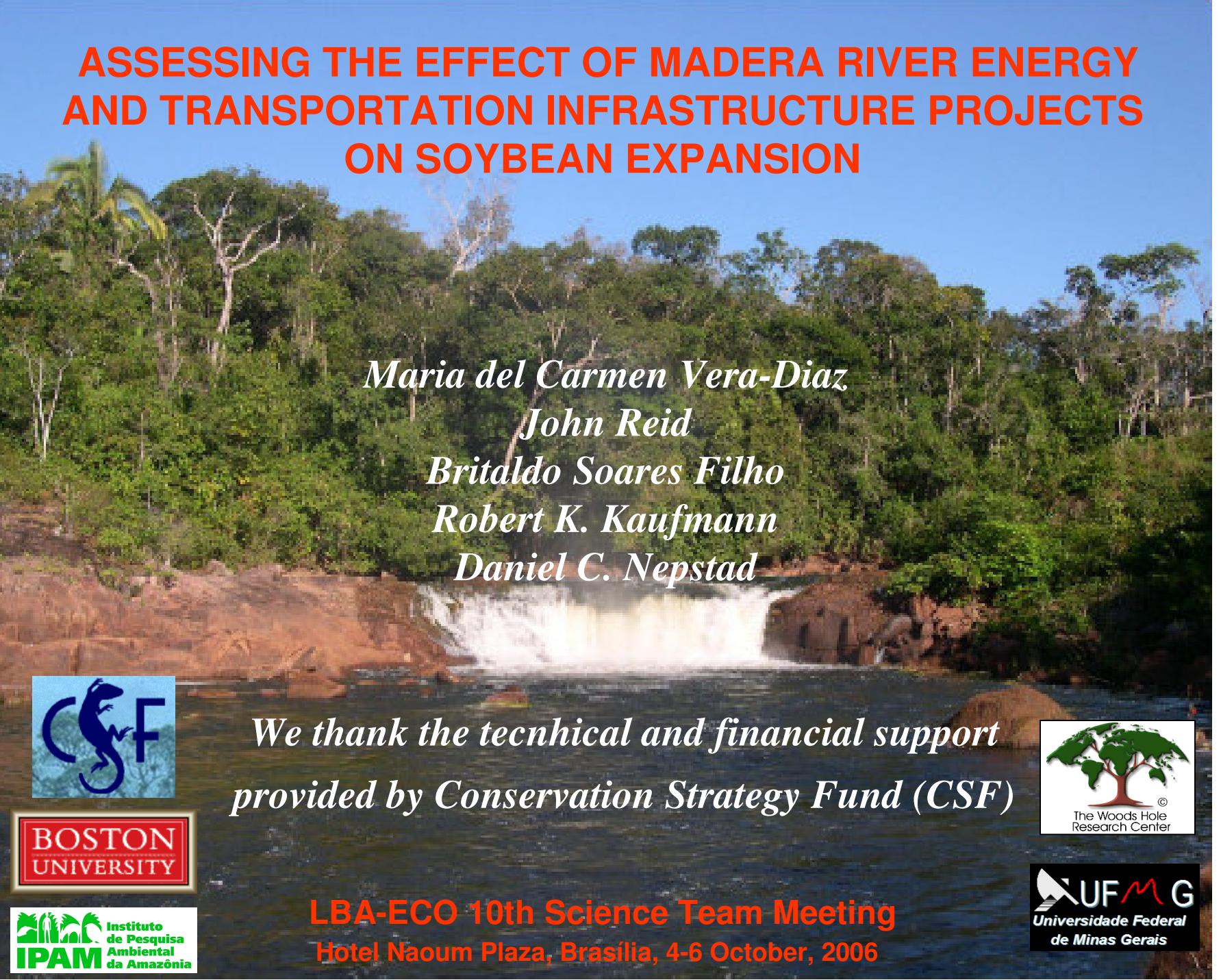


ASSESSING THE EFFECT OF MADERA RIVER ENERGY AND TRANSPORTATION INFRASTRUCTURE PROJECTS ON SOYBEAN EXPANSION



Maria del Carmen Vera-Diaz

John Reid

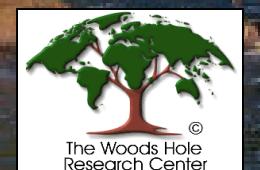
Britaldo Soares Filho

Robert K. Kaufmann

Daniel C. Nepstad



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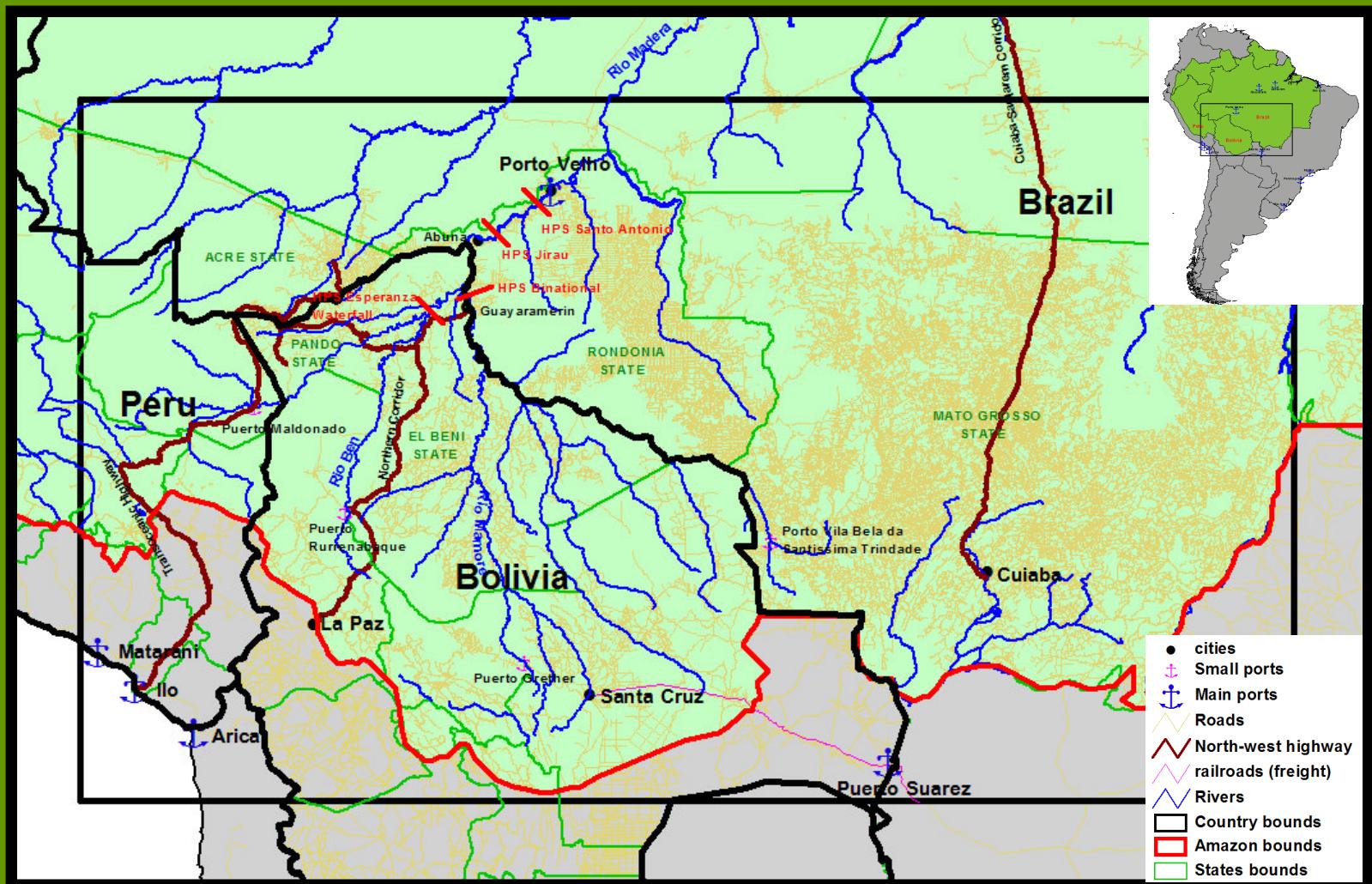


OBJECTIVES

- *To assess the effect on soybean spread by the construction of Hydro Power Stations and navigation channels on the Madera, Mamore, and El Beni Rivers and roads improvement in the Southeast Amazon Basin.*

- *To simulate POTENTIAL SOYBEAN RENT SCENARIOS integrating crop simulation models and econometric regression models.*

STUDY AREA



It covers 2.1 million km² in the border region of Bolivia-Brazil-Peru, in the Southeast Amazon Basin. This area would be directly affected by the Madera River Hydroelectric and Navigation Mega-projects and the road investments. Landscape is constituted by a mix of forest, grasslands, savannas and crops and large, meandering rivers.

MADERA RIVER HYDROELECTRIC AND NAVIGATION MEGAPROJECTS



Salto do Jirau



Cachoeira de Santo Antonio

Hydro Dams	Countries Influenced	River	Strecht to be navigable	Km
Santo Antônio and Jirau (Madera River)	Brasil	Madeira	Abunã - Porto Velho	270
Abunã-Guayaramerín (Mamoré River)	Brasil	Mamoré/Guaporé	Vila Bela SS Trindade - Abunã	1,565
	Bolivia	Mamoré	Puerto Grether - Costa Marques	780
Esperanza Falls (Beni River)	Brasil	Beni	Puerto Rurrenabaque - Mamoré	710
	Bolivia	Orthon	Puerto Rico - Beni	200
	Peru	Madre de Dios	Puerto Maldonado - Beni	630
Total				4,155

Source: Furnas/Odebrecht/Leme (2005)

PAVING ROADS



Northern Corridor
BOLIVIA



Transoceanic Highway
BRAZIL-PERU



Cuiabá-Santarém Corridor
BRAZIL

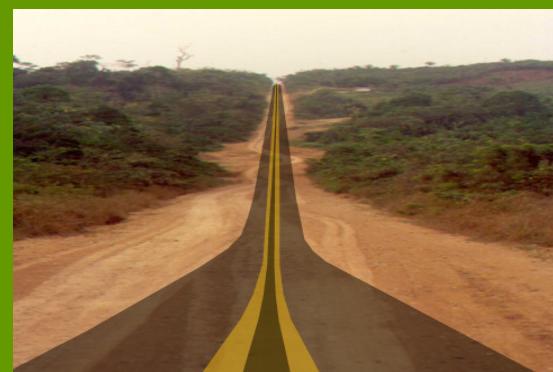
Roads Improvement	Country	Strech to be paved	Km
Northern Corridor	Bolivia	La Paz-Cobija-Guayaramerin	~1,200
Cuiabá-Santarém Corridor	Brazil	Cuiabá-Santarém	~1,000
Transoceanic Highway	Brazil-Peru	Rio Branco - Ilo	~ 600

ALTERNATIVE INFRASTRUCTURE SCENARIOS

INFRASTRUCTURE PROJECTS	SCENARIOS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Current Conditions	✓											
HPS Santo Antônio		✓	✓	✓	✓	✓	✓			✓		✓
HPS Jirau		✓	✓	✓	✓	✓	✓			✓		✓
HPS Abunã-Guayaramerín				✓	✓		✓	✓				
HPS La Esperanza					✓			✓				
Northern Corridor						✓	✓	✓	✓	✓	✓	✓
Cuiabá-Santarém Corridor										✓	✓	
Transoceanic Highway											✓	✓
Scenario Likelihood: High - Medium - Low		H	M	L	H	M	L	H	H	H	H	H



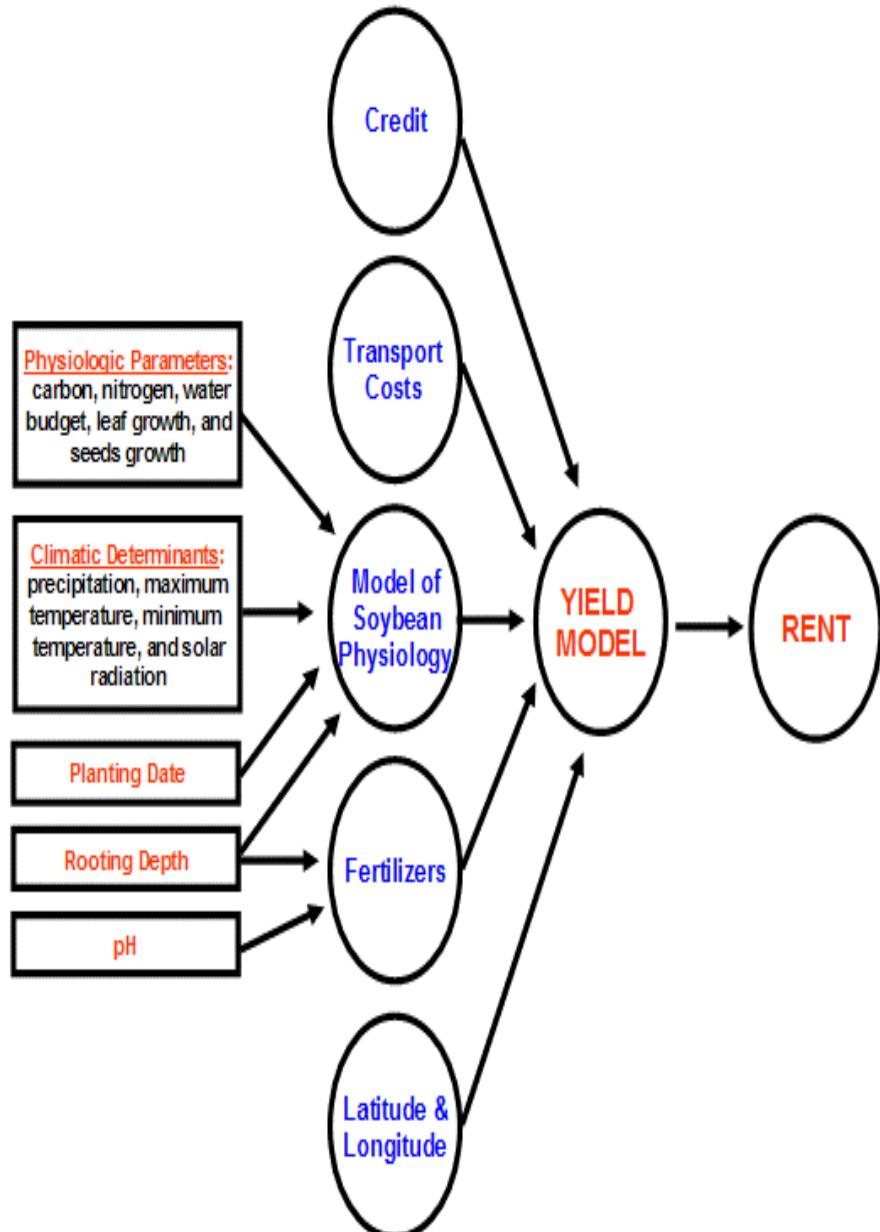
Hydro Power Stations - Navigation



Roads Paving



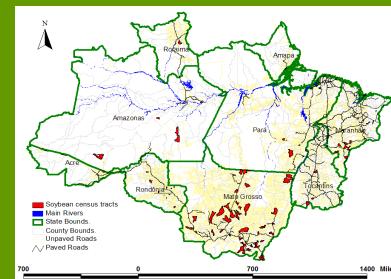
Interdisciplinary Model for Soybean Yield



Vera-Diaz, Maria del Carmen, R. Kaufmann, D. Nepstad, P. Schlesinger. An Interdisciplinary model of Soybean Yield in the Amazon Basin: the climatic, edaphic, and economic determinants. Accepted in Ecological Economics, August, 2006.

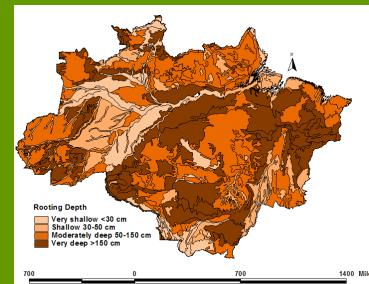
DATA SOURCES

Agricultural Census (1995-96)

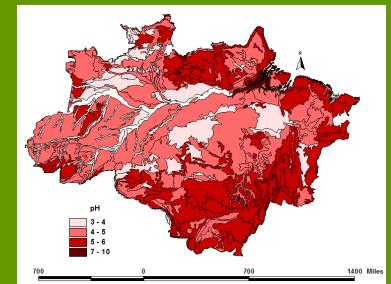


88 polygons

Soil Parameters

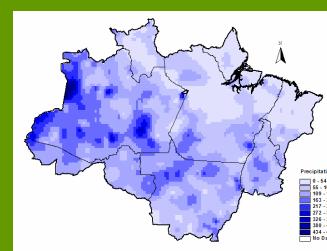


Rooting Depth

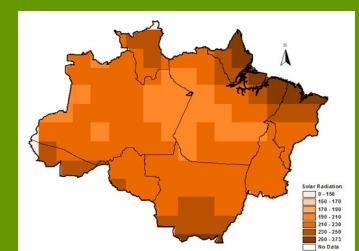


pH

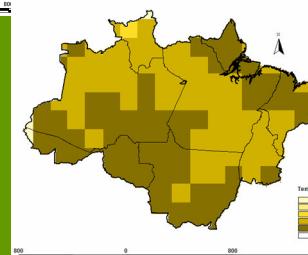
Climate Data



Precipitation



Solar Radiation

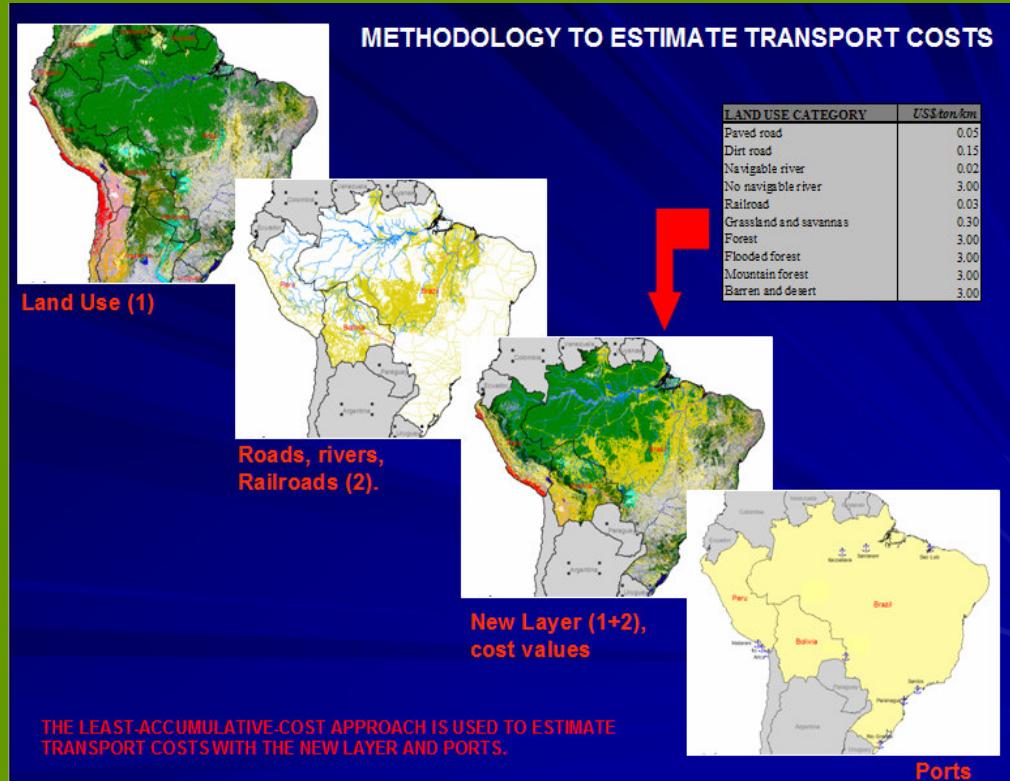


Temperature

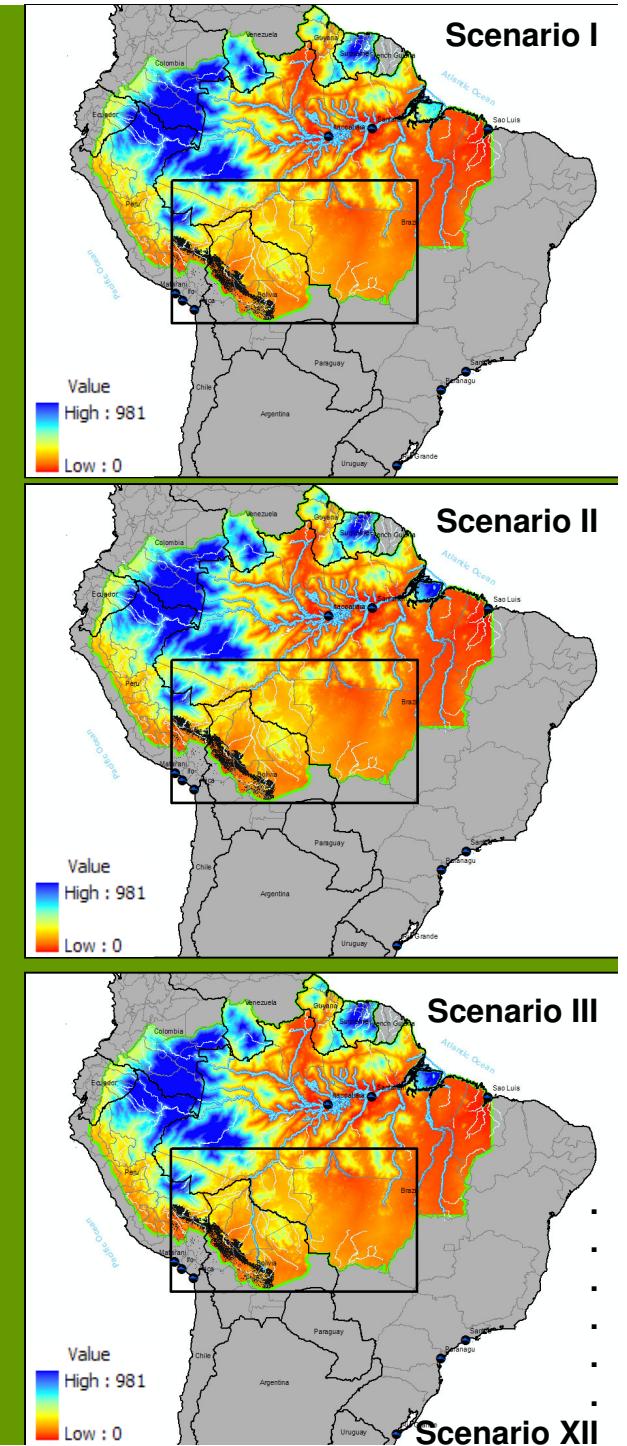


.....DATA SOURCES

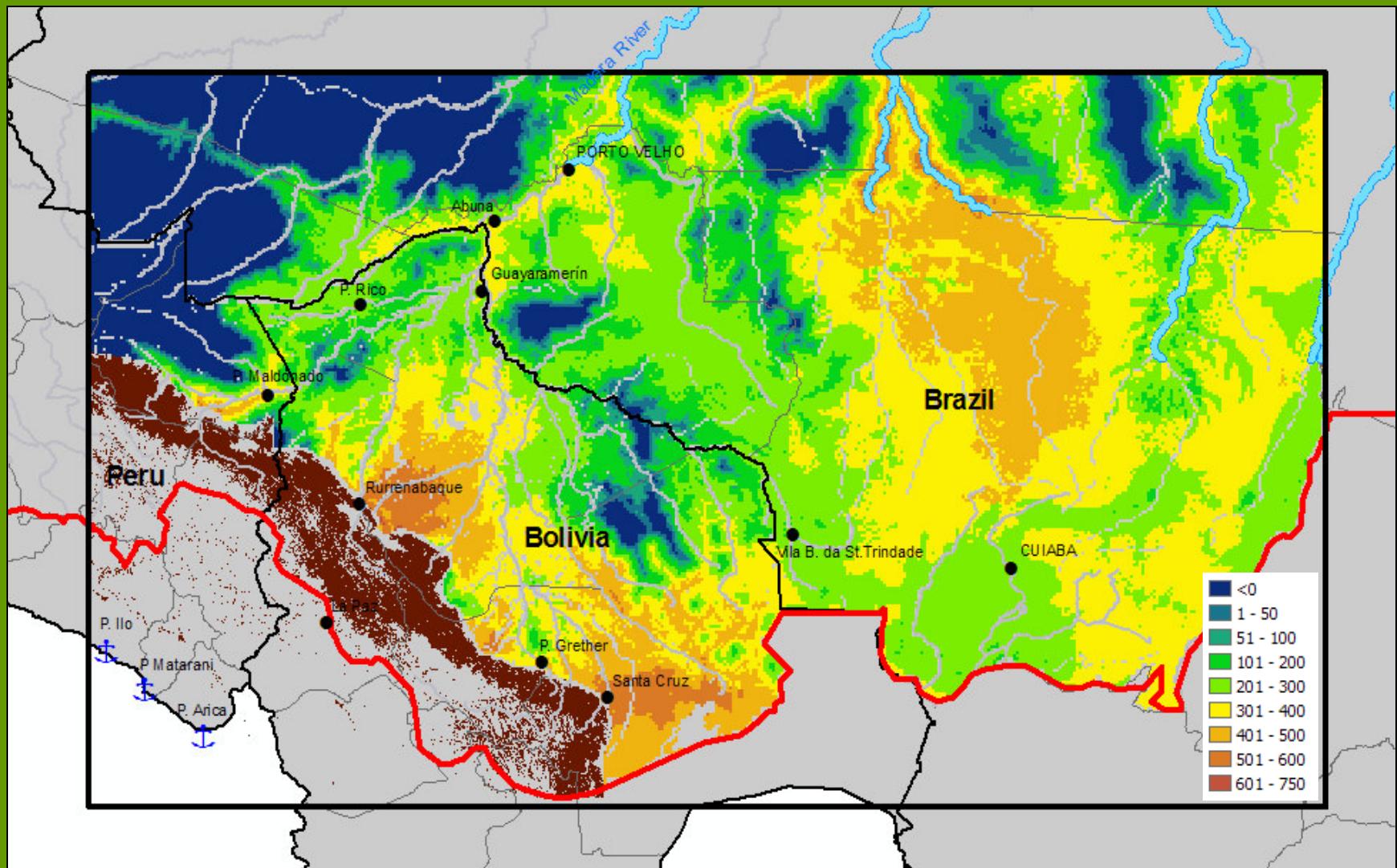
Transport Cost Surfaces



Least Cost Approach
Nearest soybean export port defined by the lowest cost path.

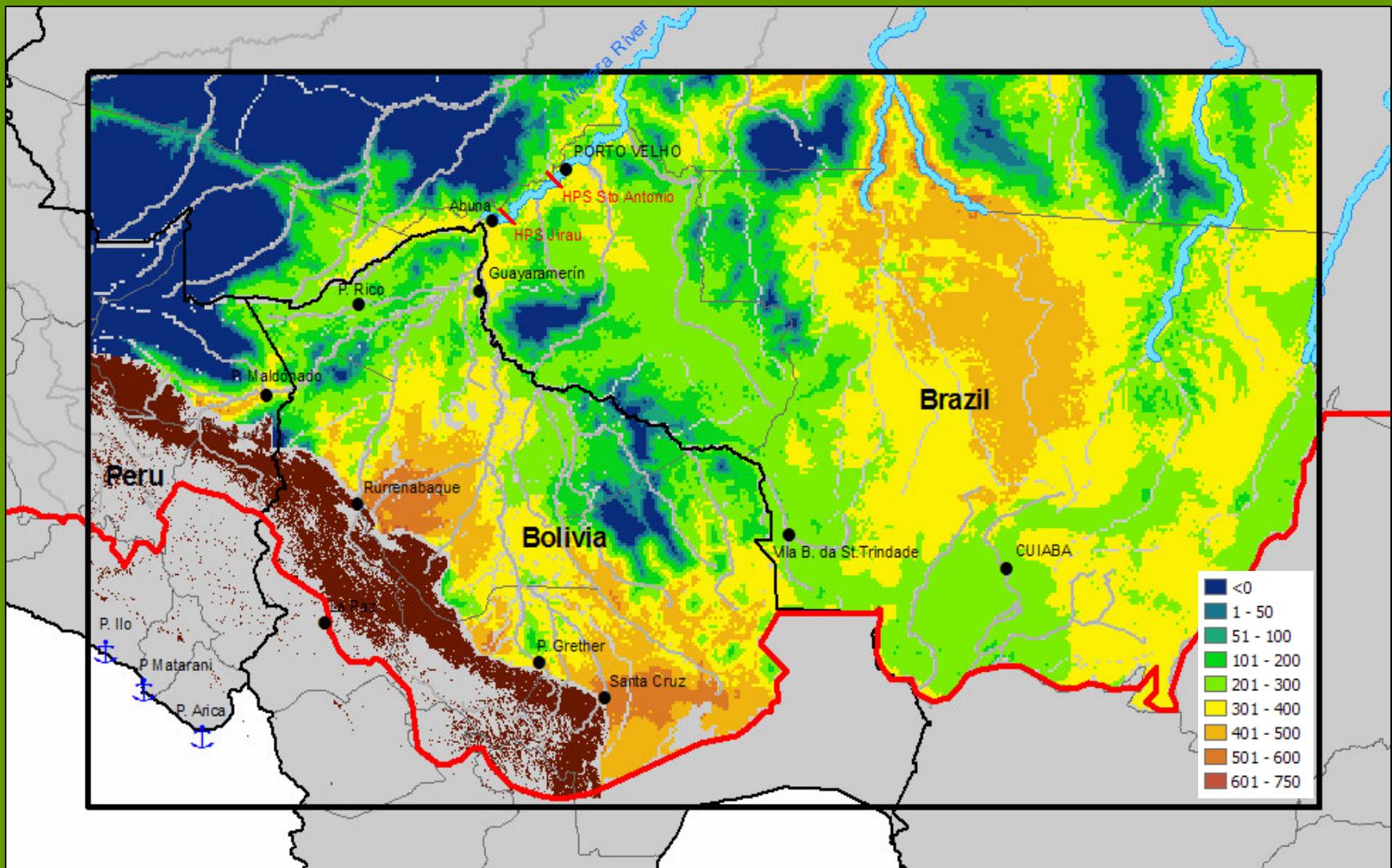


RENT - SCENARIO I – Current Conditions



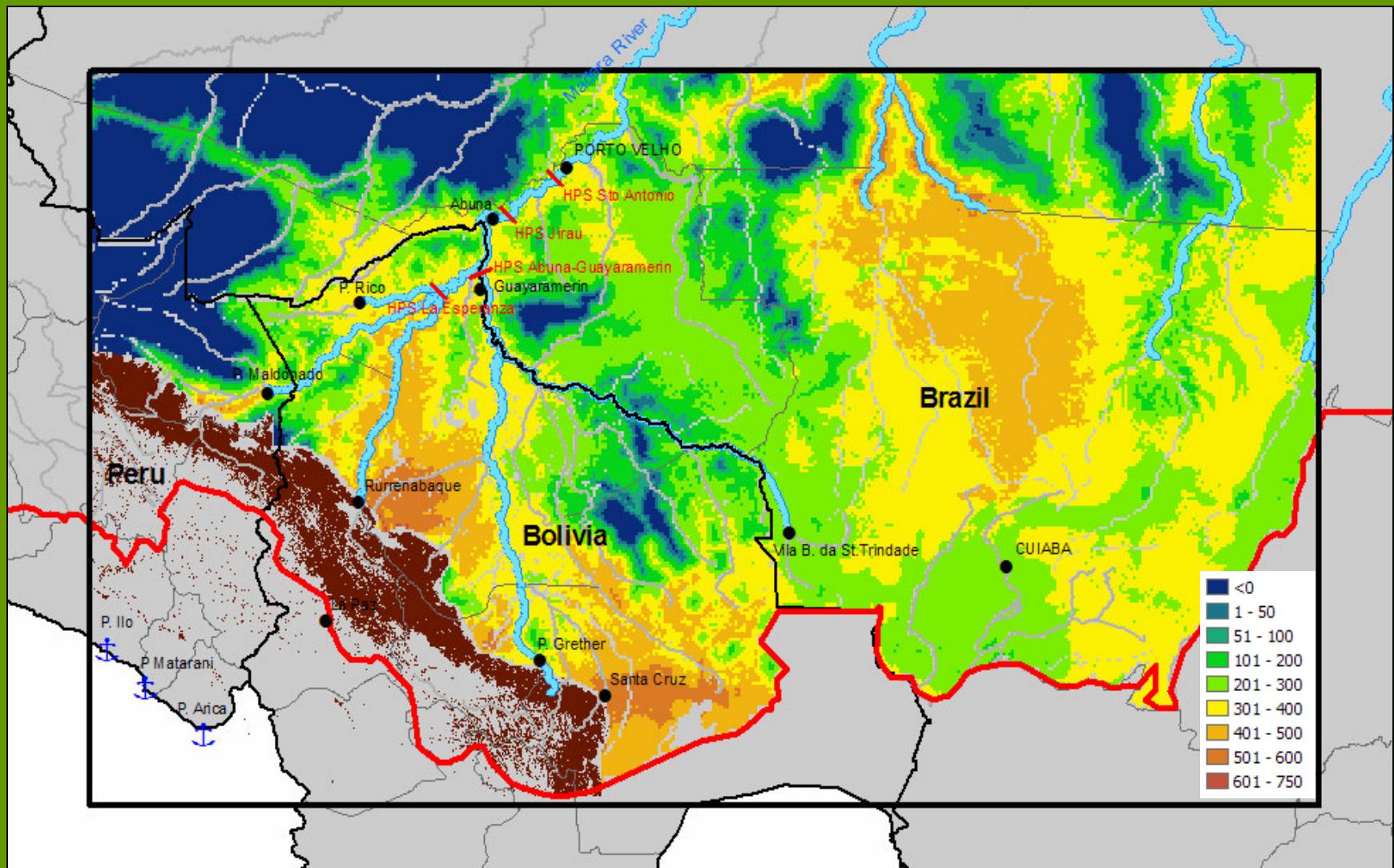
Under current conditions 853,000 km² (40%) of the study area have high rent potential to raise soybean crops (greater than \$300/ha). Forest lands (57%), agriculture lands (25%), and grasslands and savannas (15%). Most of areas with highest economic rents are located in Mato Grosso (60%) and Santa Cruz (14%). An area of 166,405 km² with high rent potential is located on indigenous lands and protected areas of Bolivia (52%), Brazil (46%), and Peru (1%).

RENT - SCENARIO II



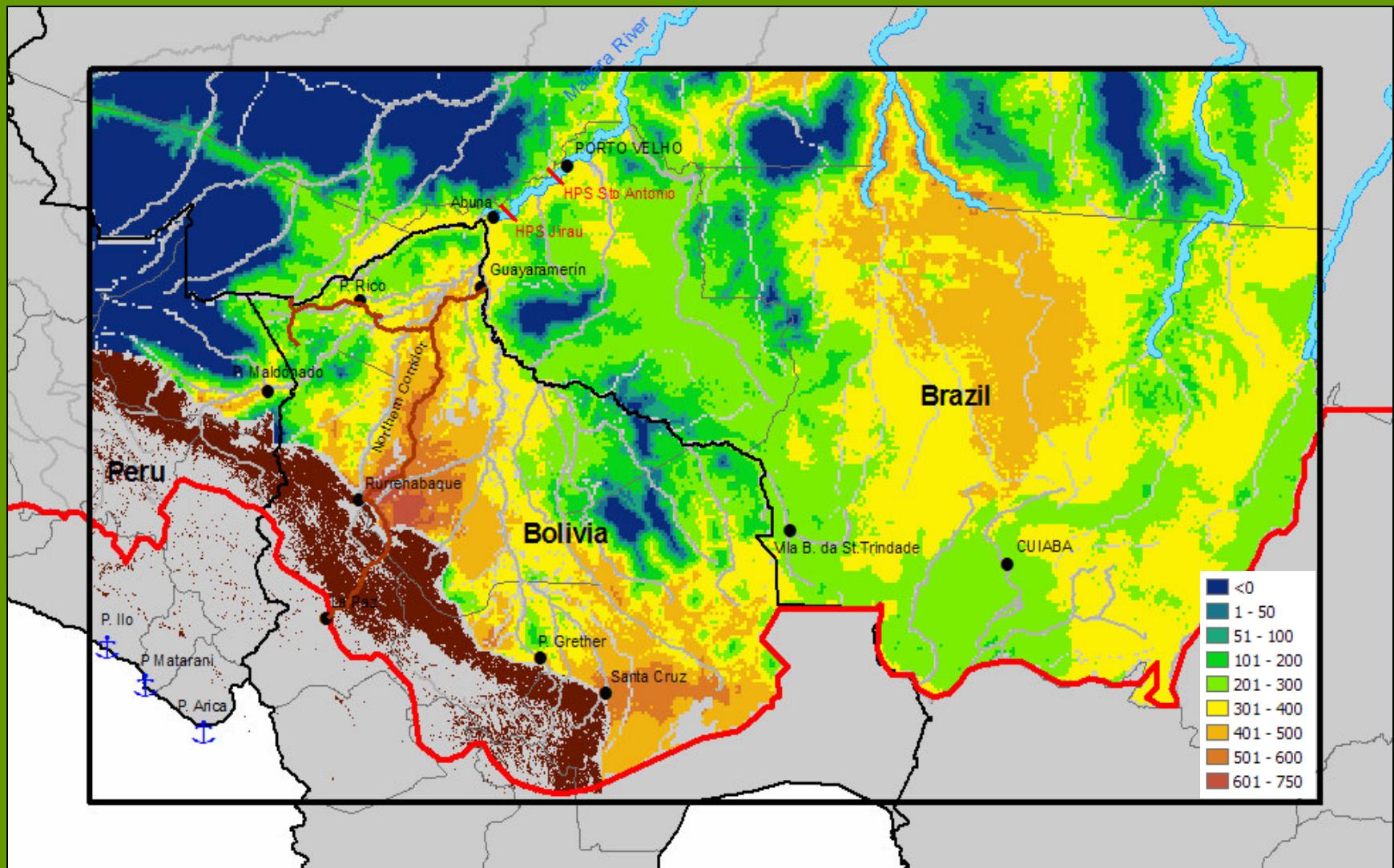
Hydro Powers: Jirau and Santo Antônio
Potential area with high rents = 860,000 km².
Minimal impact on soybean spread (less 1% increase)
Rondônia and Acre

RENT - SCENARIO IV



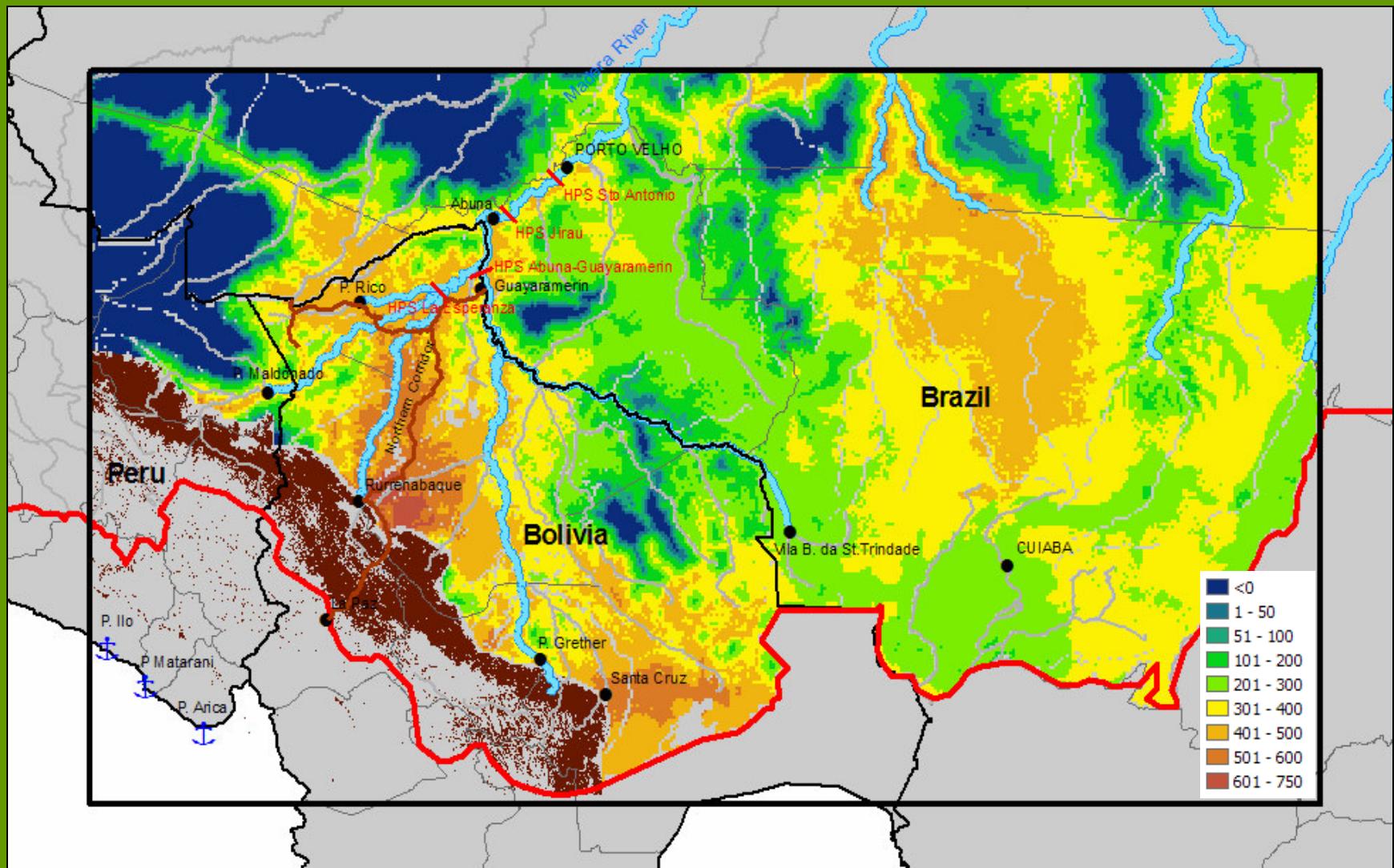
Hydro Powers: Jiraú, Santo Antônio, Abunã-Guayaramerin, and La Esperanza
Potential area with high rents = 928,000 km² or increase of 8%
Pando, El Beni, Acre, and Rondônia

RENT - SCENARIO V



Hydro Powers: Jiraú and Santo Antônio
Northern Corridor (La Paz-Cobija-Guayaramerin)
Potential area with high rents = 912,000 km² or increase of 6%
El Beni and Pando

RENT - SCENARIO VII



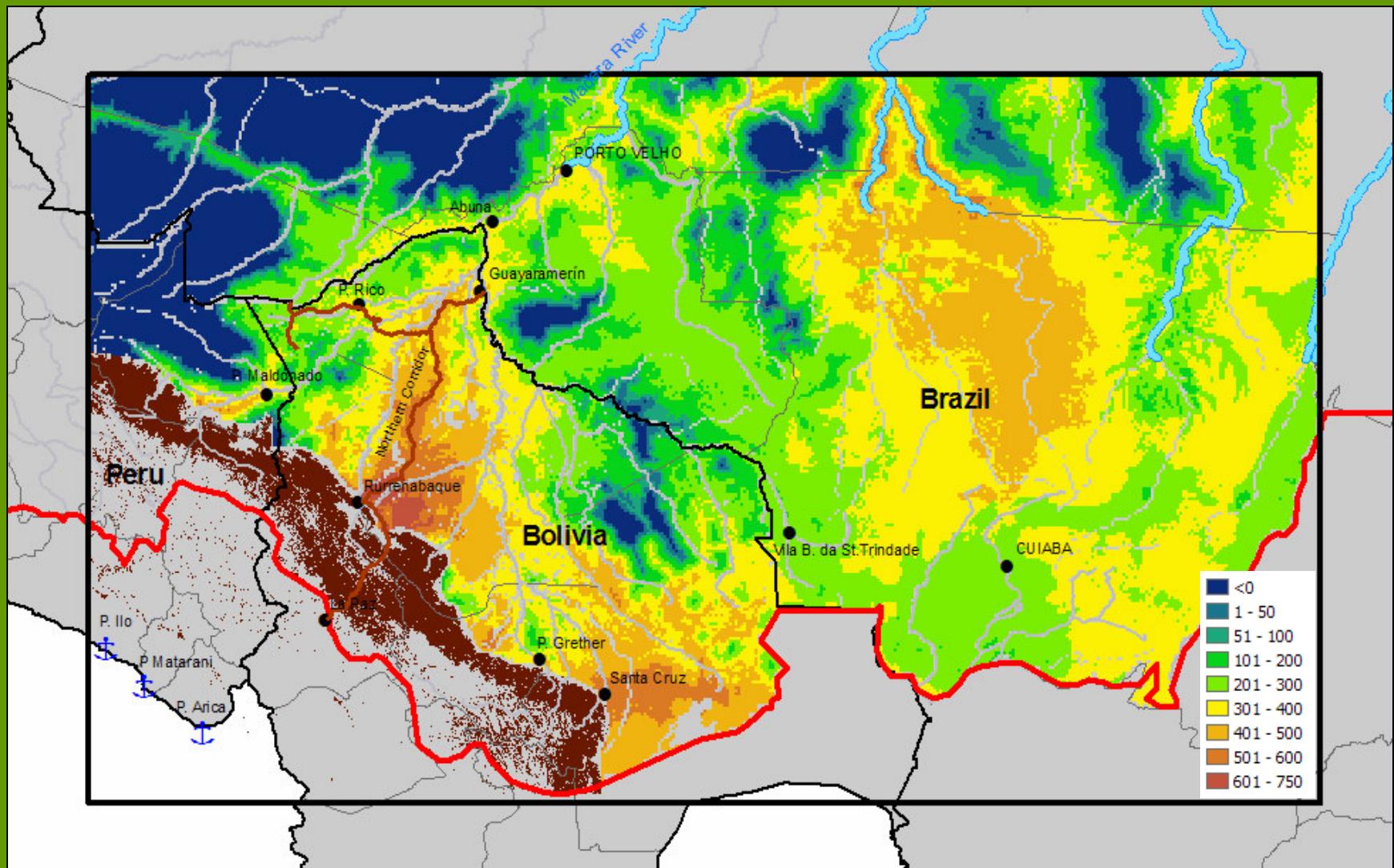
4 Hydro Power Stations

Northern Corridor (La Paz-Cobija-Guayaramerin)

Potential area with high rents = 996,000 km² or increase of 15%

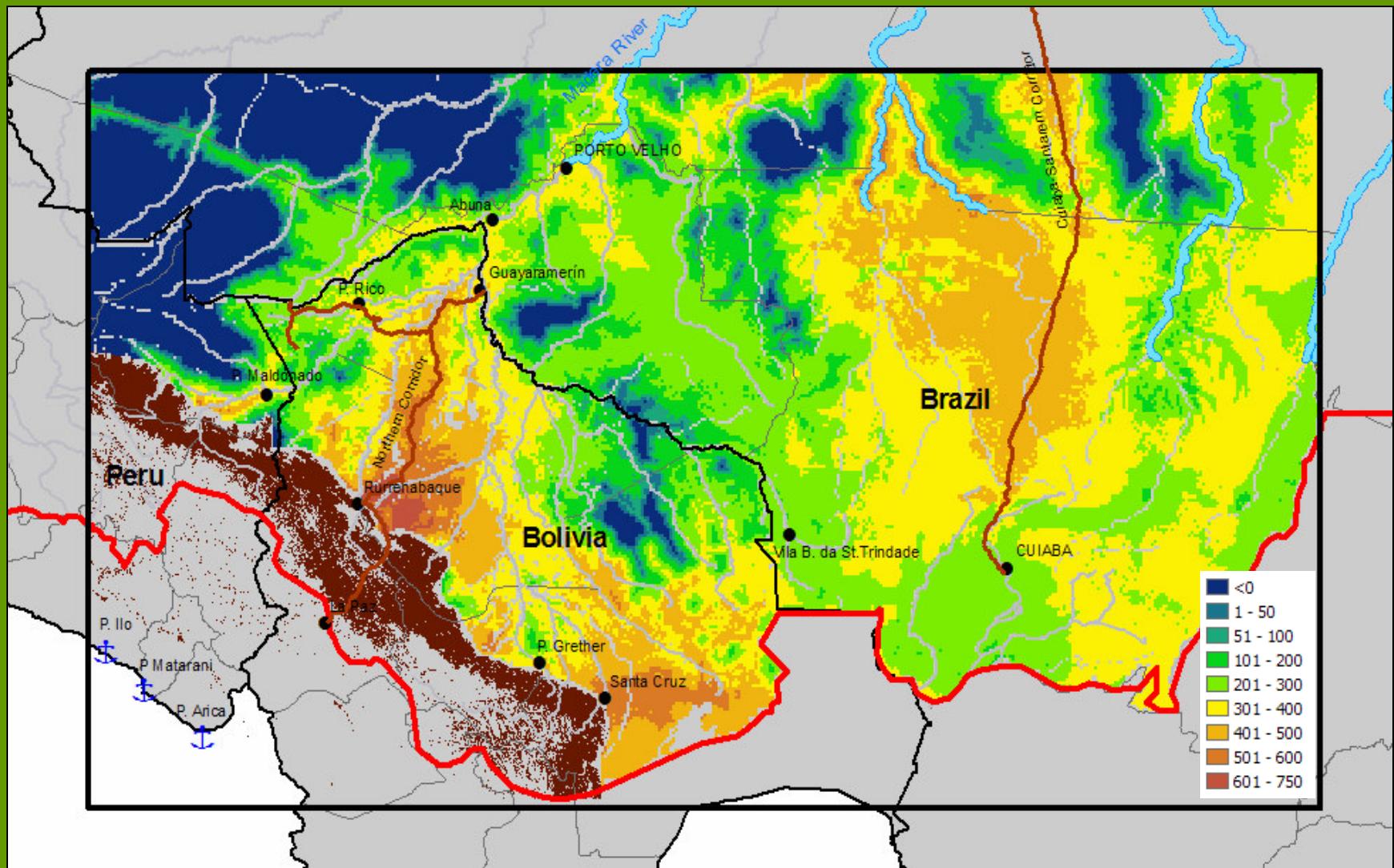
Pando, El Beni, Acre, and Rondônia

RENT - SCENARIO VIII



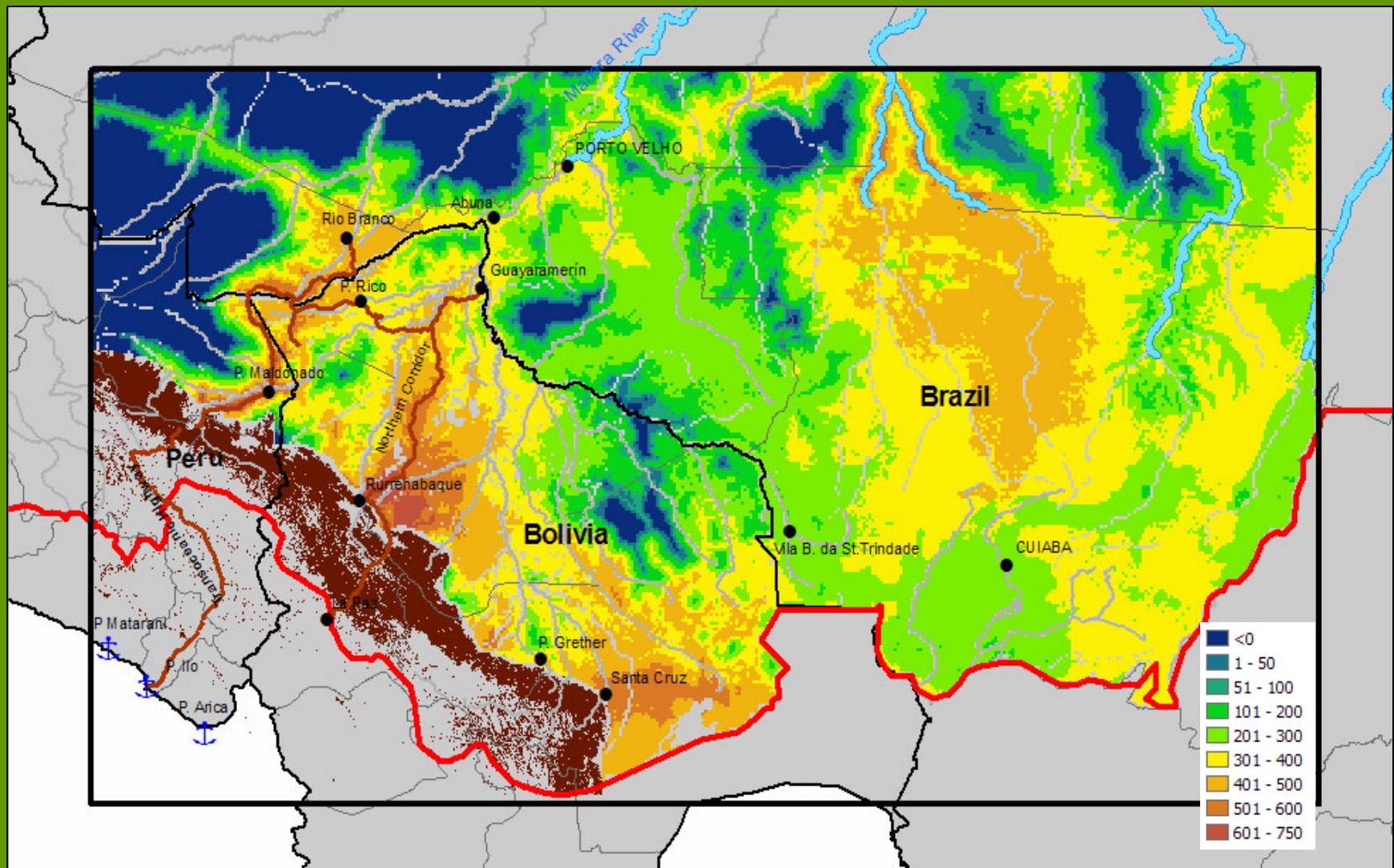
Northern Corridor (La Paz-Cobija-Guayaramerin)
Potential area with high rents = 906,000 km² or increase of 5%
El Beni and Pando

RENT - SCENARIO IX



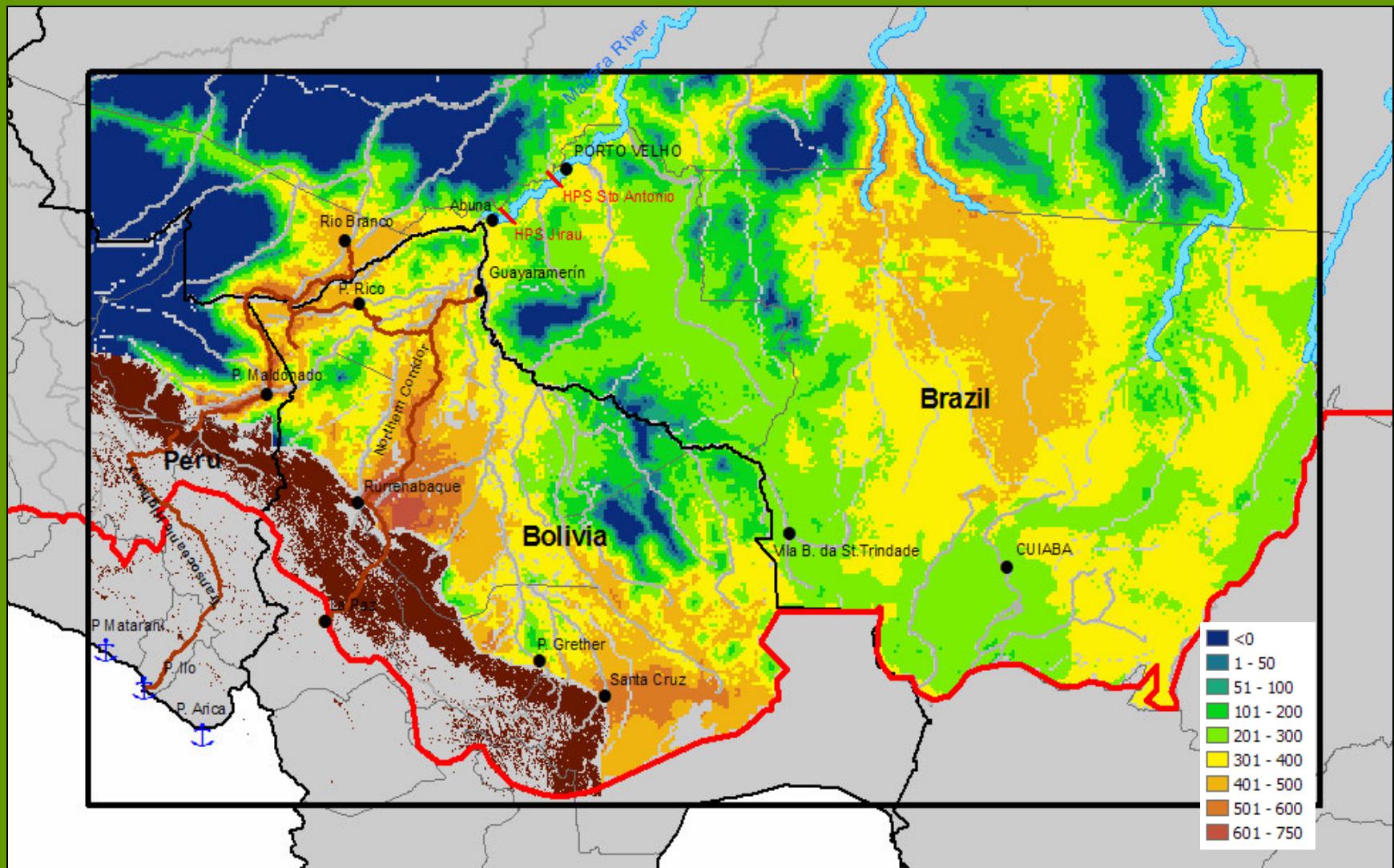
Northern Corridor and Cuiabá-Santarém Corridor
Potential area with high rents = 930,000 km² or increase of 9%
El Beni, Pará, and Pando

RENT - SCENARIO XI



Northern Corridor and Transoceanic Highway
Potential area with high rents = 974,000 km² or increase of 13%
Pando, El Beni, Acre, and Madre de Dios

RENT - SCENARIO XII



Hydro Powers: Jirau and Santo Antônio
Northern Corridor and Transoceanic Highway
Potential area with high rents = 976,000 km² or increase of 13%
Pando, El Beni, Acre, and Madre de Dios

Scenarios	Area Total		Increase	
	km ²	km ²	%	
I	853,474	-	-	
II	860,068	6,595	1	
III	875,738	22,264	3	
IV	927,526	74,052	8	
V	912,733	59,260	6	
VI	929,401	75,928	8	
VII	996,223	142,750	15	
VIII	906,441	52,968	5	
IX	930,914	77,440	9	
X	937,206	83,732	9	
XI	974,685	121,212	13	
XII	976,803	123,329	13	



Scenario XII – with high probability of medium-term implementation – would be the more economic and ecological impacting. The construction of the Jirau and Santo Antônio hydro power plants and the pavement of Northern Corridor and Transoceanic Highway would expand the area with potential for high rents in 123,000 km². 30% of this increase would impact protected areas and indigenous lands. Rainforest would be the most affected by this soybean expansion.

Scenario II - with high probability of medium-term implementation – would provoke reduced impact on soybean spread. However, although reduced, this impact would achieve indigenous lands located nearby to Porto Velho city as Karitiana, which is home for roughly 100 indigenous people practicing shifting cultivation.



Conclusions

- ❖ Our results indicate that the border region of Bolivia-Brazil-Peru, in the Southeast Amazon Basin, have a high rent potential for raising soybeans, which would be expanded by the future navigation mega-projects and road improvements.
- ❖ In all scenarios we constructed (except for Scenario II), the northern Bolivia would be the most impacted in economic and ecological terms by the new infrastructure projects, and specifically the states of El Beni and Pando. The Beni Biological Station (EBB) would be one of the protected areas threatened by the spread of soybean cultivation. Nevertheless, the state of Mato Grosso (Brazil) would continue holding the first place in terms of total area with high potential rents for soybean cultivation.
- ❖ Roads improvements showed to be more relevant for the expansion of soybean crops in the study area and could provoke also greater ecological impacts.
- ❖ The construction of dams, although shows less impact than road paving on soybean expansion, would cause a multiplicity of ecological and economic impacts that characterize this type of energy investments (high impact on the aquatic life, interrupting fish migration routes and reducing fish diversity, interruption of sediment transport, increase of the ground water level, flooding, and alteration on the quality and dynamic of the hydrological resources).