MEASURING RURAL ACCESS INDEX

Methodology and Application

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- New methodology
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- Relevance to operations
- References
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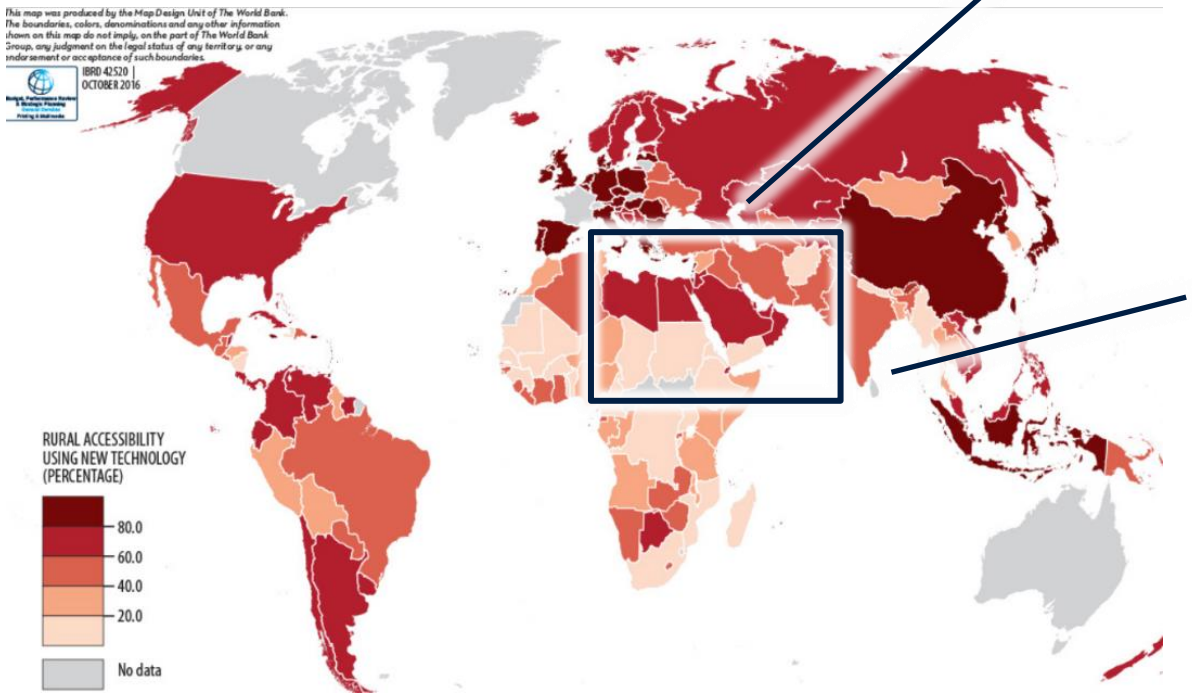
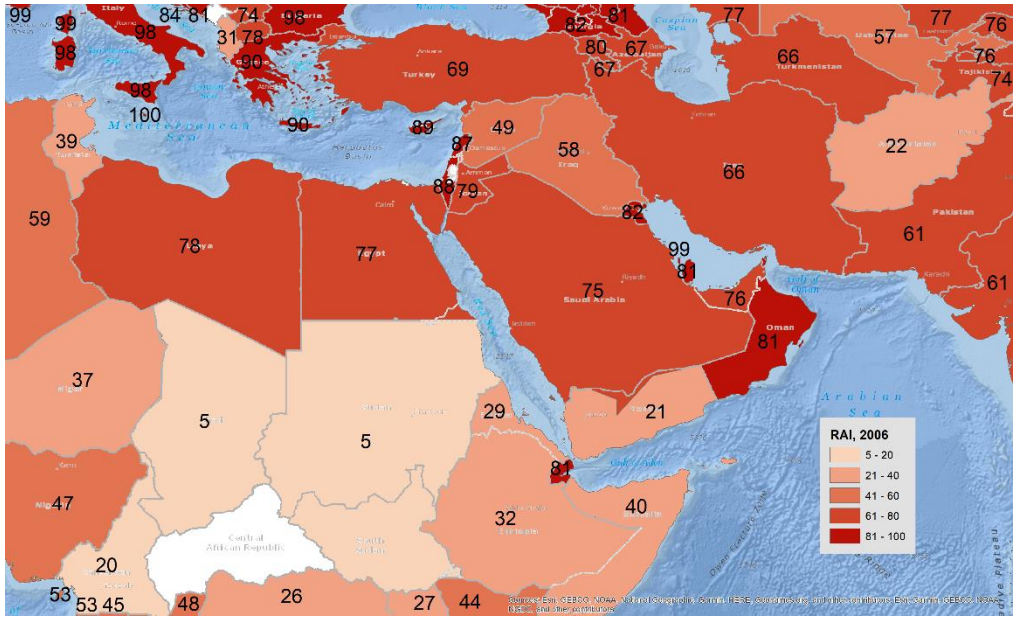
Rural Access Index – Share of rural population who has access to an “all-season road” within 2 km (approximately, 25-minute walk)

Rural Access Index developed originally by Roberts et al. (2006) – Globally, 1 billion people or 68% of total rural population were left unconnected





- Original method in 2006
  - Based on household surveys
  - Statistical modeling if no HH survey is available
- Methodological challenges
  - Data availability – No regular update
  - Inconsistency across countries
  - Sampling at national level – Little operational relevance

Source: Roberts, Peter, K. C. Shyam, and Cordula Rastogi. 2006. “Rural Access Index: A Key Development Indicator.” *Transport Papers* TP-10. The World Bank Group, Washington, DC.

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Renewed interest in the SDG context – RAI is one of a few global indicators in the transport sector

SDG Target 9.1

"Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all"

- **Indicator 9.1.1**: Proportion of the rural population who live within 2 km of an all-season road
- **Indicator 9.1.2**: Passenger and freight volumes, by mode of transport
  - Aviation
  - Road, rail, inland water, pipeline
  - Led by ICAO; International Transport Forum; UNECE; UNCTAD

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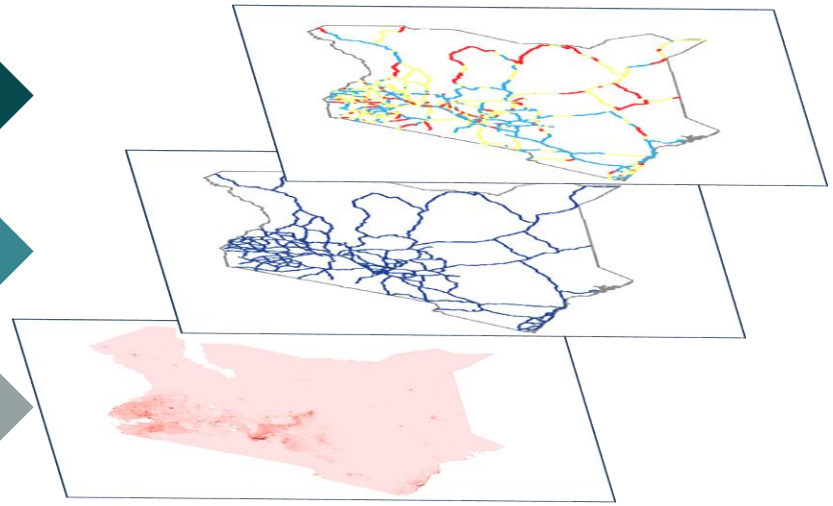
New methodology – Conceptually the same, but measured differently using new spatial data and technologies for sustainability and operational relevance

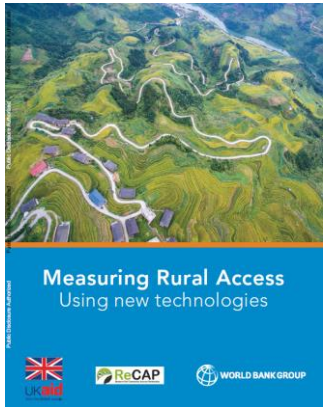
Main principles of the new methodology

- Sustainability
- Consistency
- Simplicity
- Operational relevance

To calculate RAI, use and overlap 3 spatial data

- Road condition
- Road network
- Population





See World Bank (2016) for more details
http://documents.worldbank.org/curated/en/367391472117815229/Measuring-rural-access-using-new-technologies

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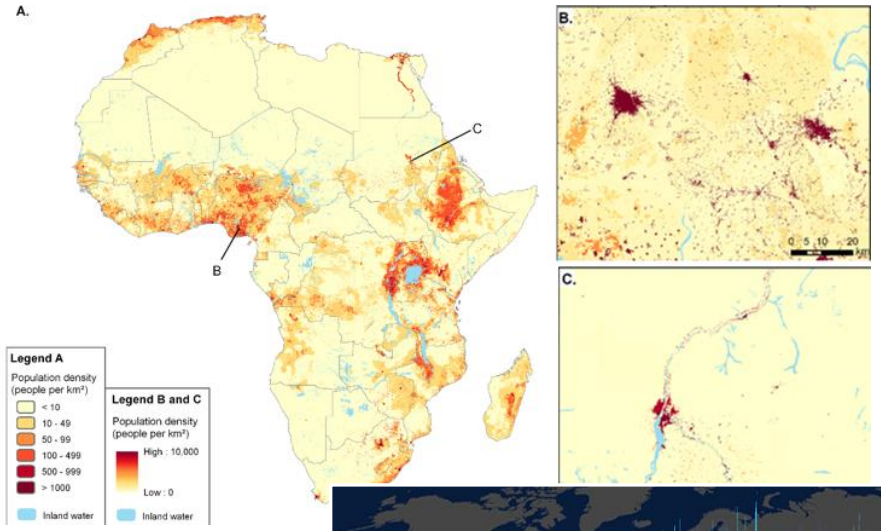
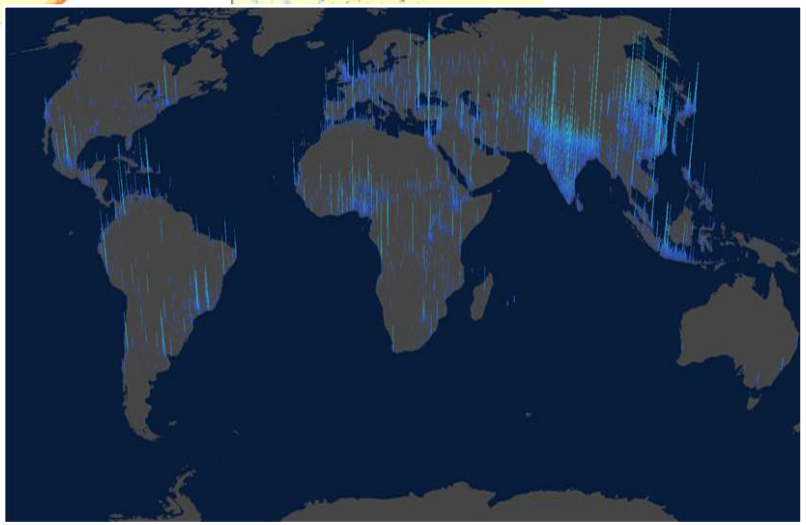
Where do people live? – Detailed global population data, e.g., WorldPop, GPW, etc. or national census data



WorldPop



Global Human Settlement

Global population data

Source	Resolution	Year	Update	Input data?	Re-producible	Urban/ Rural	Link
WorldPop (AsiaPop, AfriPop, AmeriPop)	~100m	2000/ 2005/ 2010/ 2015/ 2020	Ongoing	Available	Yes (with code)	No	http://www.worldpop.org.uk/
Gridded Population of the World (GPW) - CIESIN	2.5 arc minutes (~5 km)	1990/ 1995/ 2000/ 2005/ 2010/ 2015	Occasional	Available	Yes	No	http://sedac.ciesin.columbia.edu/gpw/global.jsp
Global Rural Urban Mapping Project (GRUMP) - CIESIN	30 arc seconds (~1 km)	1990/ 1995/ 2000	Occasional	Available	Yes	Yes	http://sedac.ciesin.columbia.edu/data/collection/grump-v1
LandScan – Oak Ridge Labs	30 arc seconds (~1 km)	2012	Annual	No	No	No	http://www.ornl.gov/sci/landscan/
UNEP Global Population Databases	2.5 arc minutes (~5 km)	2000	None	Available	Yes	No	http://na.unep.net/siouxfalls/datasets/datalist.php

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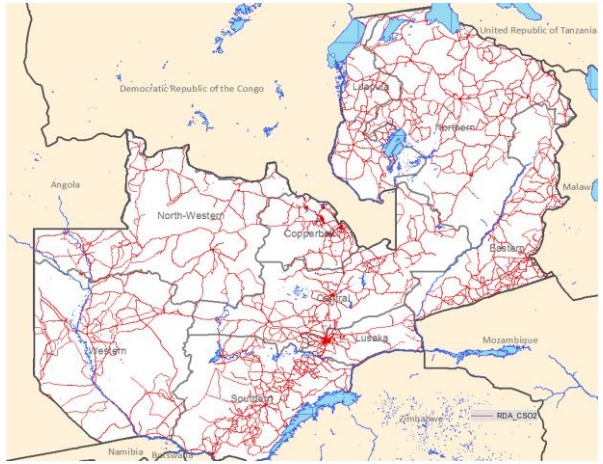
Where do roads exist? – National road network data owned by road agencies, or commercial database, or open data

- Pros and cons
  - Different coverage – Govt data vs. OSM
  - Consistency with classified road network
  - Costs of data management – Free OSM
  - Voluntary, ad hoc update in OSM

Example of Zambia

(Govt data)



(OpenStreetMap)

Available road network data

	Availability	Access	Consistency	Update
Government data	Road agencies, statistical offices	Subject to country policy	Consistent with official network	Govt responsibility
Collected by mobile applications	By RoadLab etc.	Free application	Consistent with official data	Every time when a survey is carried out
Commercial data	e.g., DeLome database	Commercial license	Consistent across countries	Regularly updated
Open data	e.g., OpenStreetMap	Free and open	Vary across countries	On an ad hoc, voluntary basis

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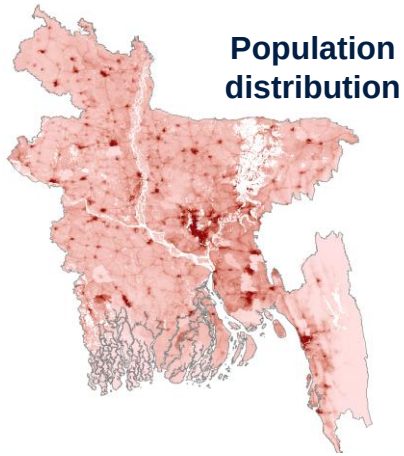
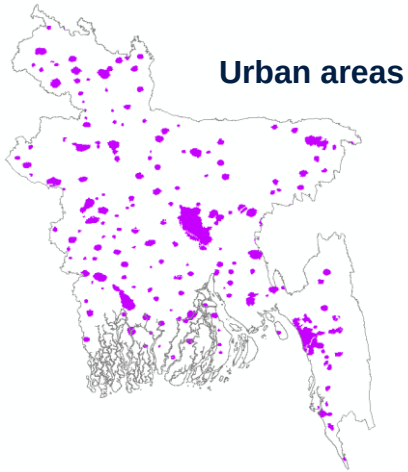
RAI is sometimes sensitive to urban-rural delineation

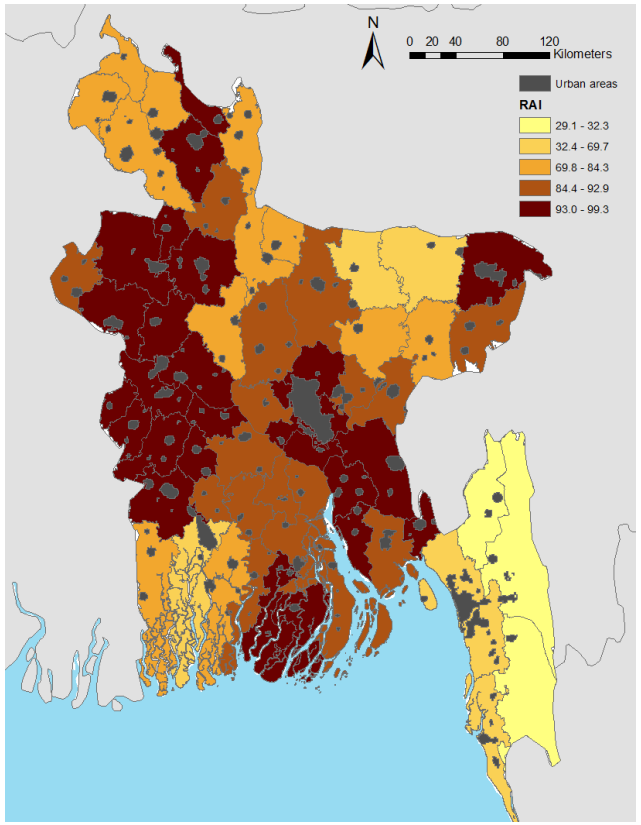
In RAI calculation, urban areas need to be excluded using GRUMP data



Population distribution



Urban areas



- Different urban-rural classifications are available
  - Global databases – Global Rural Urban Mapping Project (GRUMP) in 1990
  - National administrative definition
  - New method to delineate cities, urban and rural areas endorsed by the UN Statistical Commission
    - UN. (2020). “A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons”
    - https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Recommendation-E.pdf

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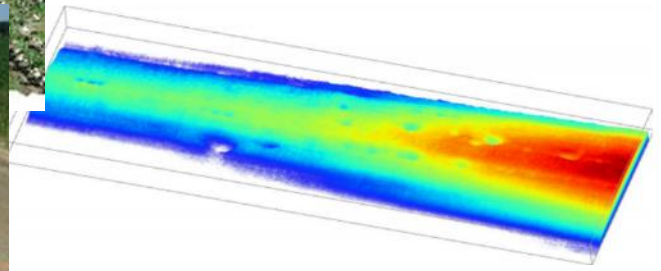
Road conditions? – Key for successful RAI calculation and update
➔ A wide variety of technologies are available

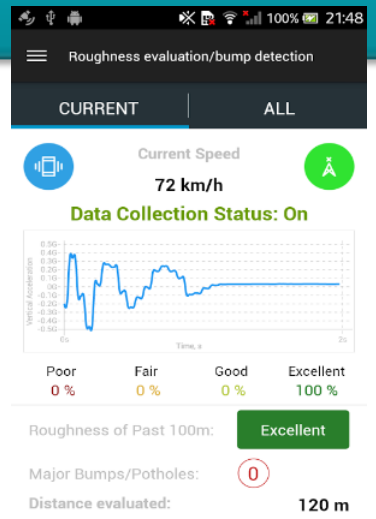
Traditional pavement profiler

Drones



Traditional

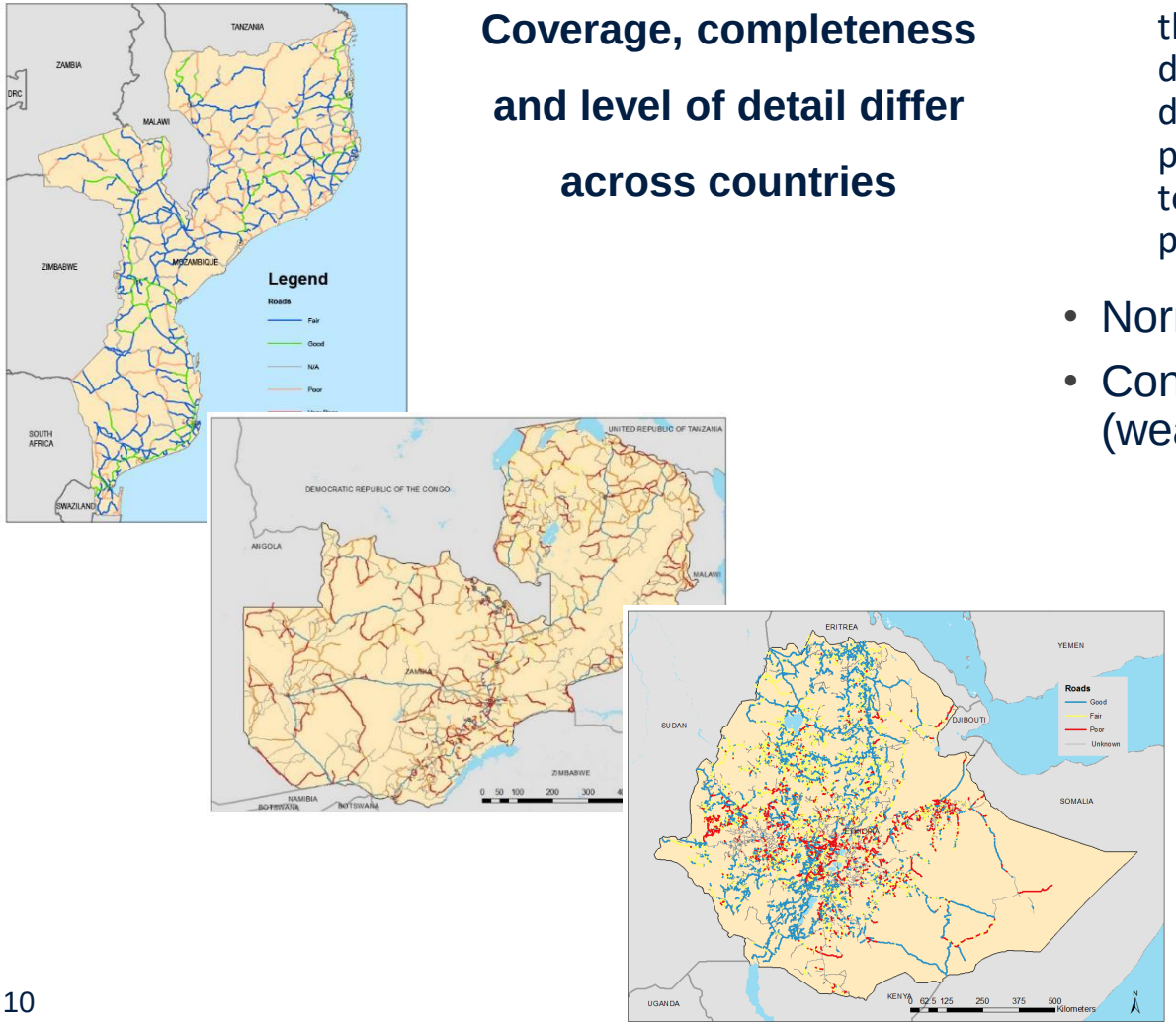
Innovative



Smartphone app

High resolution satellite imagery

Road conditions – Normally, road agencies own Road Asset Management (RAM) systems and update regularly



Coverage, completeness and level of detail differ across countries

- "All-season road"?
  - "All-season road" is defined as a road that is motorable all year round by the prevailing means of rural transport (often a pick-up or a truck which does not have four-wheeldrive). Predictable interruptions of short duration during inclement weather (e.g. heavy rainfall) are accepted, particularly on low volume roads. A road that it is likely to be impassable to the prevailing means of rural transport for a total of 7 days or more per year is not regarded as all-season. (Roberts et al., 2006)
- Normal RAM data may not have all-season variable
- Conversion needed based on individual country context (weather, road specification, etc.)

Example of "all-season" roads based measured IRI

HDM-4 Recommended IRI default values				RONET Recommended IRI values		
	Paved road				Unpaved	
Condition	Primary	Secondary	Tertiary	Condition	Gravel	Earth
				Very good	7	10
Good	2	3	4	Good	10	13
Fair	4	5	6	Fair	13	16
Poor	6	7	8	Poor	17	20
Bad	8	9	10	Very poor	22	24

Source: World Bank (2016)

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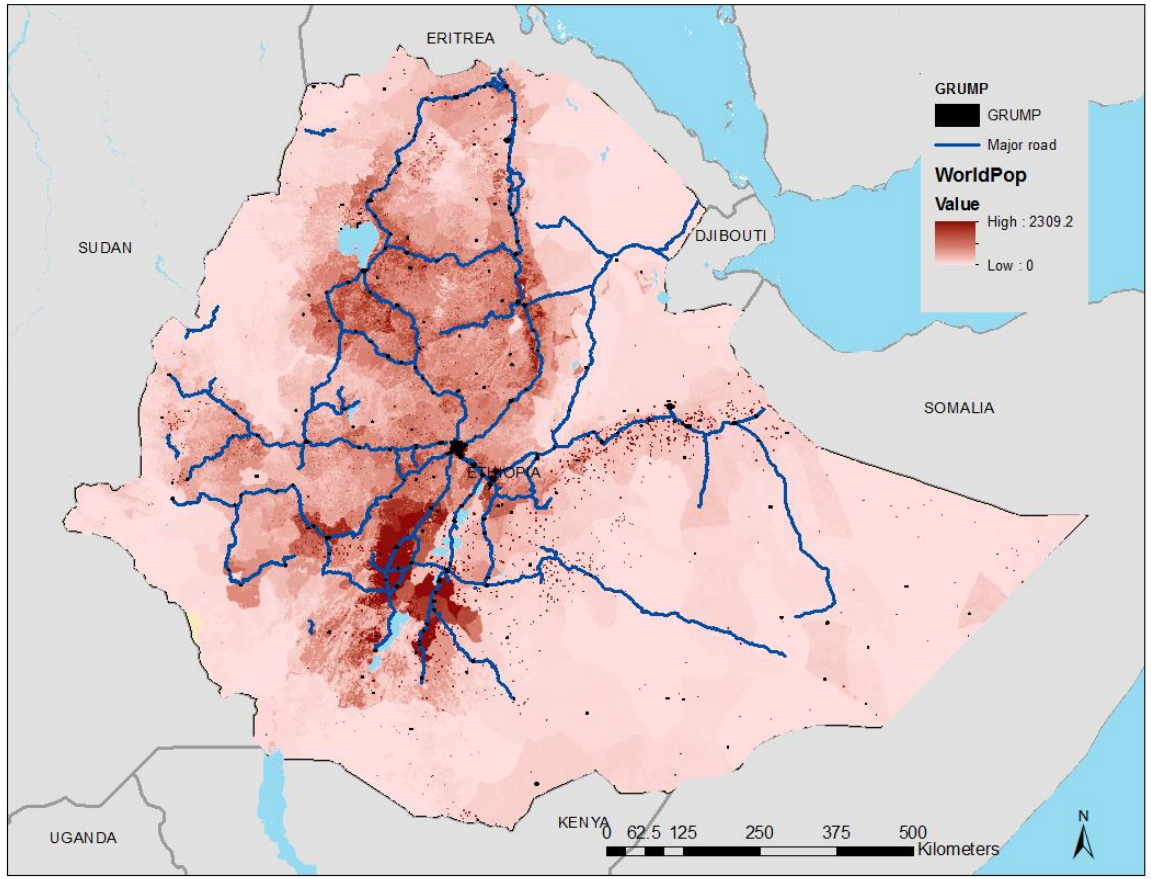
Example – Ethiopia

81.3 million people live in rural areas



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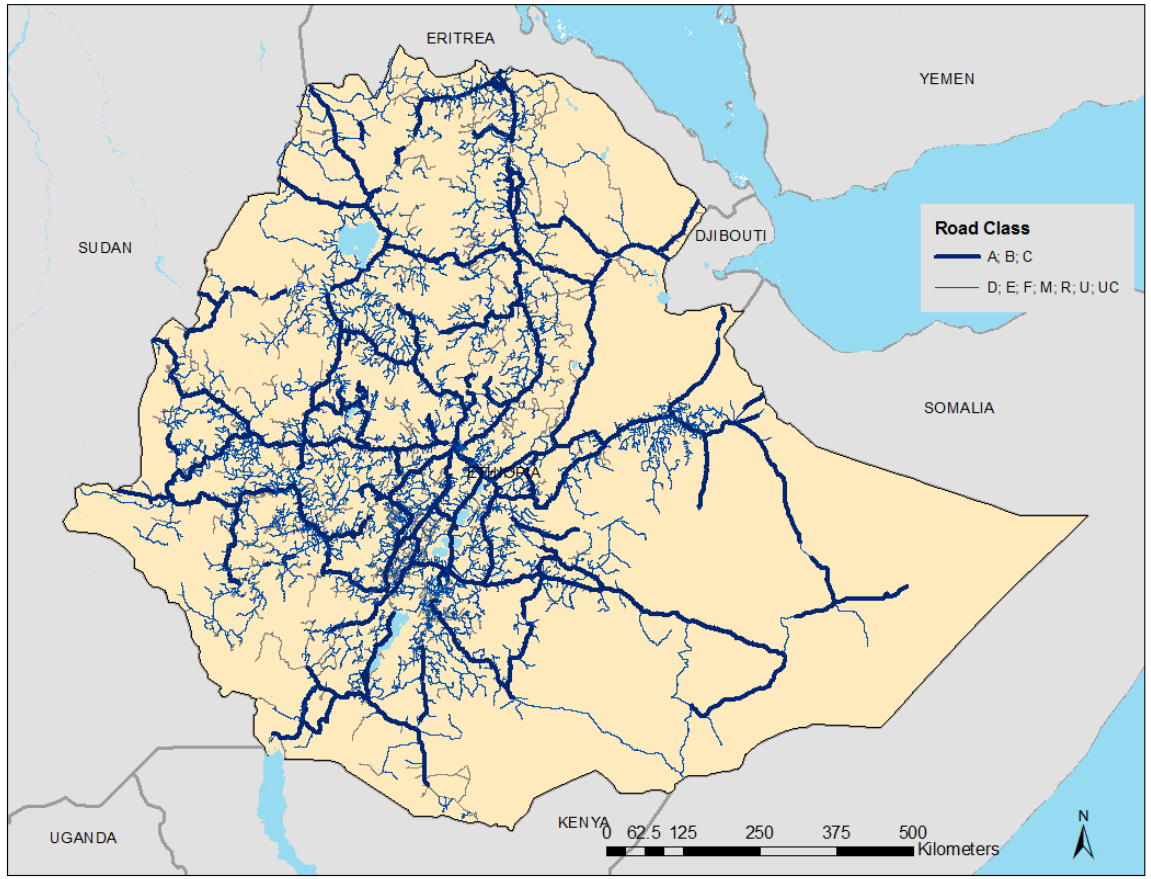
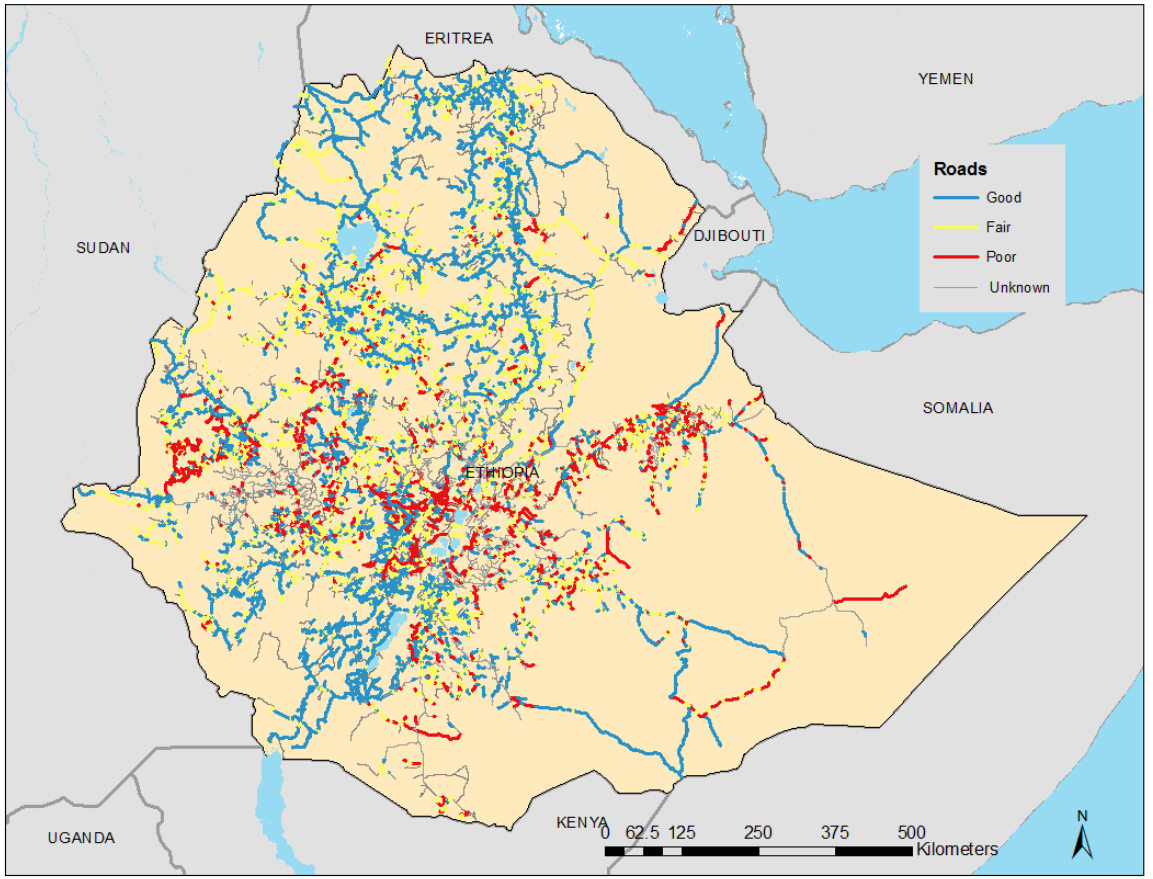
Example – Ethiopia

85,880 km of roads



31% of roads are in "good" condition – equivalent to all season roads



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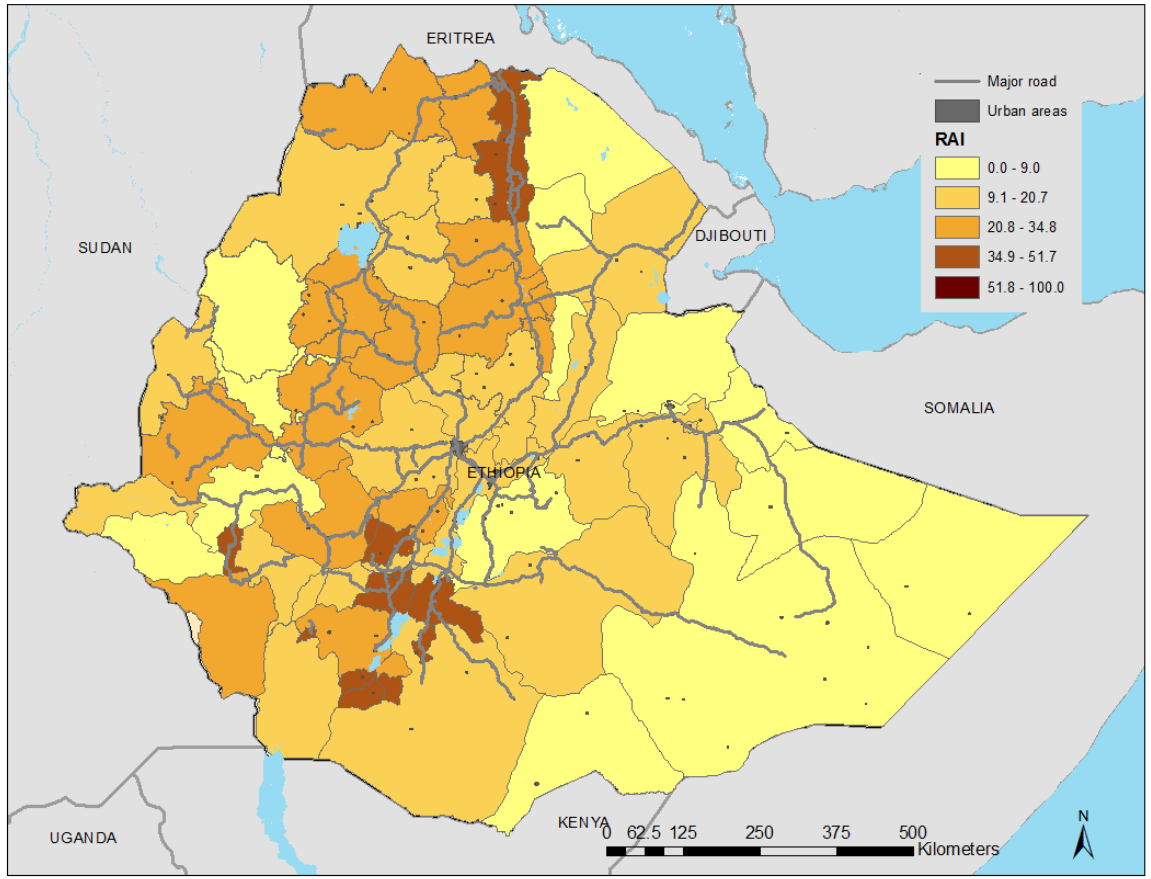
Example – Ethiopia

RAI = 21.6%



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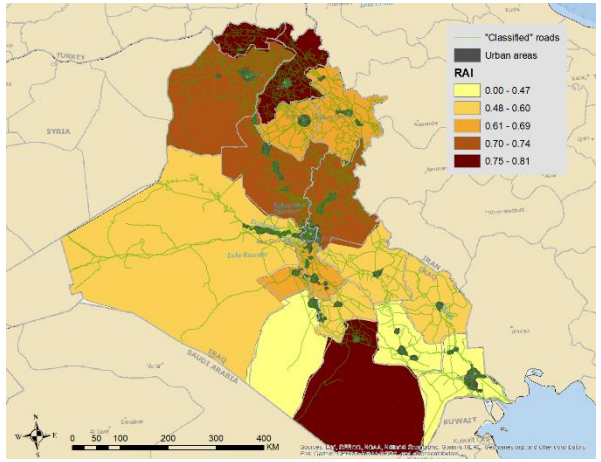
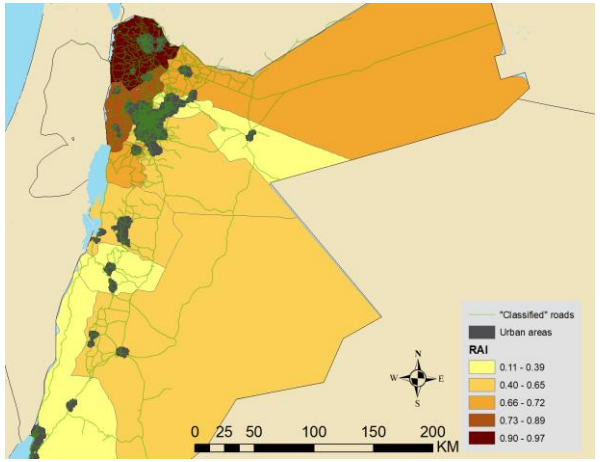
In the MENA region, new RAI method was applied to several countries (see World Bank "Rural Access Update 2017/18")

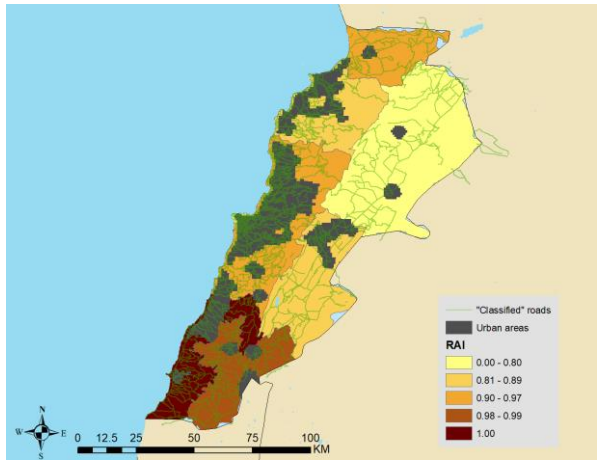
Iraq



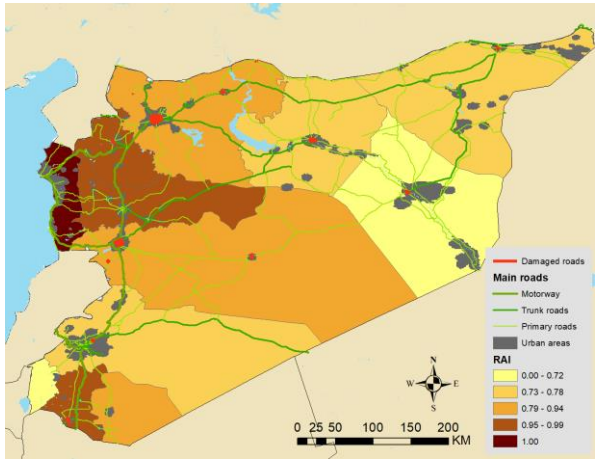
Jordan



Lebanon



Syria



Sources: World Bank Rural Access Update (2017/18); World Bank (2020) "The Fallout of War".

Rural Accessibility is generally high – consistent with the 2006 estimates

	Rural population (million)	Population with access (million)	RAI (%)
Iraq	18.760	11.889	63.4
Jordan	1.341	0.958	71.4
Lebanon	0.030	0.028	92.6
Syria	8.580	7.720	90.0

- Largely relying on open data
  - WorldPop
  - OpenStreetMap; damaged roads by civil war
  - Classified roads in OSM are assumed to be all-season

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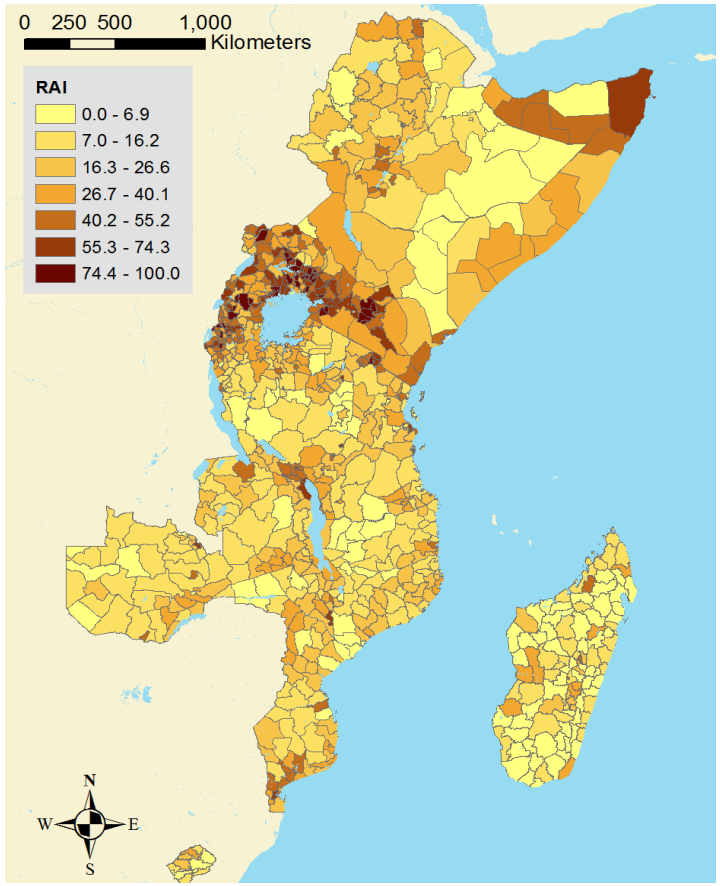
Operational relevance – RAI is calculated at the national and subnational levels, allowing to identify potential needs in rural access within a country and guide its rural road programs

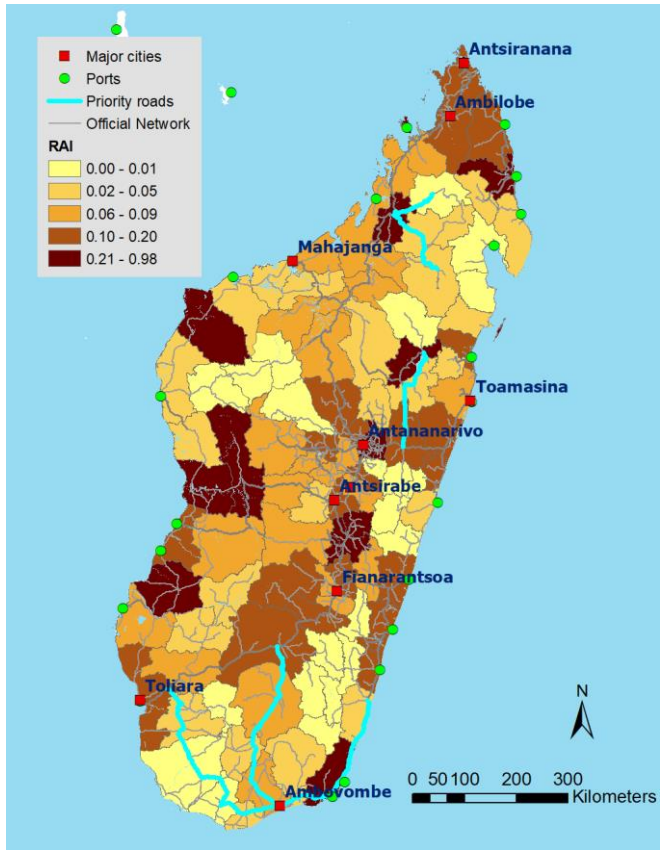
Consistency

Regional connectivity based on RAI in Eastern and Southern Africa

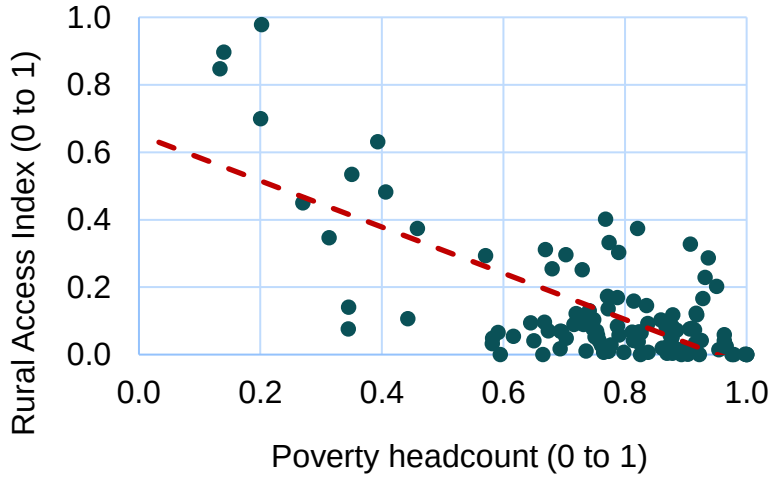


Granularity (subnational data)

In Madagascar, prioritizing rural road programs, based on RAI, agricultural production, poverty, …



Normally, poverty is higher where rural access is limited



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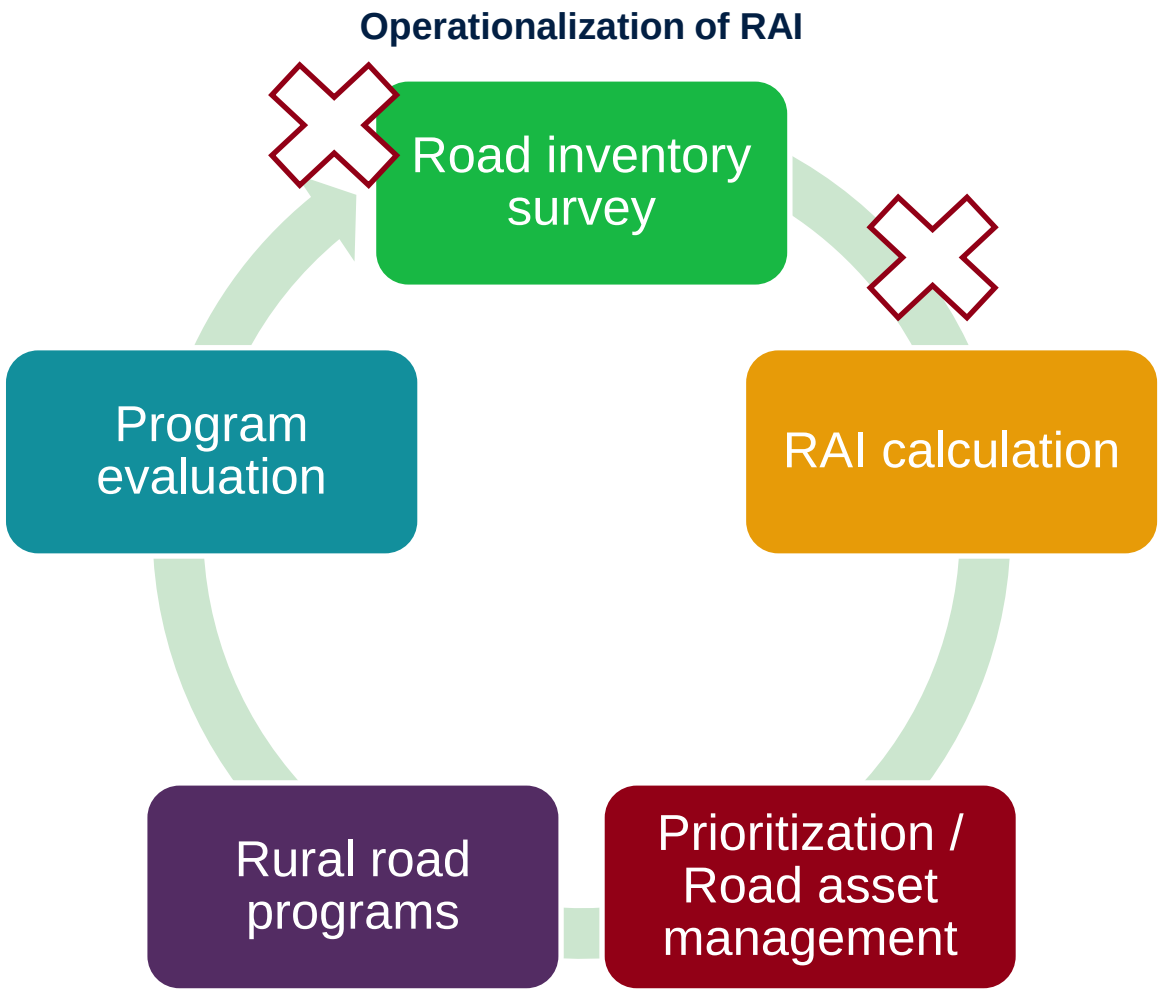
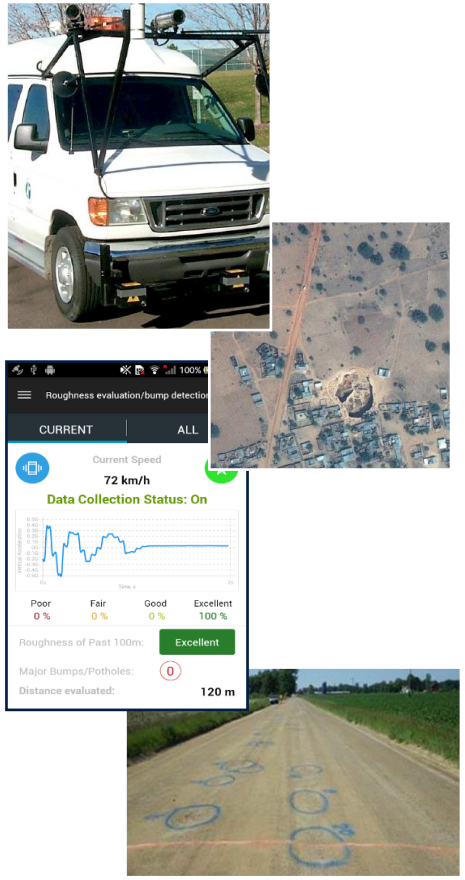
As of now, RAI were updated in 25+ countries… Two typical challenges to calculate RAI, and more importantly, to use RAI in road sector operations



1. Regular data collection
   - Responsibility of governments or road authorities
   - A wide variety of new technologies to collect data



2. Interface between RAMs and RAI calculation tool
   - Traditional RAM data are not georeferenced
   - Govt data may not be comprehensive
   - Multiple datasets (national/local)

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Resources

- World Bank Rural Access Index Website https://datacatalog.worldbank.org/dataset/rural-access-index-rai
- Rural Access Methodology Report (2016) https://documents.worldbank.org/en/publication/documents-reports/documentdetail/367391472117815229/measuring-rural-access-using-new-technologies
- Rural Access Update (2017/18) https://documents.worldbank.org/en/publication/documents-reports/documentdetail/543621569435525309/world-measuring-rural-access-update-2017-18
- World Bank. 2020. The Fallout of War : The Regional Consequences of the Conflict in Syria https://openknowledge.worldbank.org/handle/10986/33936

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Questions?

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