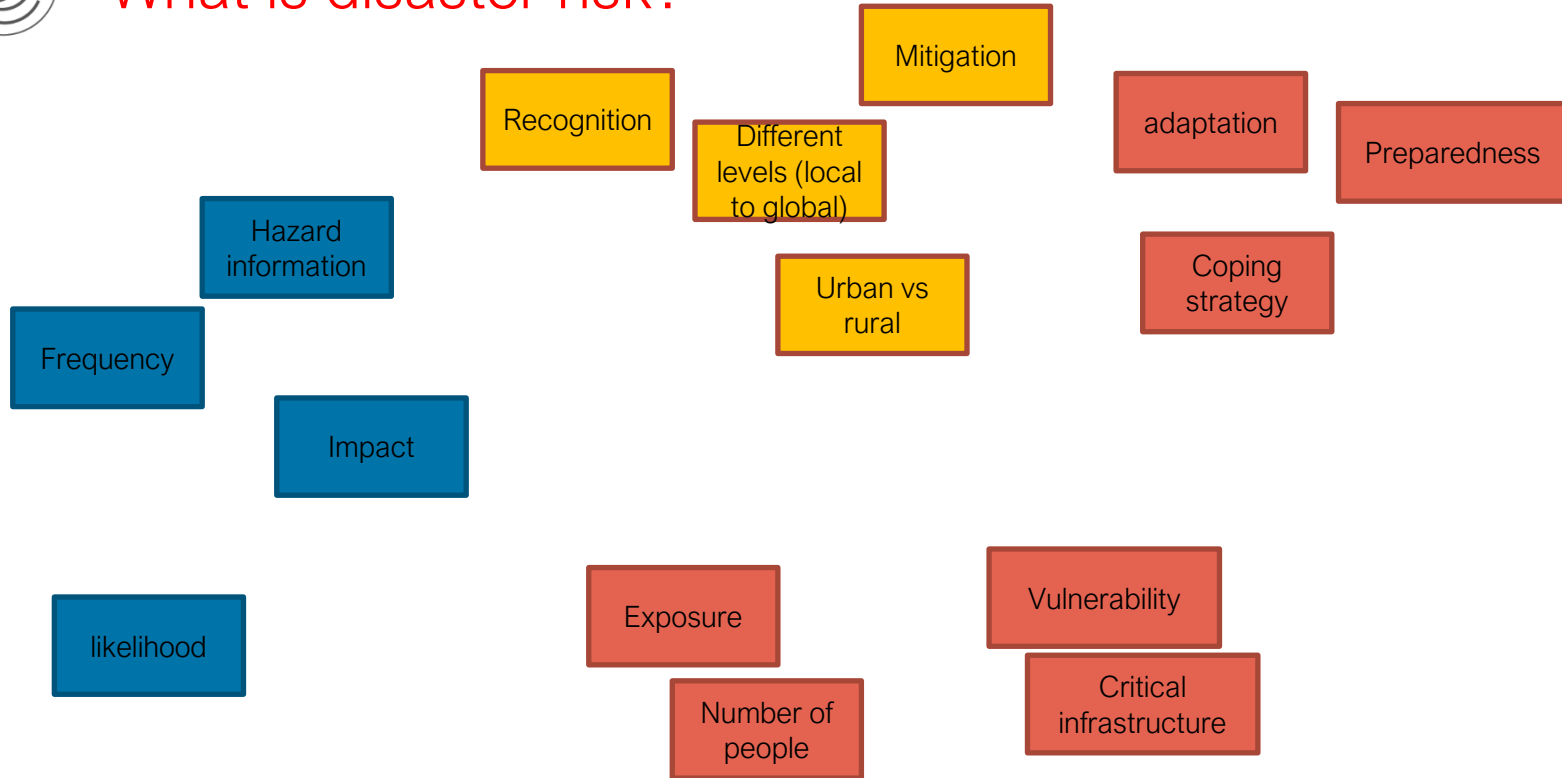


Vulnerability and Risk assessments with GIS



What is disaster risk?





What is disaster risk?



Risk is the combination of
hazard, exposure and
vulnerability

Source: [UNDRR](#)

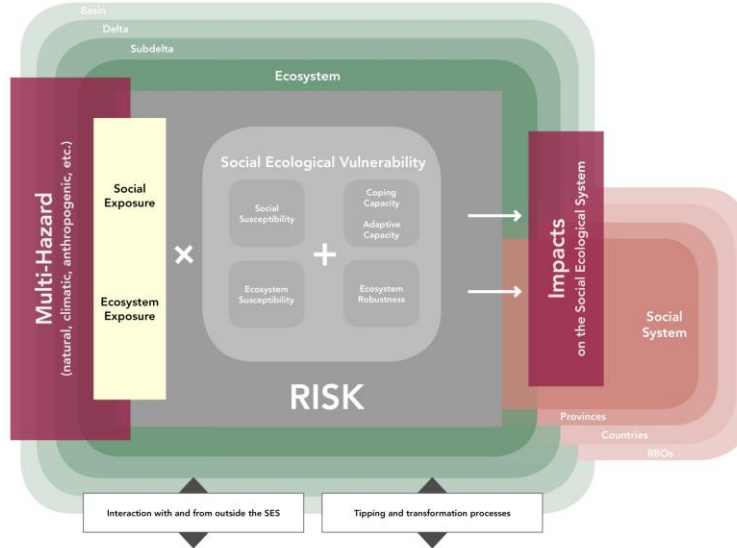
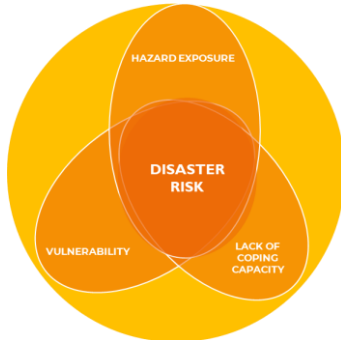


What is disaster risk?



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hazard, exposure and
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Source: [UNDRR](https://www.undrr.org/)



Source: UNU-EHS



Risk = Hazard x Exposure x Vulnerability
Vulnerability = Susceptibility + (1 - Coping Capacity)

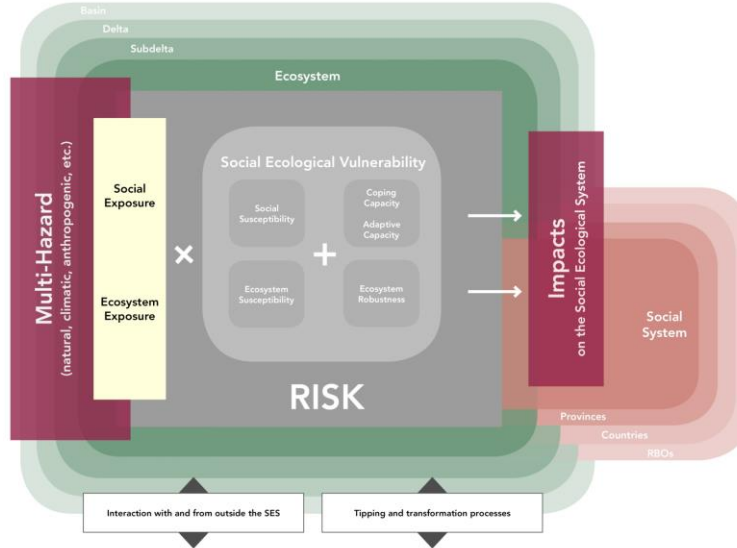
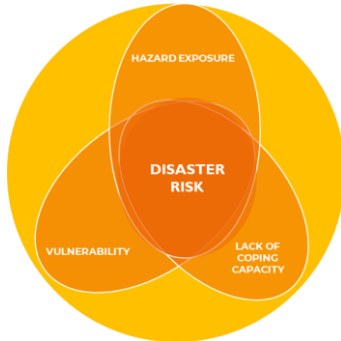


What is disaster risk?



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Source: [UNDRR](https://www.undrr.org/)



Source: UNU-EHS



Risk = Hazard x Exposure x Vulnerability
Vulnerability = Susceptibility + (1 - Coping Capacity)



Source: [INFORM Index](https://www.inform-index.org/)



Risk = 1/3Hazard&Exposure x 1/3Vulnerability x 1/3
Lack of Coping Capacity



Considerations for Anticipatory Action

- 1 What hazard should be considered for the Early Action Protocol Development?
- 2 What are the disaster risks/disaster impacts that could be addressed by Anticipatory Action?
- 3 What are the root causes of those disaster risks and impact? (vulnerability and exposure)
- 4 What vulnerability and exposure indicators should be prioritized as part of the trigger and selection of action?



Which information do you need to act early when a forecast comes in?





Peru Cold Wave EAP



Prioritized impact

1. Acute respiratory infections
2. Mortality and morbidity of livestock

Trigger: 4 consec. days of temp. under the 5th percentile

Lead time: 5 days

Lifespan: 5 years

Budget

- 56.000 CHF Readiness
- 86.800 CHF Pre-positioning
- 107.000 CHF Activation

Total: CHF 249.800

Readiness Activities



Annual workshop to review EAP, warehousing, DM staff

Prepositioning



Shelter materials, protection kit, clothing

Early Actions



- Distribution of veterinary kits, materials to install a temporary shelter for alpacas, protection kit for alpaca herders.

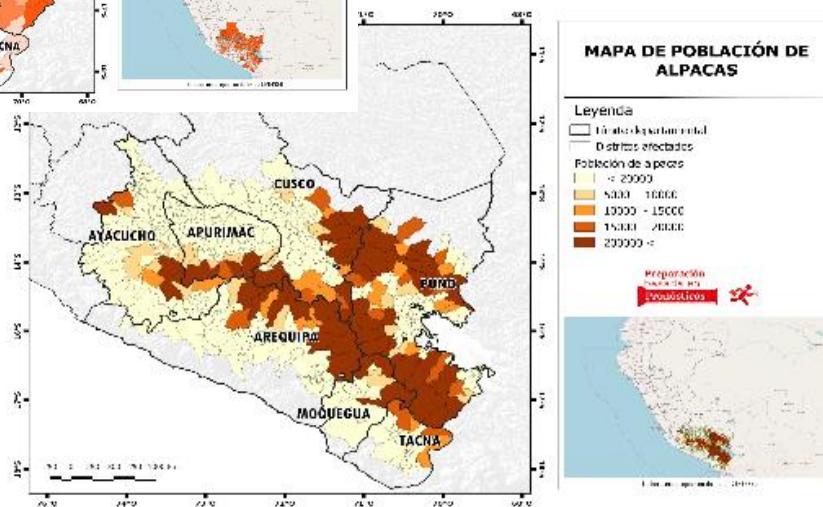
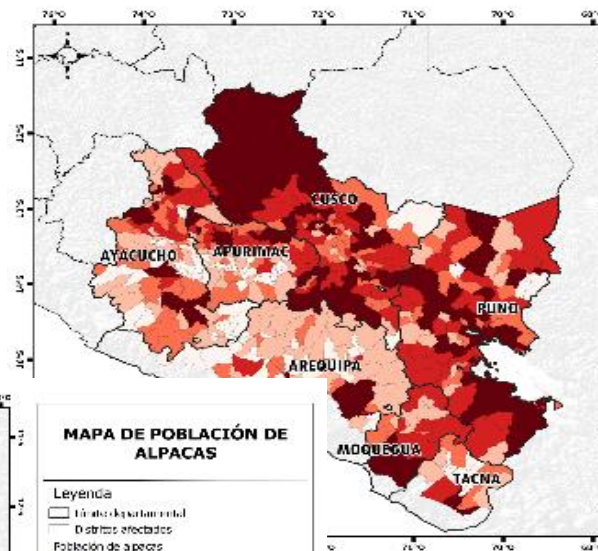
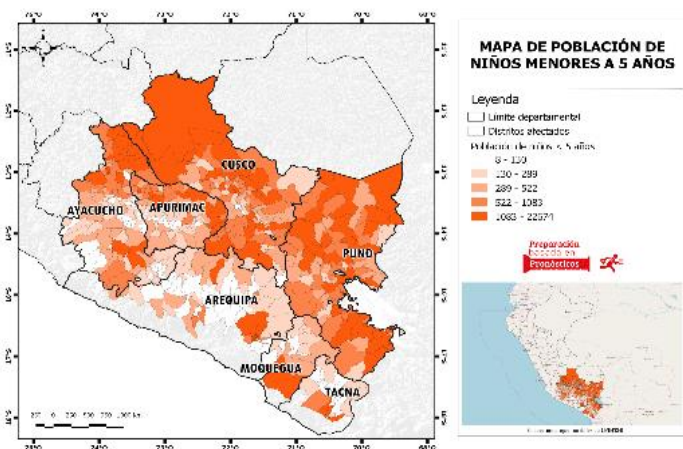


- Warm clothing for children under five years, material for house insulation.



- Disease prevention and health promotion awareness raising.

Exposure in the Peru cold wave EAP



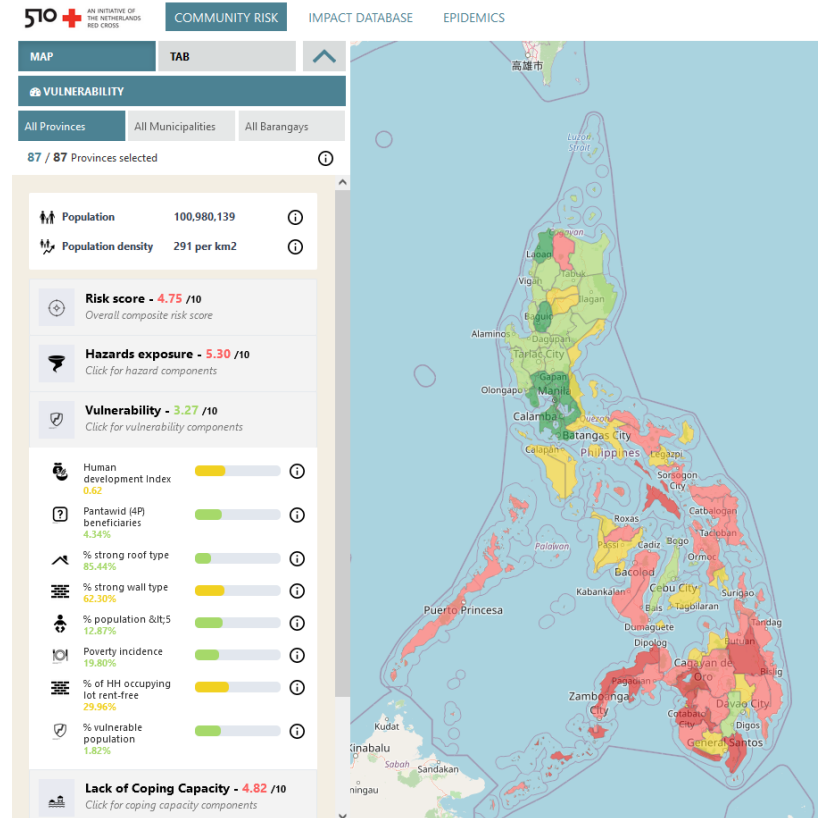
Vulnerability towards typhoons in the Philippines

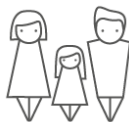
Prioritized impacts

1. Loss of income of farmers and fishermen
2. House damage due to the wind

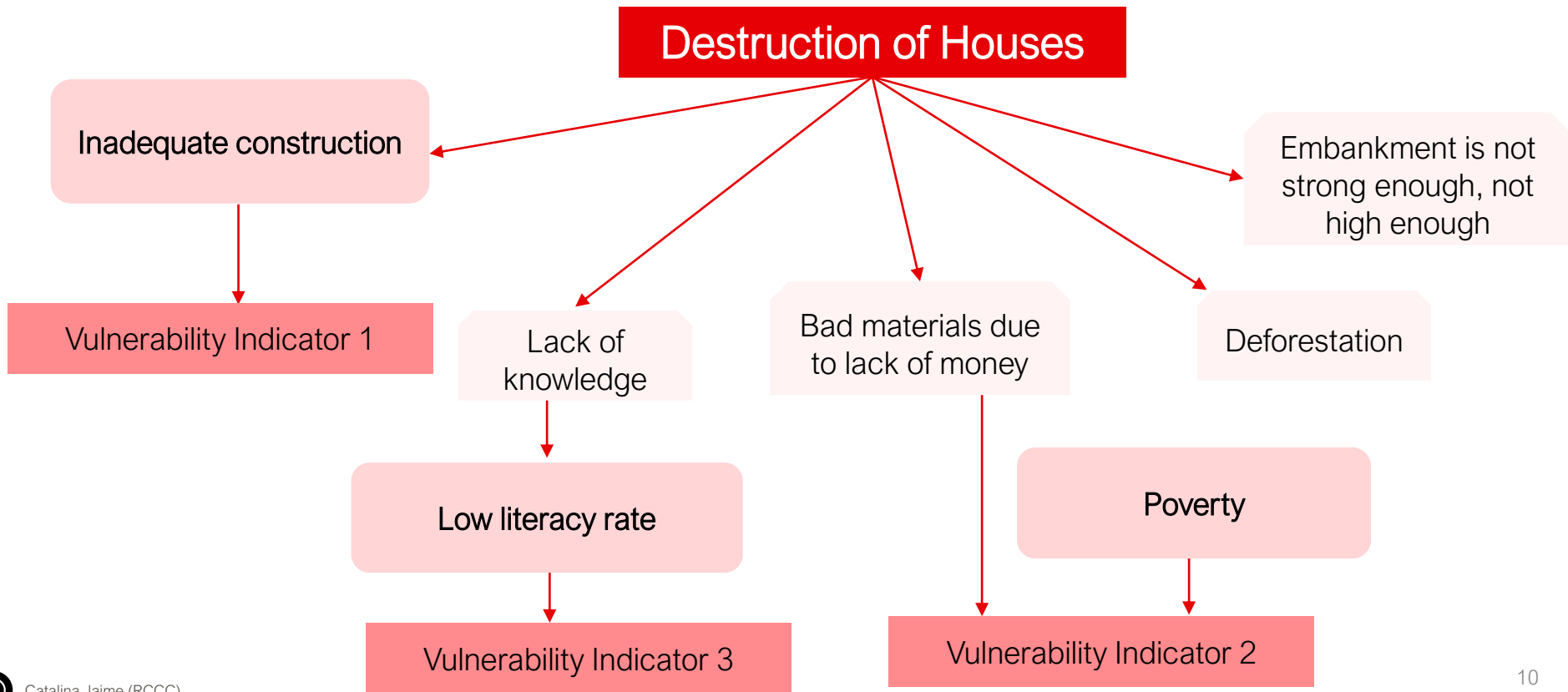
With regard to the prioritized impacts, the typhoon Early Action Protocol (EAP) will target:

- the vulnerable farmers (rice, corn, abaca) as well as smallholders of livestock;
- the fishing communities involved in small-scale “municipal” fisheries or in aquaculture;
- or the people living in light-weight material houses.





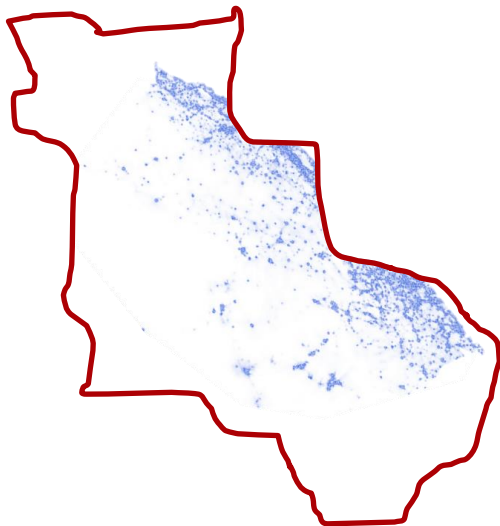
Identify key vulnerability indicators



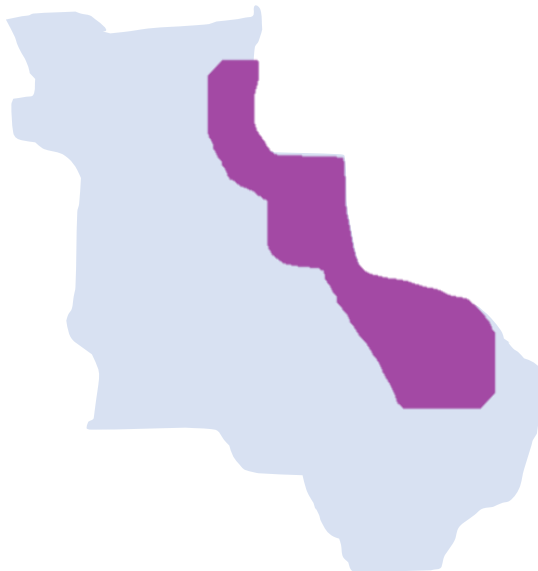


Hazard exposure

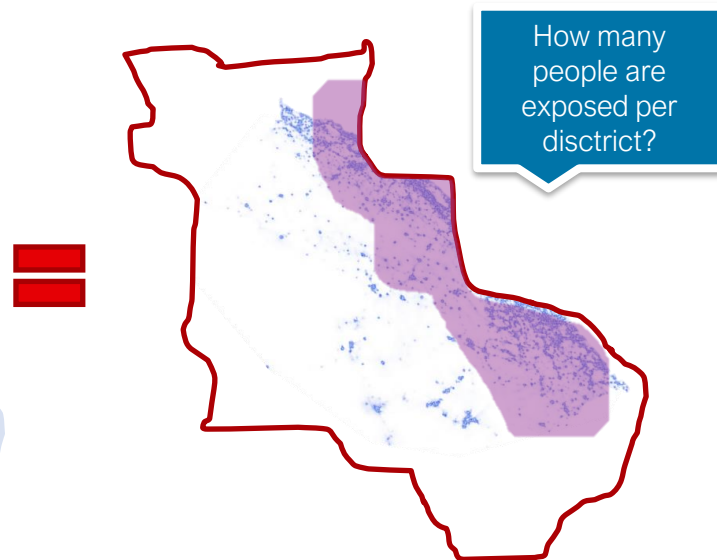
Population data



Area susceptible to flooding

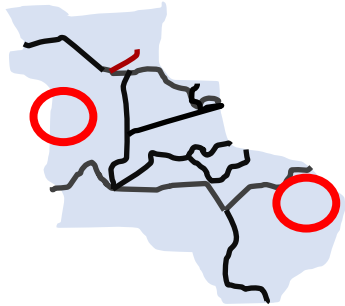


People exposed to flooding

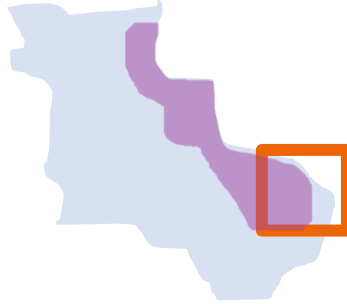




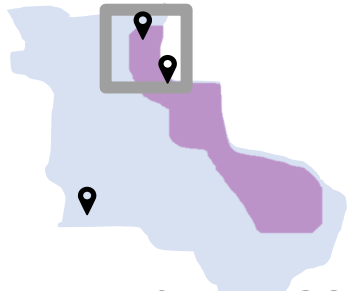
Vulnerability and risk assessment



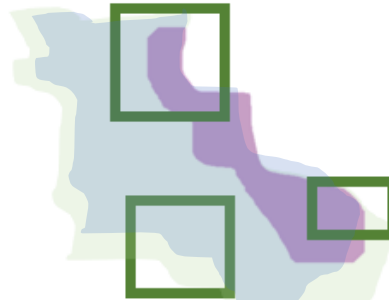
Accessibility by road



Recently hit by a flood



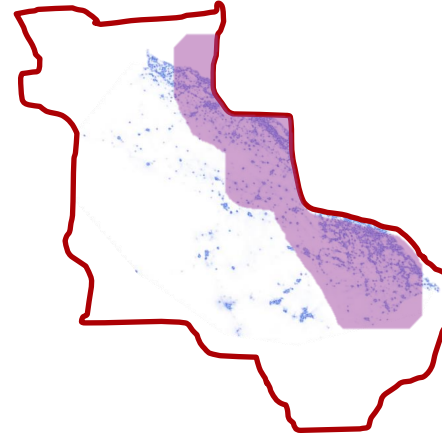
Presence of other NGOs



Informal settlements

Which area is most vulnerable?

Which area is most at risk?

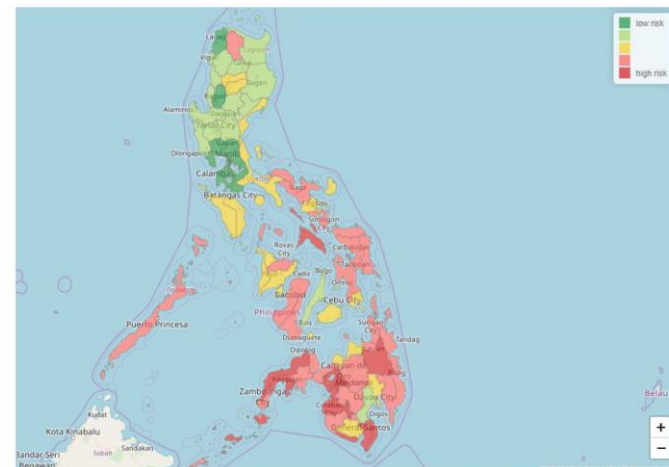
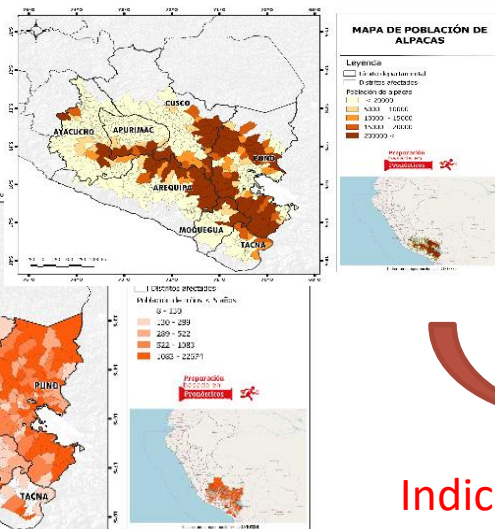
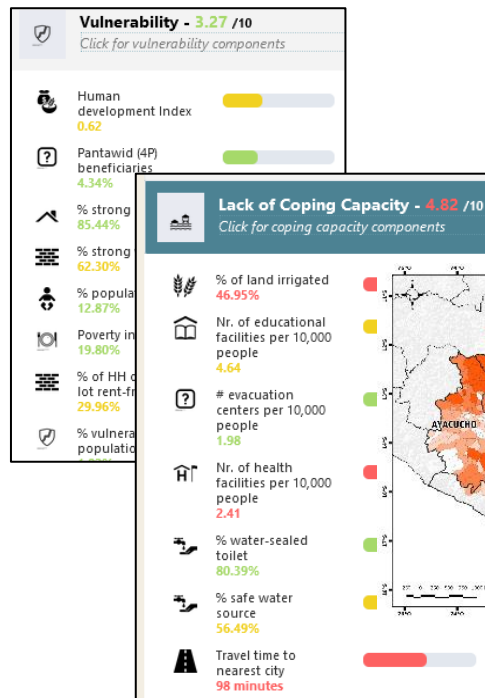


Hazard
Exposure

 Risk



Indicator-based assessments



Indicator-based assessments

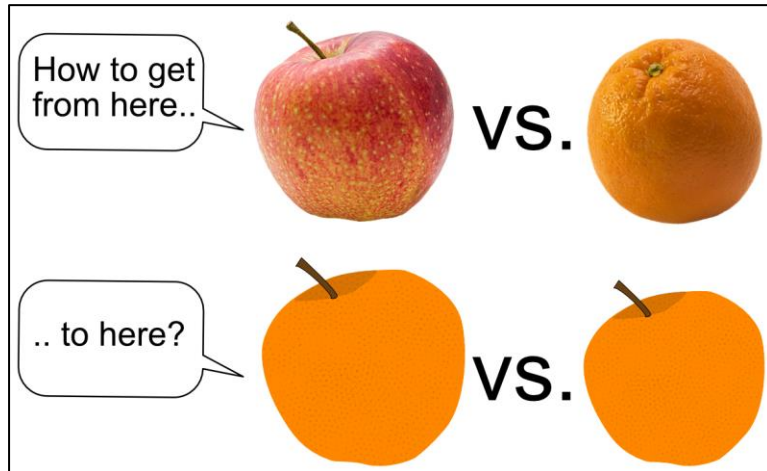


Workflow for indicator-based assessments





Normalisation of data



$$X_{new} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

Municipality	Number of Hospitals/ 100 000 inhabitants	Normalization
1	5	0,17
2	7	0,29
3	2	0
4	15	0,76
5	6	0,23
6	2	0
7	19	1
8	4	0,11
9	8	0,35
10	12	0,58
11	17	0,88
12	10	0,47



Risk index



*Risk = Hazard exposure * Vulnerability*



$$\text{Hazard Exposure index} = \frac{w1E1 + wEn}{n}$$

$$E = \frac{\text{alpaca herders}}{\text{sqkm}} (\text{normalised})$$

$$\text{Vulnerability index} = \frac{w1V1 + wVn}{n}$$

$$V = \frac{(\text{Hospitals}_n) + (\text{poverty}_n) + (\text{food insecurity}_n)}{3}$$

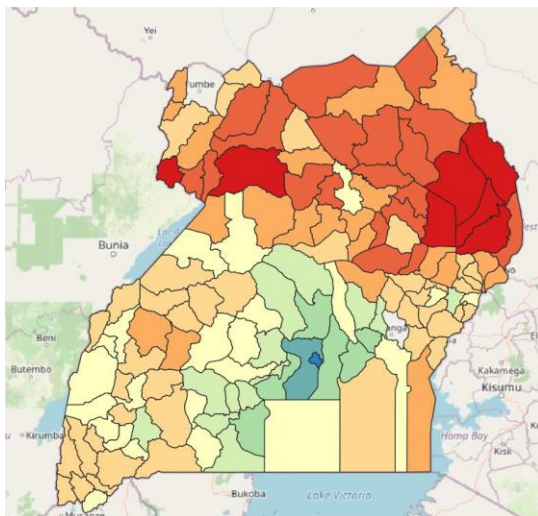
$$V_{\text{weighted}} = \frac{(0.25 * \text{Hospitals}) + (0.5 * \text{poverty}) + (0.25 \text{food insecurity})}{3}$$



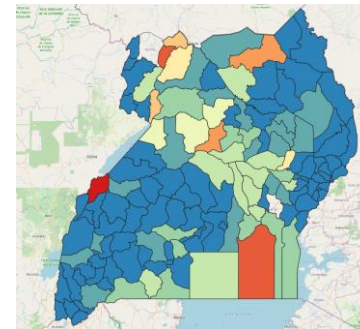
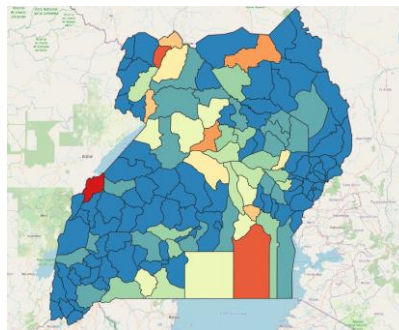
Example - Flood Risk

How do you
interpret those
maps?

Vulnerability map



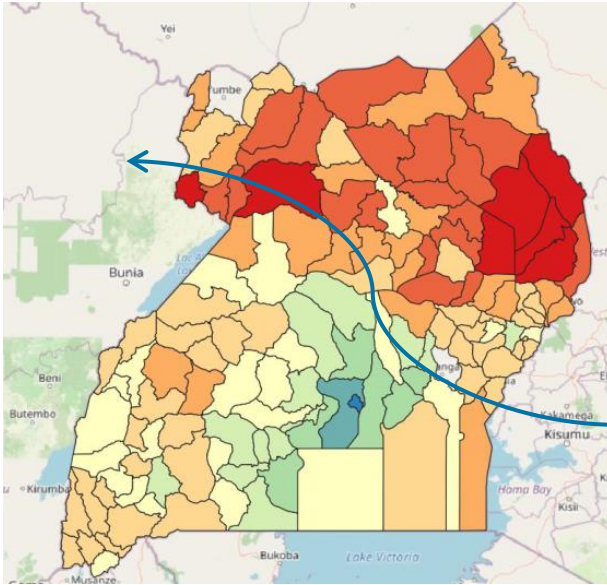
Flood exposure map





Example – Intervention map

Vulnerability map



How do you
interpret those
maps?



Pros and Cons of composite indicators