the National Council for Economic and Social Policy (CONPES), Purdue faculty and staff seek to work with Colombian partners to develop a plan for improving health, education, roads, airports, communication and electrification. Hypotheses and scenarios based on this data would be rigorously tested and modified with Colombian partners, leading to a master plan for the long-term transformation of the Orinoquía.

The partnership is mutually beneficial to Colombia and Purdue. Colombia, and especially the people of Orinoquía, would benefit through a sustainable, equitable and environmentally sound transformation of the region. Purdue faculty, staff, and students would benefit through the research, learning and engagement skills they would hone in the process of creating and implementing the plan. Because universities are inherently institutions focused on the longer term, we hope to not only help co-create the plan but also play a key role in implementing it.

Colombia is the third-largest economy in Latin America, having recently surpassed Argentina, and it has strong economic growth prospects. It also has one of the most uneven distributions of income among OECD and Latin American countries, relatively low labor productivity and an economy tied to the boom-and-bust cycles of natural resource exploitation. The Orinoquía region, abundant in rivers and rich in biodiversity, could serve as a model for sustainable economic growth across Colombia and the Latin American region. Development in the Orinoquía ultimately could help provide opportunities for Colombians all along the social ladder as similar initiatives are adopted for other areas. Likewise, as modern infrastructure, education and growth of the formal business sector improves labor productivity in the Orinoquía, other regions could borrow from these plans for success. Finally, sustainable development projects could help smooth the boom-and-bust cycles not only in the Orinoquía but also around the rest of the country as similar ideas are implemented.

PURDUE'S STRENGTHS

Purdue continues to be one of higher education's leading destinations for international students. The university has the third-largest number of such students among U.S. public institutions, according to a report issued by the Institute of International Education. Faculty and alumni include Nobel Prize winners, World Food Prize laureates, and National Medal of Technology and Innovation honorees. Purdue University is a publicly supported state university with a global responsibility and mandate. Trade, travel and the increasing realization that we live on a small, rapidly warming planet have convinced the Purdue community and the people of the state of Indiana that our future is intimately connected to the rest of the world.

Purdue has over 60 years of experience in international capacity-building and economic development, with major initiatives in Taiwan, Brazil, Burkina Faso, Niger, Malaysia, Jordan and Afghanistan. We have a long history of educating Colombian students, and, over the past eight years, the university has developed strong relationships in Colombia. The Purdue community sees its engagement in Colombia as a partnership to make the world a better place for all, while at the same time furthering the goals of education and scholarship on its Indiana campus. Purdue offers an objective, third-party, science-driven perspective on development of the Orinoquía.

WORK PHASES

Initial Phase – Teams of Purdue faculty, staff and students in collaboration with Colombian partners review existing information, conduct needs assessments in each department in the region, develop hypotheses, analyze scenarios and draft a master plan. Purdue team members work with Colombian officials to plan pilot projects and develop rigorous monitoring and evaluation measures.

Implementation Phase – Using a mix of Colombian and international financing, the Colombian government and international funding/lending agencies such as the U.S. Agency for International Development, the World Bank and the InterAmerican Development Bank (IADB) would scale up projects to test their practicality. This would be followed by full-scale implementation, including institutional capacity-building for universities and research institutes in the region to support long-term success.

KEY INFORMATION NEEDED

Information in the following categories is key to a successful planning effort:

- 1) Physical resources
 - Climate and weather data – the expected impact of climate change
 - Soils data and mapping for crops, pasture and forest
 - Hydrological resources – availability of water
 - Geological data – petroleum reserves and mineral resources
 - Cultural and archaeological sites – mapping and descriptive narratives
 - Land use – current and expected future changes
 - Biodiversity – various landscape ecologies
- 2) Infrastructure
 - Transportation – within the region, links to the rest of Colombia, and export networks
 - Energy utilities – including electricity and natural gas
 - Health care and social services – hospitals, clinics and access to local healthcare
 - Information and communications technology systems – internet access and cell phone networks
 - Traveler and tourism infrastructure – hotels, restaurants and other resources
 - Educational institutions – all levels
 - Research facilities – including laboratories and research farms

- 3) Demographics
 - Current and projected population for the area – age structure, gender and income distribution
 - Educational level – current and expected changes
 - Professional/vocational distribution of the population – current and expected changes
- 4) Economic and financial sustainability
 - Structure of the Orinoquía economy by sector – agriculture, mining, food processing and other areas
 - Public finance – government funding for education, roads and other services
 - Labor force – current employment in region, trends and potential for in-migration
 - Banking and investment
 - Assessment of economic growth areas – feasibility studies
 - Policy environment for business

OUTCOMES AND VISION

We expect that the long-term outcomes from this science- and systems-driven planning process for Orinoquía would include:

- More sustainable economic growth and improved health and well-being for all of Colombia;
- Civil infrastructure for the development of Orinoquía;
- Preservation and enhancement of the biodiversity of Orinoquía for future generations; and
- Research, engagement and scholarship known and utilized worldwide to improve the capacity for sustainable development.

Our overall vision is of an Orinoquía with a prosperous, environmentally sustainable, market-oriented agricultural system; ample areas respected and set aside for ecological and cultural diversity; a robust, accessible education system at all levels; a growing knowledge-based economy with ubiquitous use of e-commerce, e-governance and online education; and the departments in the region operating cohesively and fully integrated into the future of Colombia. Petroleum and other natural resource extraction play a role, but do not dominate the region. The indigenous people of the Orinoquía, those internally displaced from the region and those attracted from elsewhere, have a stake in the economy and a clear voice in decision-making. Universities and research institutions build educational and research capacity, libraries and viable networks, initially to address the region's needs, but with the eventual goal of developing knowledge-based industries with a worldwide reach in such areas as the life sciences. Similarly, the importance of transportation in the development of the Orinoquía may foster growth of world-class engineering and innovation capacity in this arena.

Perhaps equally important is what this initiative will not do. It will not interfere with Colombia's internal discussions on development of Orinoquía and other regions. Our science- and systems-driven approach will complement current efforts within the country, offering options and consequences to partner with Colombian government agencies and other stakeholders. The faculty and staff of Purdue provide objective information and input because we have no direct stake in the outcome, other than a desire to see Colombia achieve its potential and the satisfaction of playing some small part in that success.

Details aside, our dream is that the partnership will evolve into a participative, inclusive collaboration in which Purdue teams work alongside our Colombian counterparts to identify and address needs through process-oriented, results-driven and scientifically robust means.

INTERDISCIPLINARY TEAMS AND THEMATIC AREAS

Implementation of the approach laid out above relies on the activities of five interdisciplinary teams working in a staged manner on the following thematic areas:

TEAM 1: SUSTAINABLE AGRICULTURAL DEVELOPMENT

Assessment of Agricultural Opportunities: soil mapping and classification, Geographical Information Systems (GIS) assessment of agricultural potential, and cost/benefit analyses for rural development strategies

Geomatics and Geospatial Science: classical land-surveying, digital mapping, photogrammetry, GIS, Global Positioning Systems (GPS) and remote sensing technologies

Leadership, Civic Engagement and Agribusiness Development: social science dimensions of agriculture, including community leadership, conflict resolution around land use, and agribusiness development for smallholder farmers

Food Security, Safety and Enhanced Nutrition: food process engineering to add value at the local level, distribution, and harvest and post-harvest loss prevention through parasite and pest mitigation

TEAM 2: ECO-TOURISM, BIODIVERSITY AND NATURAL RESOURCES MANAGEMENT

Preservation and Utilization of Biodiversity: soundscape ecology (use of sound recordings of natural environments to assess changes in biodiversity); informed decision-making on economic and social change; and microbial metagenomics, proteomics and systems biology

Water Resources Engineering and Management: agricultural, urban and groundwater hydrology; watershed flow models; impact assessments on water quality and quantity; and aquaculture and fisheries management in riverine environments

Human, Animal and Plant Protection: parasites, pest insects, weeds, pest nematodes, mites, fungi, bacteria and viruses that impact humans, livestock and crops

Environmental and Ecological Engineering: remediation of contaminated soils and sediments, industrial and solid waste treatment, water and wastewater treatment, and urban and agricultural air and water quality management

Traveler and Tourism Infrastructure: facility layout and design, menu development, food safety, menu nutrition/recipe development, business plan development, concept promotion, culinary tourism, agritourism, cultural tourism, destination brand development, international market trends and opportunities, and market development strategies

<p>TEAM 3: OIL AND ENERGY</p>	<p>Power and Energy Systems Initiatives: sustainable technologies in solar, wind and bioenergy; component design; life cycle analysis and smart grid technologies</p>
<p>TEAM 4: HUMAN AND SOCIAL CAPITAL</p>	<p>Integrated Systemic Educational Approaches: STEM (Science, Technology, Engineering and Mathematics) education from pre-kindergarten to college and graduate study; gifted education programming; and engineering-based service learning</p> <p>Transformative Learning: teacher preparation, professional development and leadership; university-level science and engineering for pre-college students; and contemporary curriculum approaches, such as participatory, service-learning and global/cross-cultural</p> <p>Higher-Education Capacity Building: knowledge-based hubs of expertise and development of local Extension services to provide university-based research insights to citizens and businesspeople</p> <p>Health Care and Social Services: Improving health care access, equity and services; population-based strategies for healthier lifestyles; and evaluation of health outcomes</p>
<p>TEAM 5: INFRASTRUCTURE AND NATURAL CAPITAL</p>	<p>Transportation Systems and Materials: planning and economics, complex transportation systems, intermodal transportation, transportation energy and sustainability, highway safety and policy analysis, advanced materials, and life cycles of road infrastructure</p> <p>Construction and Sustainable Buildings: project management, inspection, quality assurance, in-country supply chains, support infrastructure, construction engineering and management, design and analysis of energy efficient buildings, sustainable building design, and construction of indoor environments</p> <p>Information and Communication Technology (ICT) Systems: online education and training; web-based e-governance; mobile phone-based e-commerce, vocational and entrepreneurial training; data management; machine learning; big data for analytics, decision-making, security and privacy; IT workforce development, networking systems, software engineering and development; and hub-based ITC education at the university and K-12 levels</p>