INDEPENDENT Evaluation Office
United Nations Development Programme

DEval
GERMAN INSTITUTE FOR DEVELOPMENT EVALUATION

وزارة التخطيط والمتابعة والإصلاح الإداري
Ministry of Planning, Monitoring and Administrative Reform

LEAVING NO ONE BEHIND: EVALUATION for 2030

2019 National Evaluation Capacities Conference

Identifying Climate Vulnerability Hotspots in Costa Rica

German Institute for Development Evaluation (DEval)

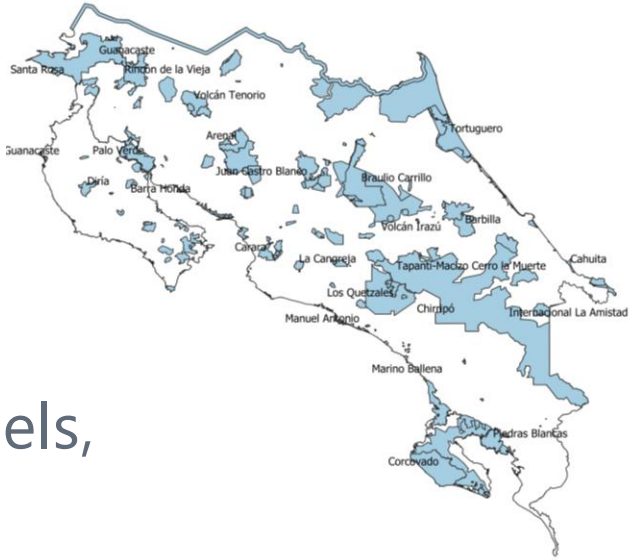
Raphael Nawrotzki, Marina Vogel, Sven Harten

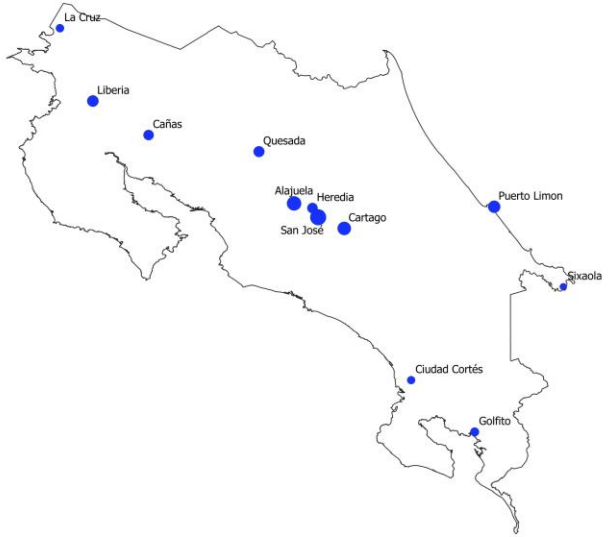
@undp_evaluation

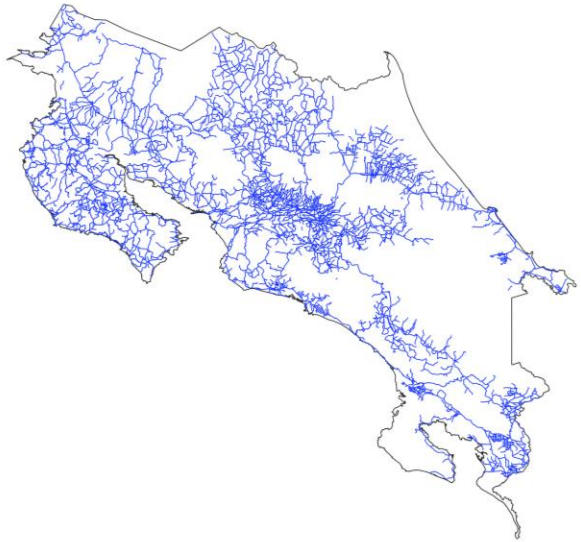
#NECdev

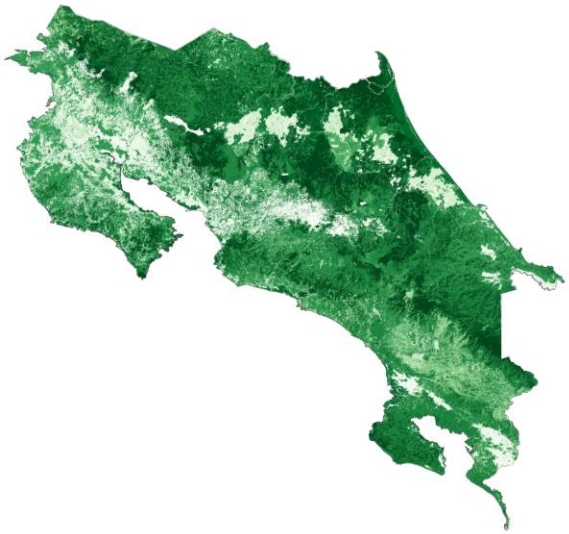
When to use Geodata?

- Many forms of Geodata
- Many types of Analysis using Geodata
  - Simple Mapping, Spatial Regression Models, Geospatial Impact Evaluations

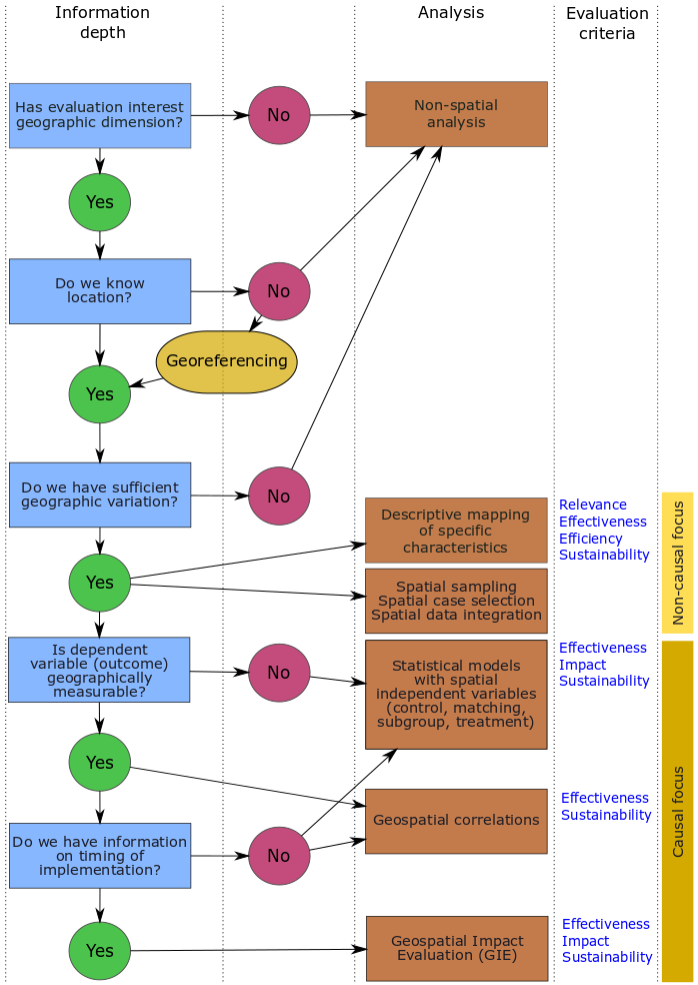








The Geodata Decision Tree



https://www.deval.org/en/policy-briefs.html

DEval Policy Brief 3/2019

THE GEODATA DECISION TREE: USING GEODATA FOR EVALUATIONS

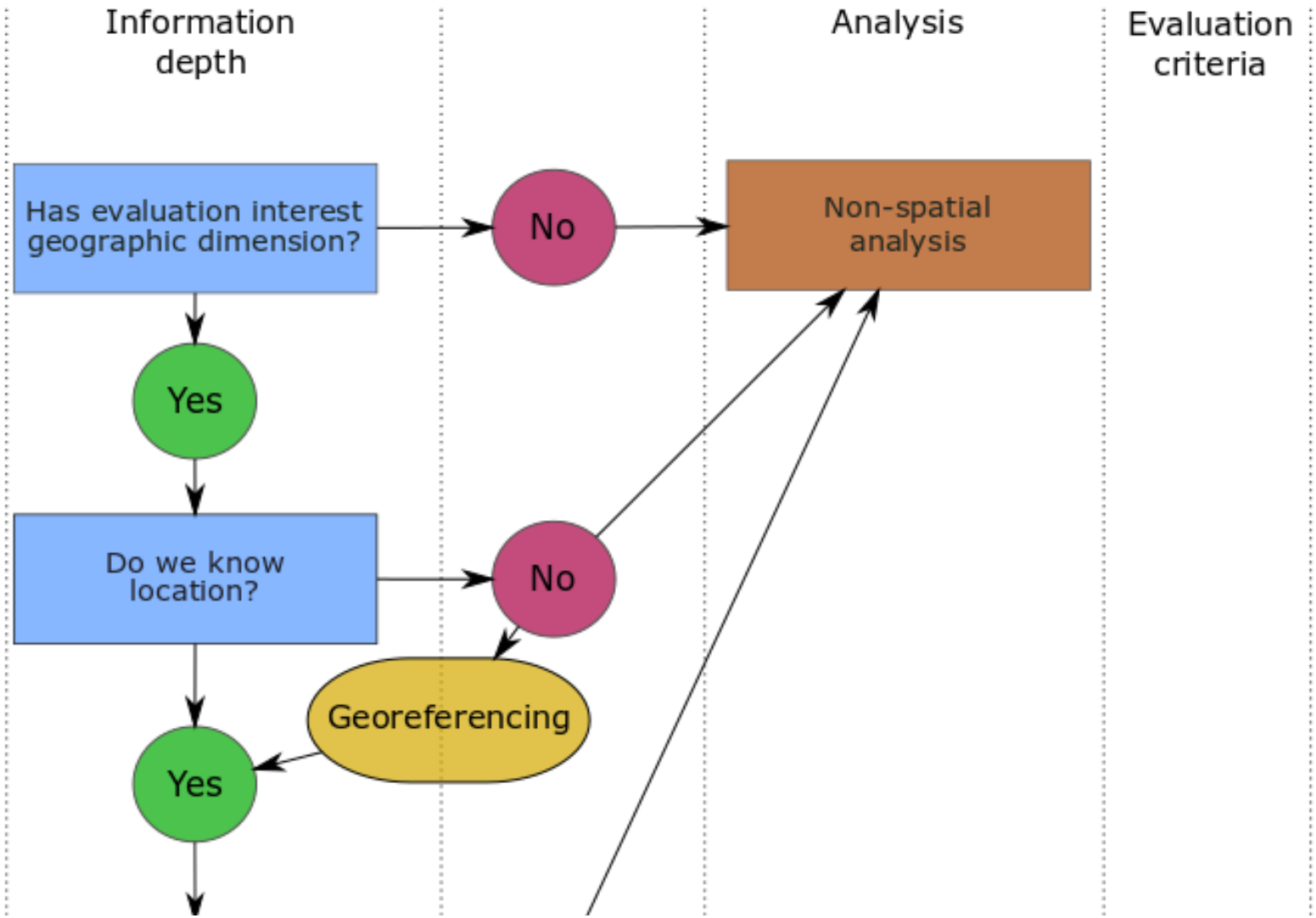
Summary

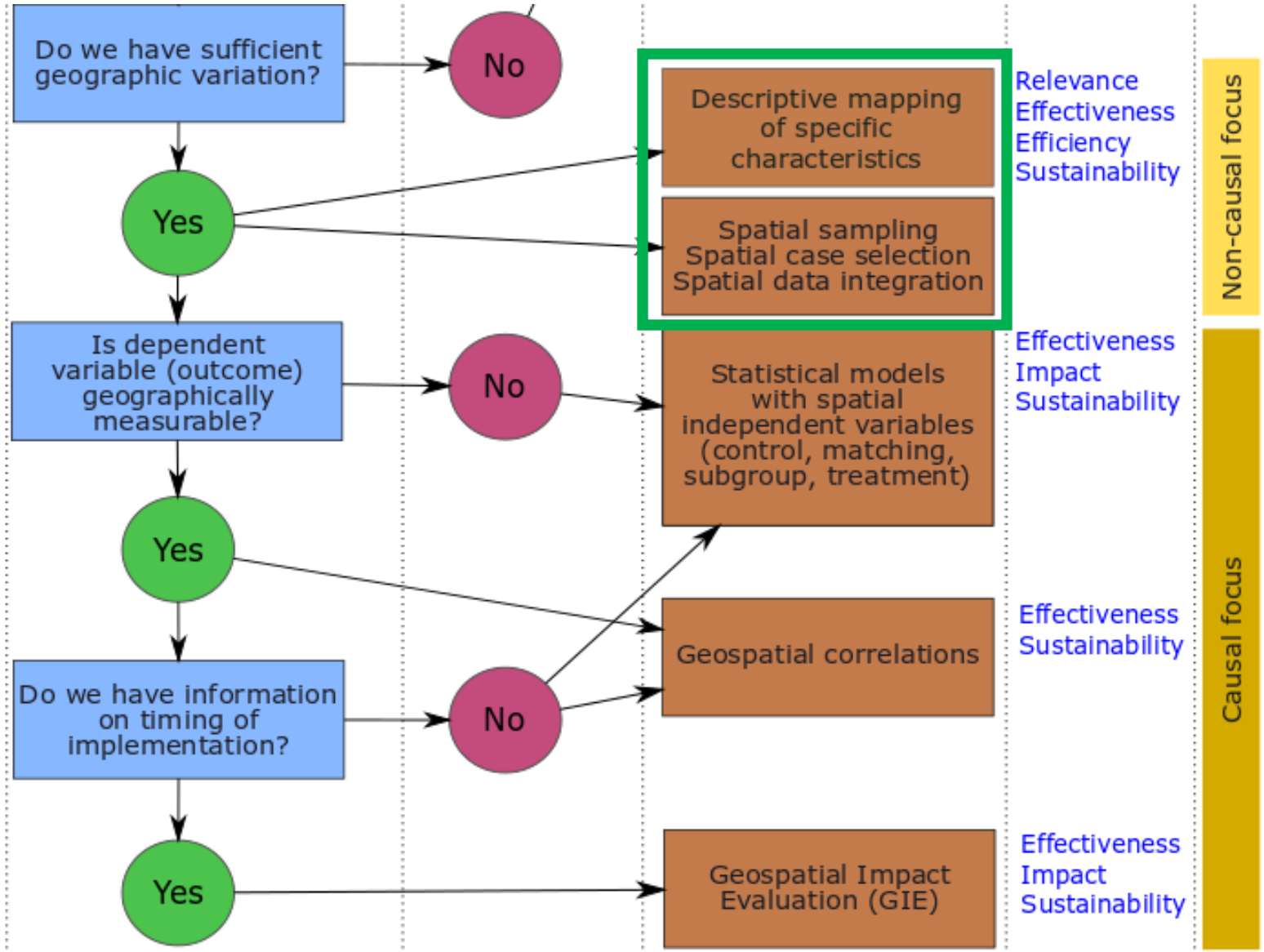
When evaluating programmes that have a clear spatial dimension, the use of geographic data (Geodata) and methods offer many benefits: Geodata constitute an objective measure of environmental change, are more cost-effective than survey data, allow evaluations in remote or dangerous locations, and permit the retrospective collection of baseline data. This article introduces the Geodata Decision Tree as a set of guiding questions that help evaluators to decide when and how to use Geodata. The geographic methods range from a simple mapping of spatial characteristics to sophisticated Geospatial Impact

images of about 0.5 meters currently available from satellites such as WorldView or GeoEye.

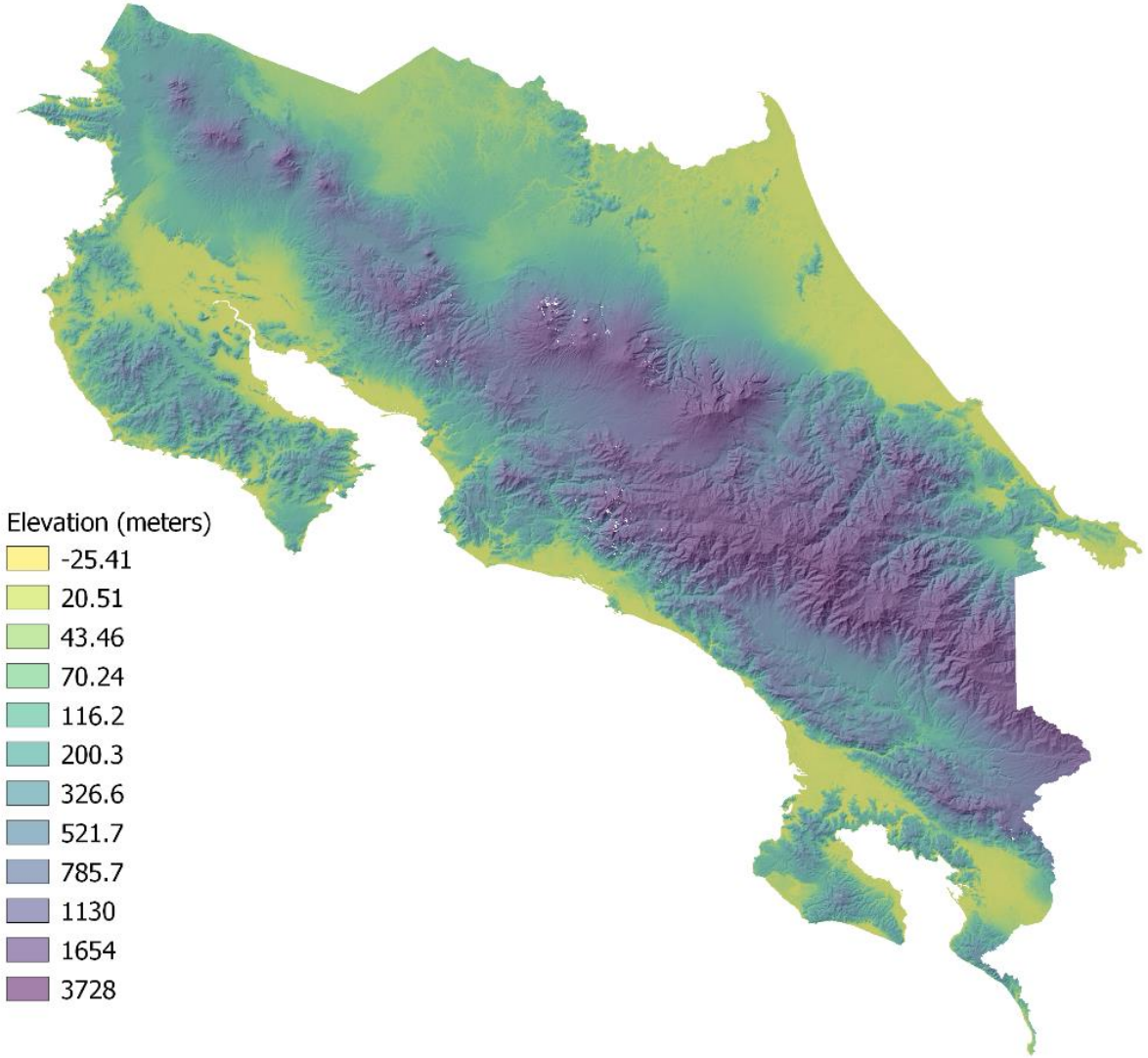
Why are Geodata useful?

Many projects and programmes that address topics such as climate change, infrastructure development, poverty distribution, or conflict have a clear geographic dimension. When we evaluate such programmes, geographic data may offer unique insights into the development–environment nexus. While, in the past, evaluators collected predominantly survey data, geographic data have some major advantages.


Information depth
Analysis
Evaluation criteria
Has evaluation interest geographic dimension?
No
Non-spatial analysis
Yes
Do we know location?
No
Georeferencing
Yes


Do we have sufficient geographic variation?
No
Yes
Descriptive mapping of specific characteristics
Spatial sampling
Spatial case selection
Spatial data integration
Relevance
Effectiveness
Efficiency
Sustainability
Non-causal focus
Is dependent variable (outcome) geographically measurable?
No
Statistical models with spatial independent variables (control, matching, subgroup, treatment)
Effectiveness
Impact
Sustainability
Yes
Geospatial correlations
Effectiveness
Sustainability
Causal focus
Do we have information on timing of implementation?
No
Yes
Geospatial Impact Evaluation (GIE)
Effectiveness
Impact
Sustainability

Identifying climate vulnerability hotspots in Costa Rica

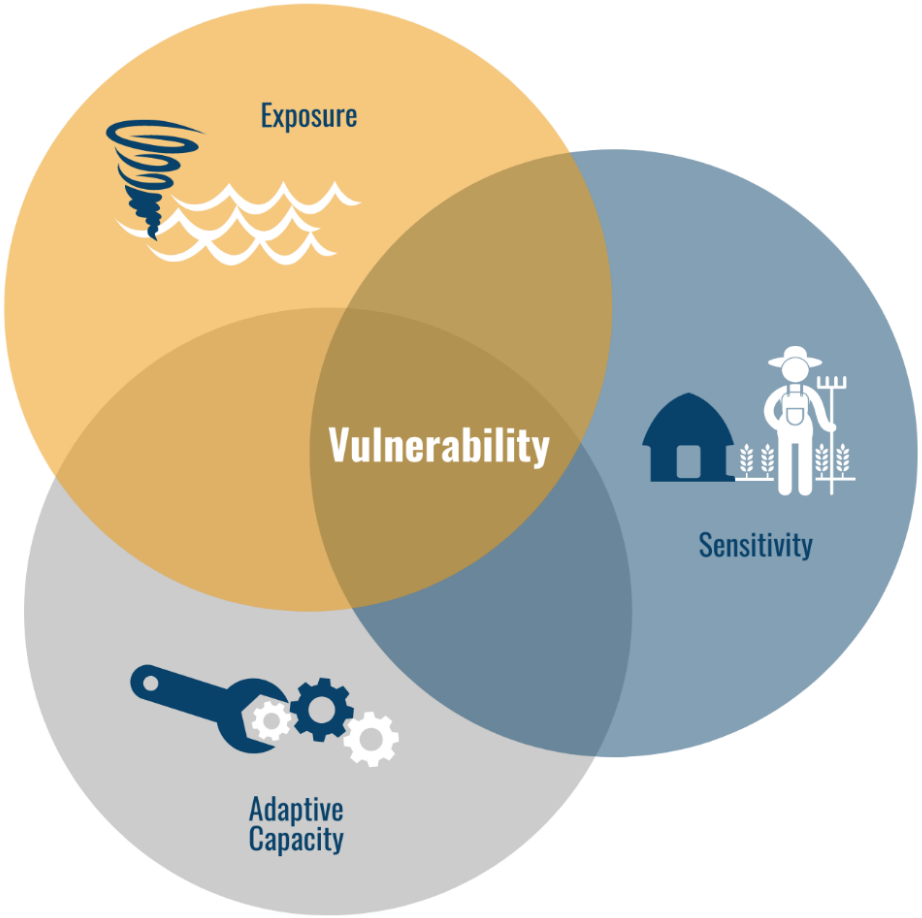


Background

- Climate change is an global issue addressed by SDG 13
- Increasing number of development programs deal with climate change adaptation
- Need to evaluate climate change adaptation programs
- Important to know which regions are particularly vulnerable
- Most climate vulnerability indices at national level
- Sub-national climate vulnerability indices for few countries
- Goal to construct a sub-national climate vulnerability index using Costa Rica as example

Conceptual Framework

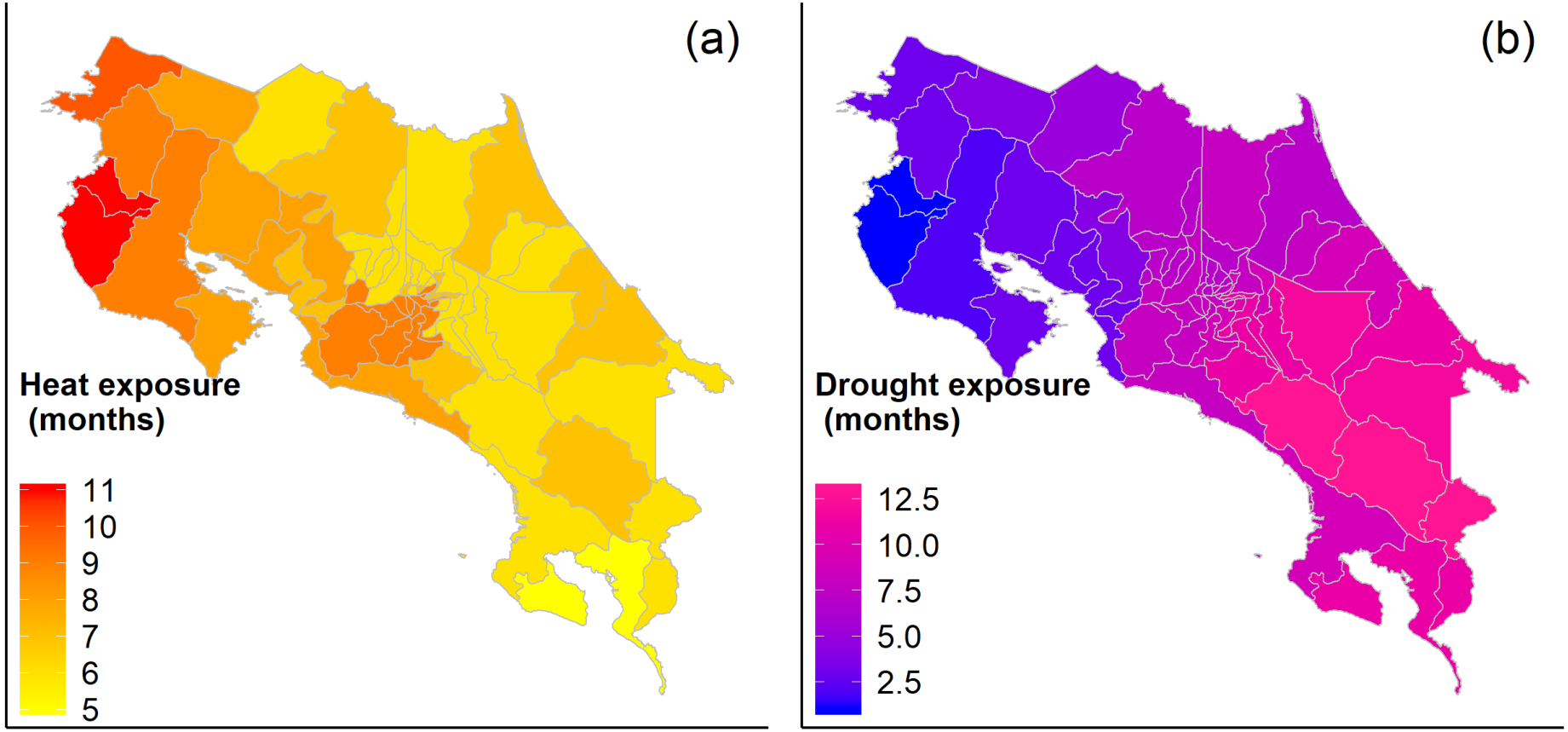
- Vulnerability = (Exposure + Sensitivity) - Adaptive capacity



Data Sources

Component	Layer	Year	Source
Exposure	Heat months	1961-2013	CRU-TS (via IPUMS-Terra)
	Drought months	1961-2013	CRU-TS (via IPUMS-Terra)
	Flood risk - Vicinity to rivers	2014	ArcGIS Online
	Flood risk - Coastal flooding	2000	SRTM 30 Meter Digital Elevation Model
	Flood risk - Land cover class	2015	Landsat 8 (processed by East View Geospatial)
	Flood risk - Flat slope	2000	SRTM 30 Meter Digital Elevation Model
	Flood risk - Impermeability of soil	2015	Centro de Investigaciones Agronomicas - CIA
Sensitivity	Asset index	2011	IPUMS international
	Work in climate sensitive industry	2011	IPUMS international
	Population density	2015	INEC
	Tree cover	2015	Landsat 8 (processed by East View Geospatial)
Adaptive capacity	Employment	2011	INEC
	Literacy	2011	INEC
	Remittances received	2011	INEC
	Infant mortality	2011	INEC
	Road density	2016	ArcGIS Online
	Distance from health centers	2004	Ministerio de Salud de Costa Rica

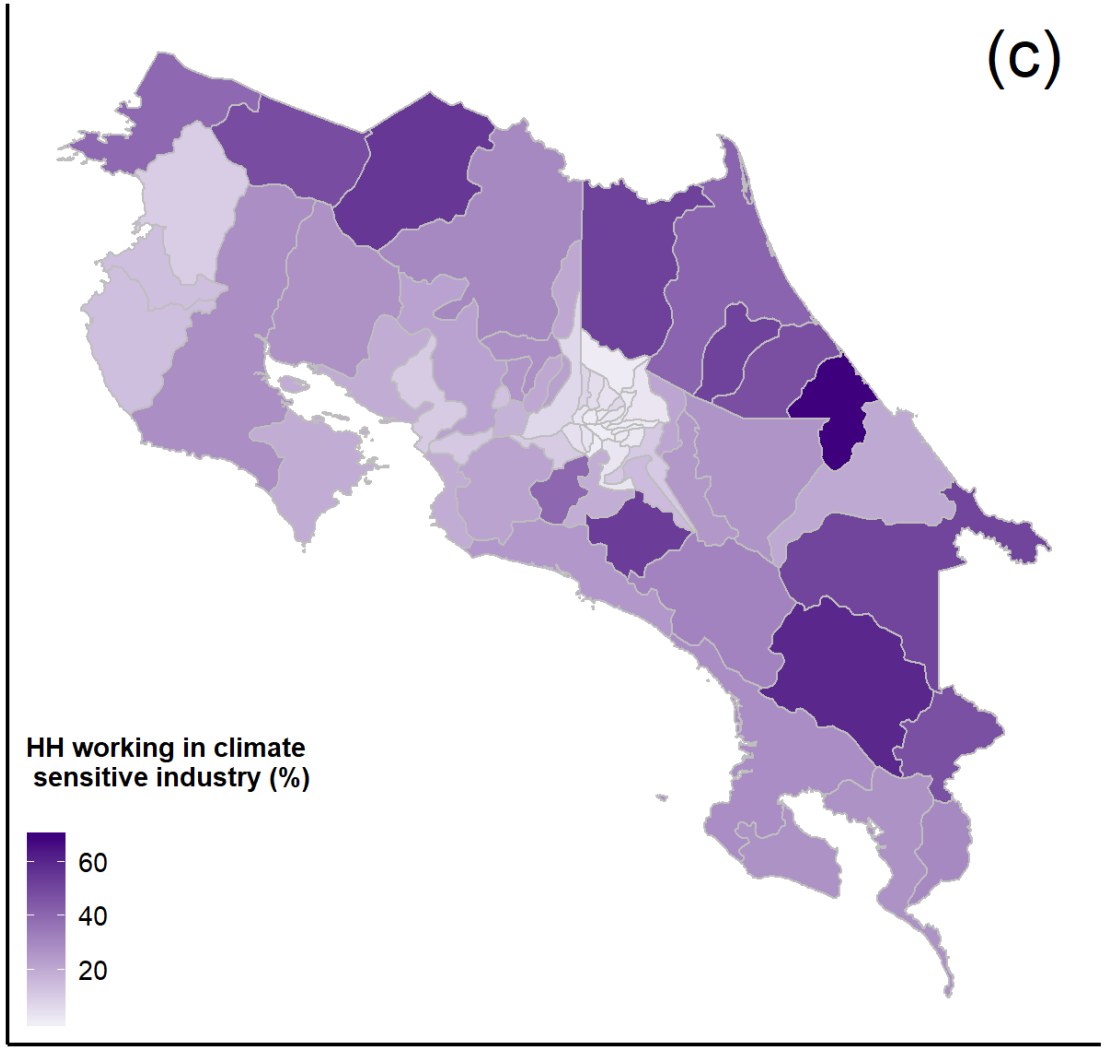
Exposure



Count of months during observation period (2011-2013; 36 months) during which temperature was higher (>1SD) or precipitation was lower (<1SD) than average monthly temperature during the 30-years (1961-1990) climate normal baseline period.

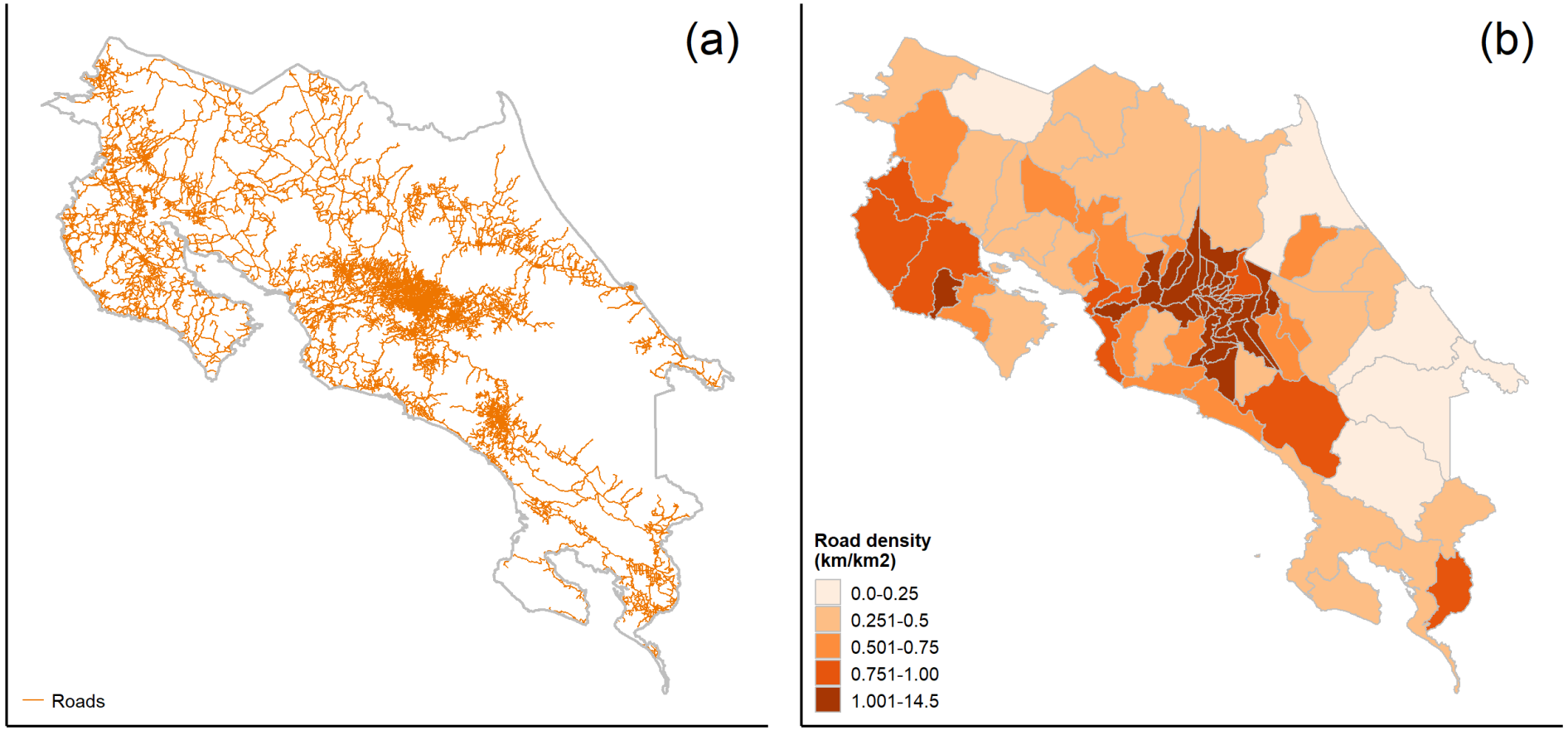
Sensitivity

- Work in climate sensitive industry (Fishing, Agriculture, Forestry)



Adaptive capacity

Road density



Dimension sub-index

Normalization

$$Y_{ij} = \frac{X_{ij} - \min(X_{ij})}{\max(X_{ij}) - \min(X_{ij})}$$

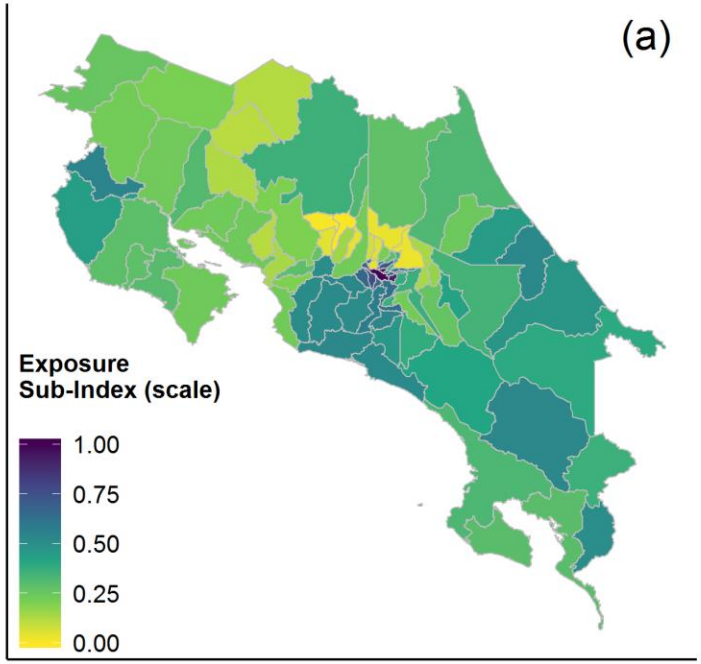
Weighting

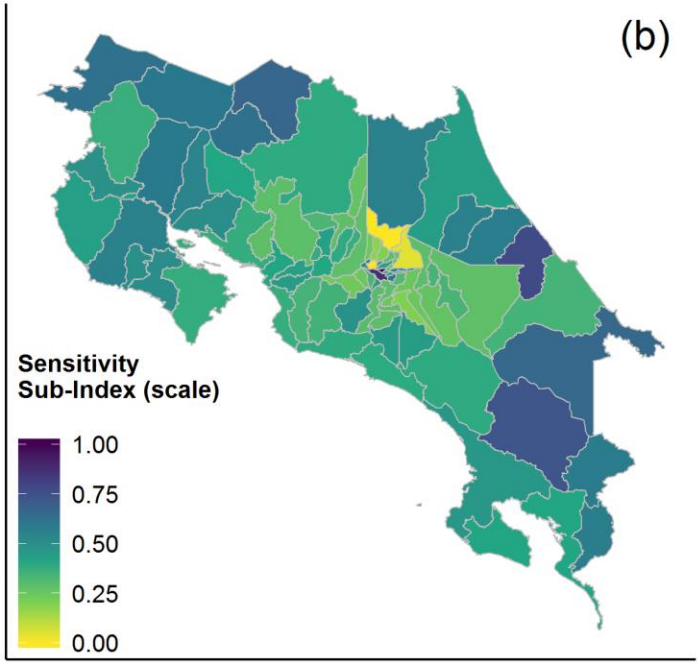
$$w_i = \frac{k}{\sqrt{var(Y_i)}}$$

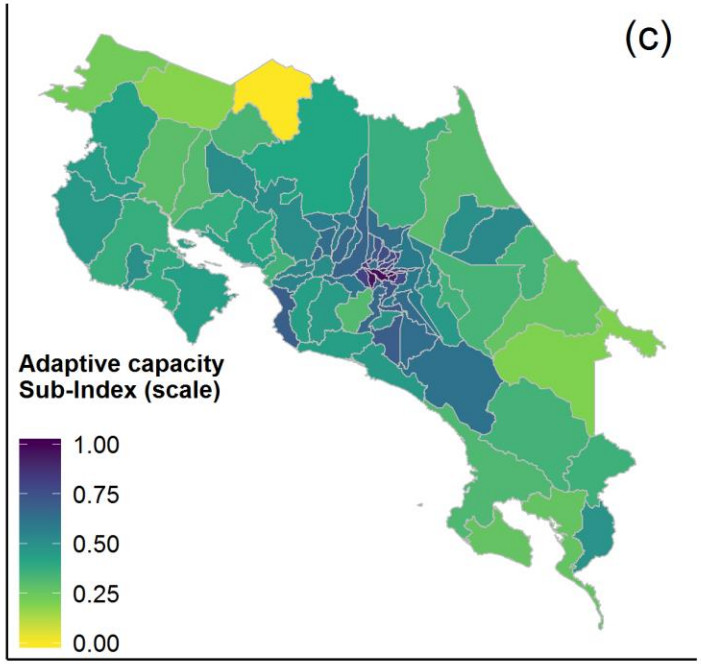
$$k = \left[\sum_{i=1}^{m} \frac{1}{\sqrt{var(Y_i)}}\right]^{-1}$$

Computation of Index

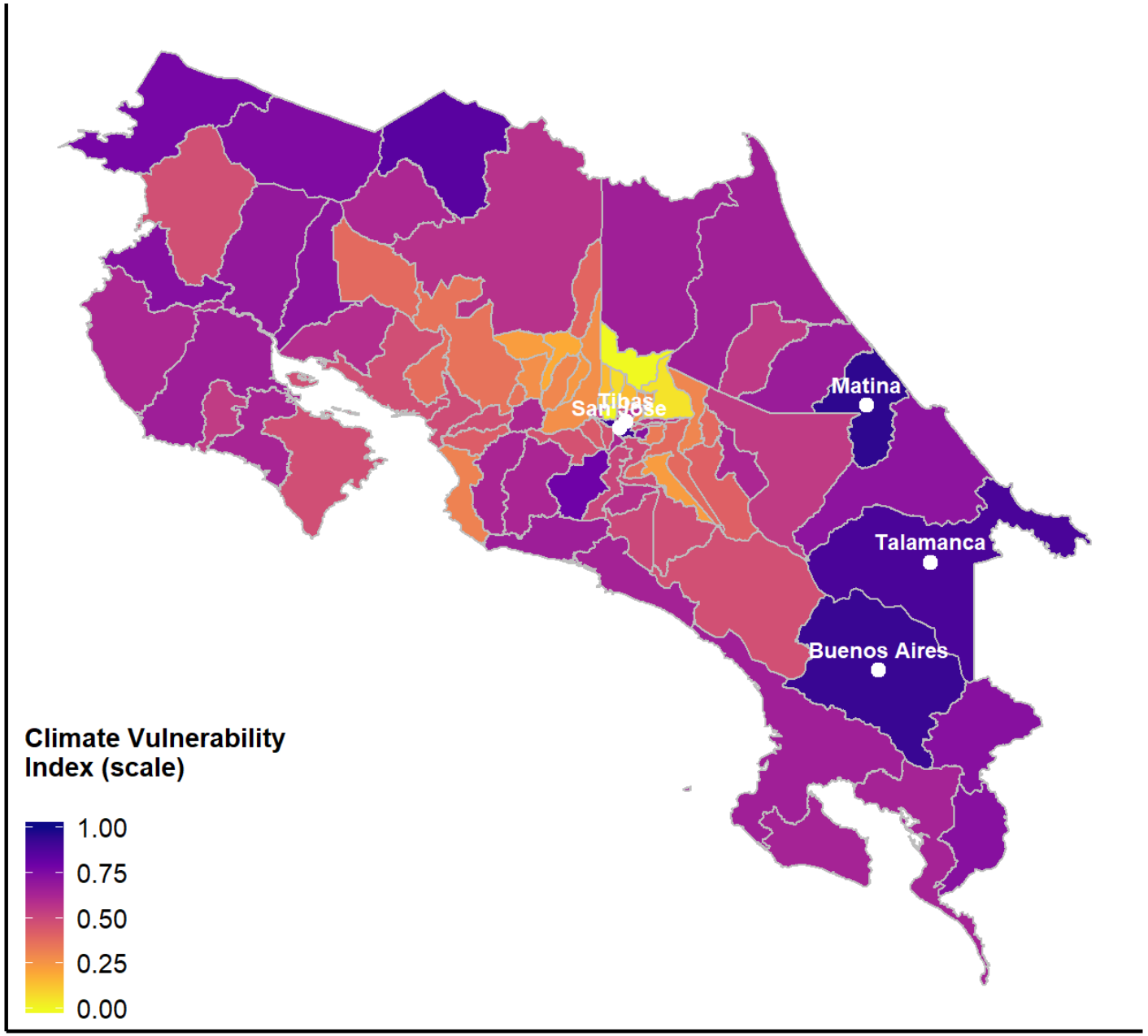
$$\bar{Y}_j = w_1 Y_{1j} + \cdots + w_m Y_{mj}$$







Climate change vulnerability index



How can CVI be used for evaluations?

- **Portfolio Analysis**: Are climate adaptation programs implemented in most vulnerable regions?
- **Case Selection**: Target evaluation to most climate sensitive regions
- **Statistical Modeling**: Stratify regression models based on climate vulnerability levels to see differences in treatment effects

INDEPENDENT Evaluation Office
United Nations Development Programme

وزارة التخطيط والمتابعة والإصلاح الإداري
Ministry of Planning, Monitoring and Administrative Reform

LEAVING NO ONE BEHIND: EVALUATION for 2030

2019 National Evaluation Capacities Conference

Thank You

@undp_evaluation

#NECdev