adelphi

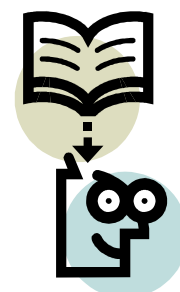# Overview of the Methodological Framework of the Regional VA

Training on Applying the Climate Change Vulnerability Assessment Methodology in the Arab Region, 11-13 May 2014, Beirut
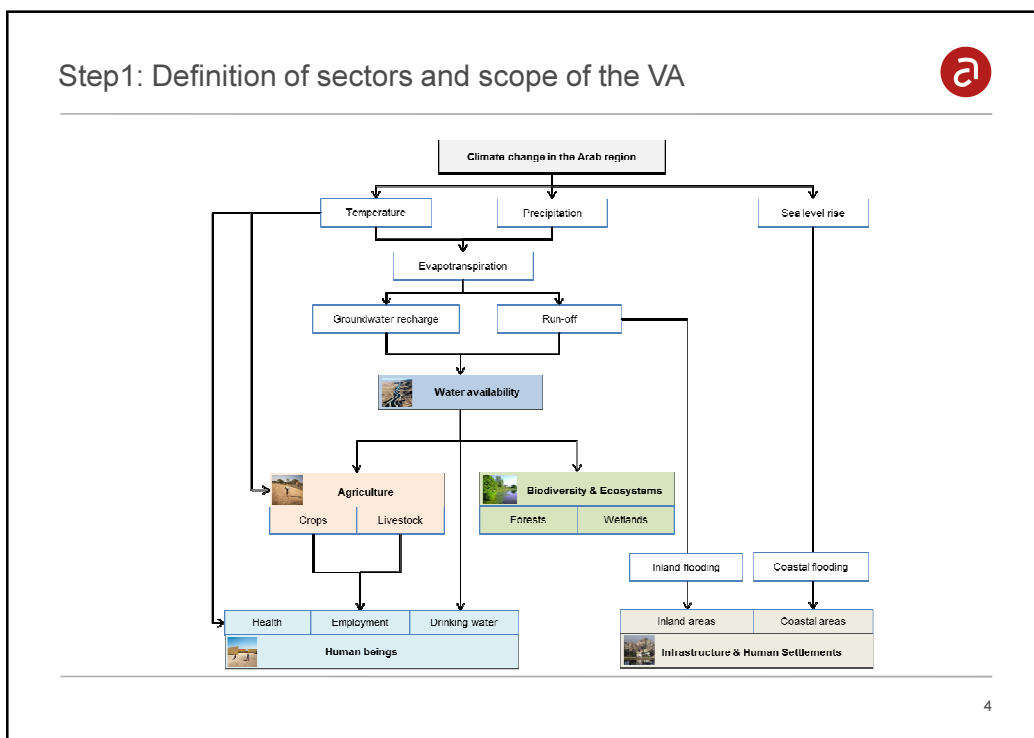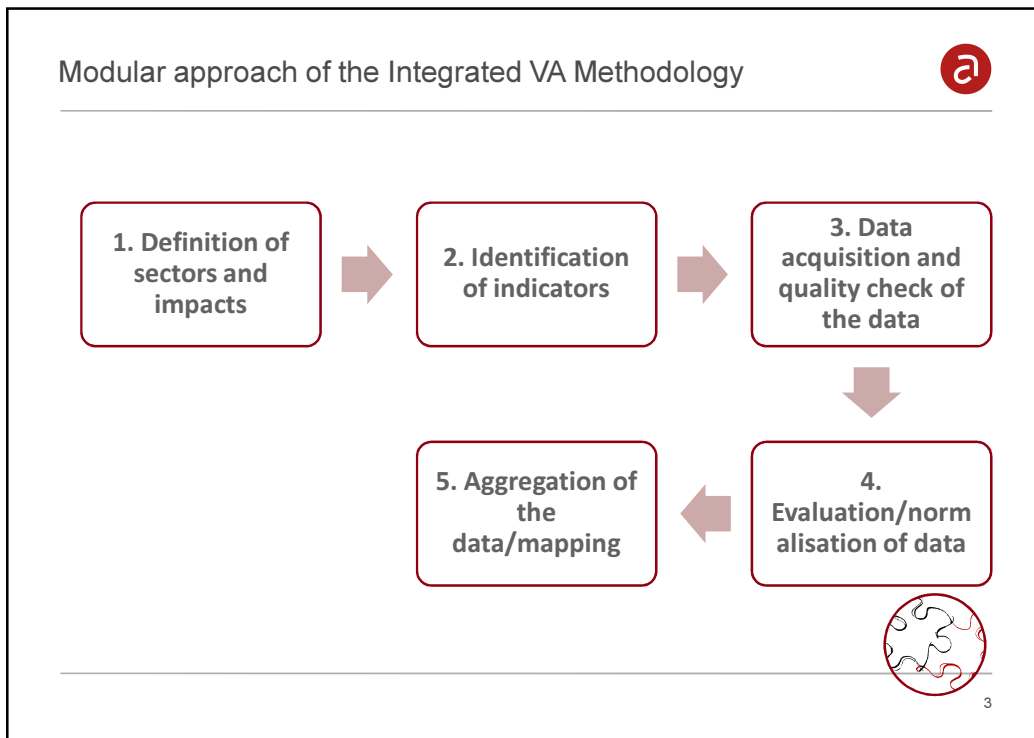
Kerstin Fritzsche, Project Manager, adelphi

VA Training Manual

- Part I: Outlines conceptual approach of the Vulnerability Assessment Methodology including selection of sectors, key climate change impacts and indicators

- Part II: Outlines the step-wise VA methodology

- Part III: Provides detailed information on the implemenation of the methodology using GIS

- Part IV: Advice on how the VA methodology can be adapted for the national level

- Annex: List of indicators and data sources

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Modular approach of the Integrated VA Methodology

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┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│ 1. Definition of│  →   │ 2. Identification│  →   │ 3. Data         │
│ sectors and     │      │ of indicators   │      │ acquisition and │
│ impacts         │      │                 │      │ quality check of│
│                 │      │                 │      │ the data        │
└─────────────────┘      └─────────────────┘      └─────────────────┘
                                                           ↓
┌─────────────────┐      ┌─────────────────┐
│ 5. Aggregation of│  ←  │ 4.              │
│ the             │      │ Evaluation/norm │
│ data/mapping    │      │ alisation of data│
└─────────────────┘      └─────────────────┘
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Step1: Definition of sectors and scope of the VA

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Step 1, cont'd: Mulit-sectoral scope

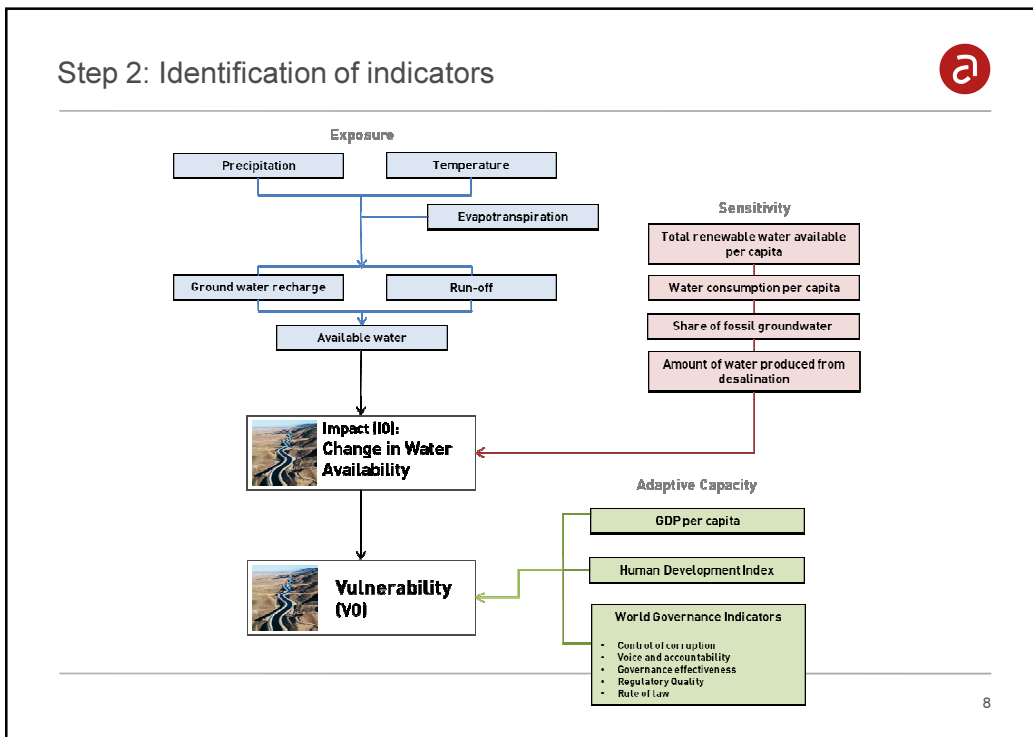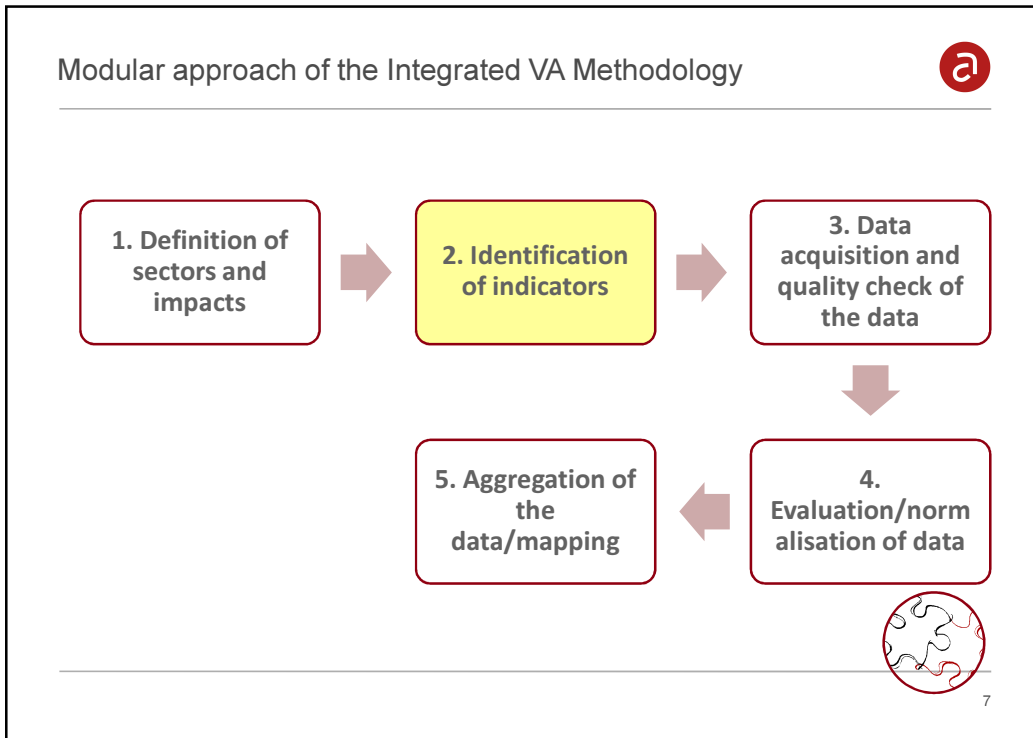|	Impacts
Water	Change in water availability
Biodiversity & Ecosystems	Change in area covered by forests
	Change in area of wetlands/marshes
Agriculture	Change of water available for crops
	Change of water available for pasture/livestock
Infrastructure & Human Settlements	Damage from inland flooding
	Damage from coastal flooding
People	Change of water available for drinking
	Change in health stress due to rising temperatures
	Change of employment rate in the agricultural sector

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Step 1, cont'd: Spatial and temporal scope & scenarios

- Regional scope: all 22 Arab countries

- Temporal scope:
  - Reference period from 1985-2005
  - Future periods: 2016 to 2035, 2046 to 2065, 2081 to 2100

- Representative concentrations pathways (RCPs):
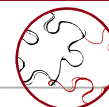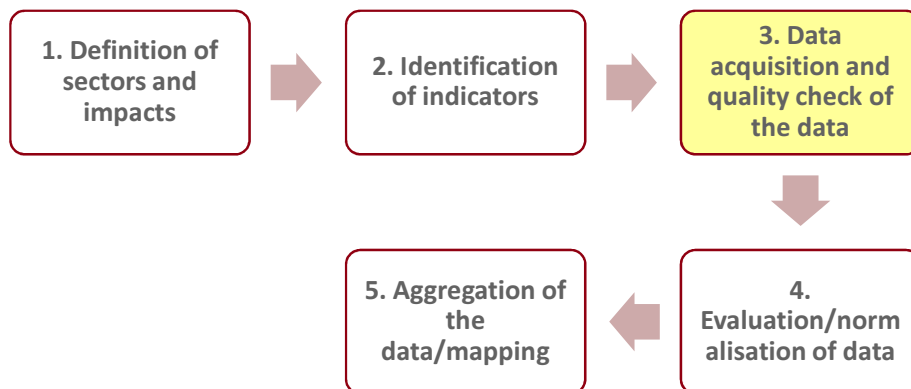 - RCP 4.5 (medium) and RCP 8.5 (high)

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Modular approach of the Integrated VA Methodology

Step 2: Identification of indicators

Step 2, cont'd: Identification of indicators

	Indicator / Index	Description	Unit	Spatial resolution
Exposure	Change in ground water recharge rate	Indicates (projected/future) trends and changes in available groundwater	mm	50*50km
	Change in run-off	Indicates (projected/future) trends and changes in run-off	mm	50*50km
Sensitivity	Total renewable water available per capita (TARWR)	Indicates human pressure on renewable but finite resources.	m3/capita/yr	national level (one value per country)
	Water consumption per capita	Indicates the intensity of use of actual water resources	m3/capita/yr	national level (one value per country)
	Share of fossil ground-water	Indicates the intensity of use of finite and non-renewable water resources	%	tba
	Amount of water produced from desalination	Indicates the share of water produced from desalination.	m3/year or m3/year/capita	national level (one value per country)
	Water reuse rate	Indicates the reuse rate of wastewater	%	national level (one value per country)
Adaptive Capacity	Water dependency	Indicates the dependency on water which is receives from other countries.	Aquastat	national level (one value per country)
	Water storage capacities (dams)	Indicates the amount of water which potentially can be stored in dams and used e.g. for irrigation.	ACSAD	Point values for dams and storage capacity by dam
	GDP per capita	Indicates the per-capita welfare and is used as an indicator for living general conditions	$/capita	15*15 minutes grid
	HDI	Indicates the social and economic development based on four criteria: Life expectancy at birth, mean years of schooling, expected years of schooling and gross national income per capita.	0 to 1	national level (one value per country)
	Control of corruption	World governance indicators indicate the traditions and	-2.5 to 2.5	national level

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Modular approach of the Integrated VA Methodology

1. Definition of sectors and impacts → 2. Identification of indicators → **3. Data acquisition and quality check of the data** ↓ 4. Evaluation/normalisation of data ← 5. Aggregation of the data/mapping

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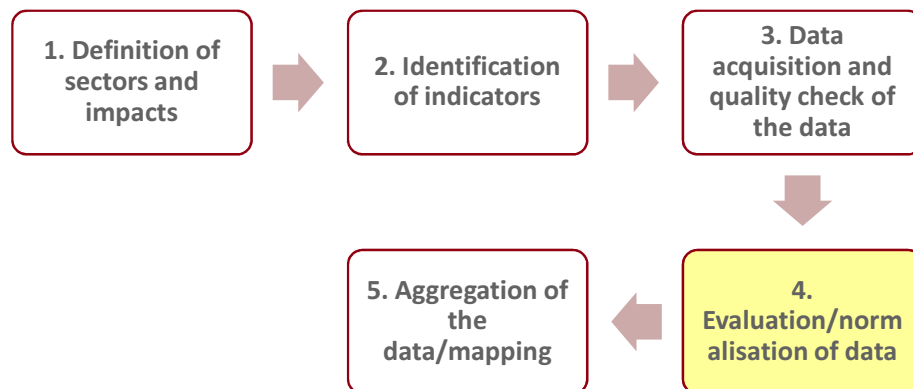## Step 3: Data Acquisition

Exposure indicators:
- RCMs and RHMs

Sensitivity & adaptive capacity indicators:
- Relying on already available data from regional as well as international institutions (e.g. ACSAD, FAO/Aquastat WHO, etc.)
- Available LULC (Modis), DEM, topographic maps, etc.

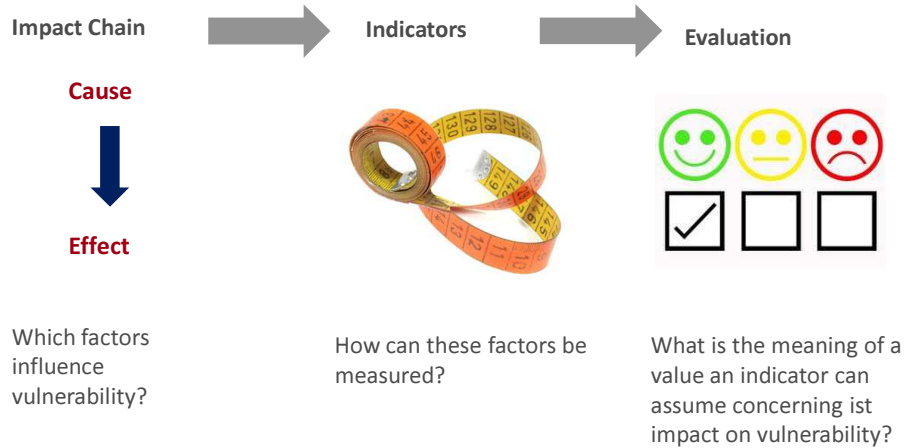⁘ Data availability & quality is essential for the assessment!

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Modular approach of the Integrated VA Methodology

| 1. Definition of sectors and impacts | → | 2. Identification of indicators | → | 3. Data acquisition and quality check of the data |

| 5. Aggregation of the data/mapping | ← | 4. Evaluation/normalisation of data |

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Step 4: Evaluation/Normalisation of Indicators

Impact Chain → **Indicators** → **Evaluation**

Cause

↓

Effect

Which factors influence vulnerability?

How can these factors be measured?

What is the meaning of a value an indicator can assume concerning ist impact on vulnerability?

Stefan Schneiderbauer, 2013.

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Step 4, cont'd: Evaluation/Normalisation

•••⋮ Min-max normalisation:

Applied on metric data with a rather linear relationship to vulnerability:

$$X_{i,\,0\,to\,1} = \frac{X_i - X_{Min}}{X_{Max} - X_{Min}}$$

X_i = Each data point i
X_{Min} = The minima among all the data points
X_{Max} = The maxima among all the data points
$X_{i,\,0\,to\,1}$ = The data point i normalized between 0 and 1

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Min-max normalisation

⋯⋮ Bringing normalised values on a scale from 1-10

Class	Normalised data value		Class	Normalised data value
1	0 – 0.1		6	0.5 – 0.6
2	0.1 – 0.2		7	0.6 – 0.7
3	0.2 – 0.3		8	0.7 – 0.8
4	0.3 – 0.4		9	0.8 – 0.9
5	0.4 – 0.5		10	0.9 – 1.0

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Evluation of indicators using expert opinion

⋯⋮ Land Use Land Cover Classes:

Extremely Sensitive

1. Forest
2. Cropland
3. Bare soil/gravel
4. Sand (beach/desert)
5. Urban
6. Salt pans
7. Water
8. Sparse vegetation
+
9. Wetlands

Not sensitive

10
9
8
7
6
5
4
3
2
1

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Modular approach of the Integrated VA Methodology

1. Definition of sectors and impacts	→	2. Identification of indicators	→	3. Data acquisition and quality check of the data

5. Aggregation of the data/mapping	←	4. Evaluation/norm alisation of data

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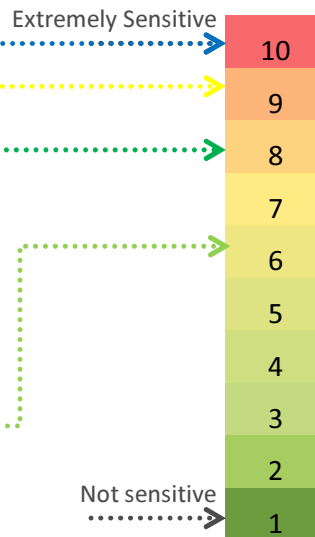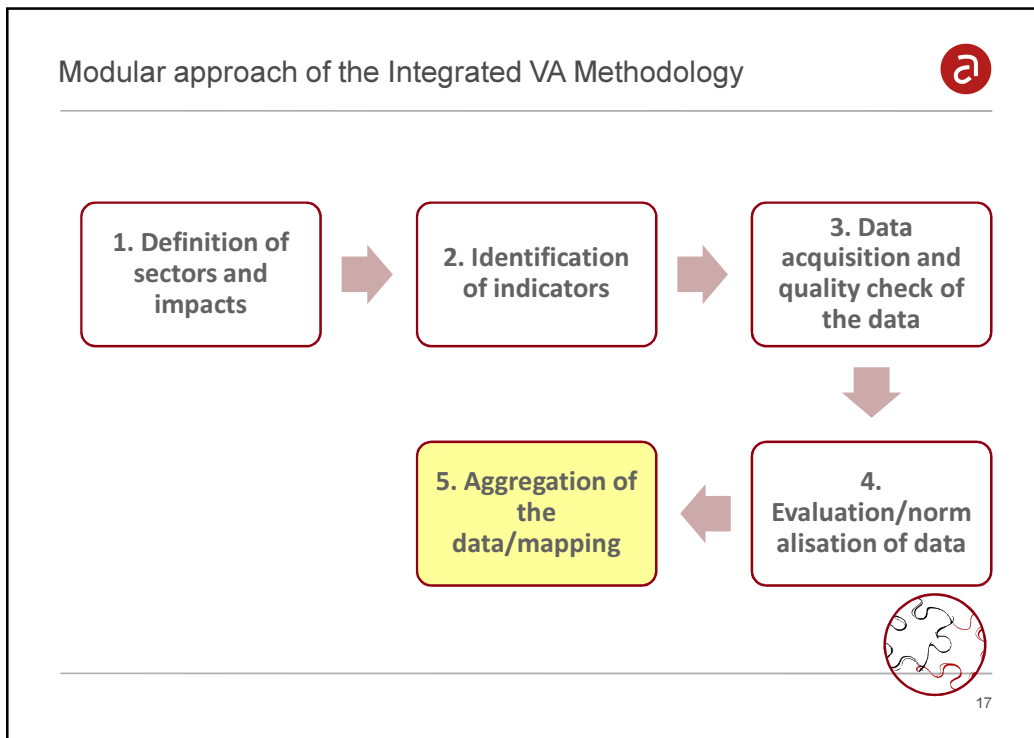
Step 5: Aggregation

⋯⋱ Geometric aggregation approach:

- State-of-the-art, used e.g. in the HDI and the European Index for Risk Management
- Allows only partial compensability

Weighted Arithmetic Mean

Indicator A
Indicator B

- 0,80-1,00
- 0,60-0,80
- 0,40-0,60
- 0,20-0,40
- 0,00-0,20

Weighted Geometric Mean

Indicator A
Indicator B

- 0,80-1,00
- 0,60-0,80
- 0,40-0,60
- 0,20-0,40
- 0,00-0,20

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Step 5, cont'd: Aggregation

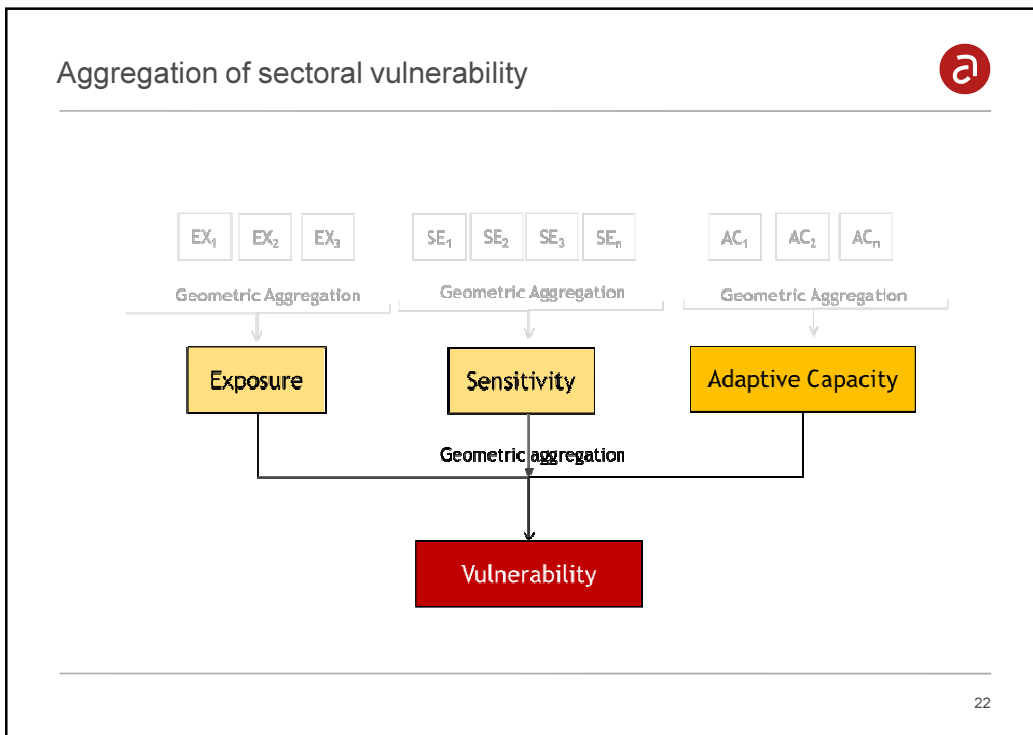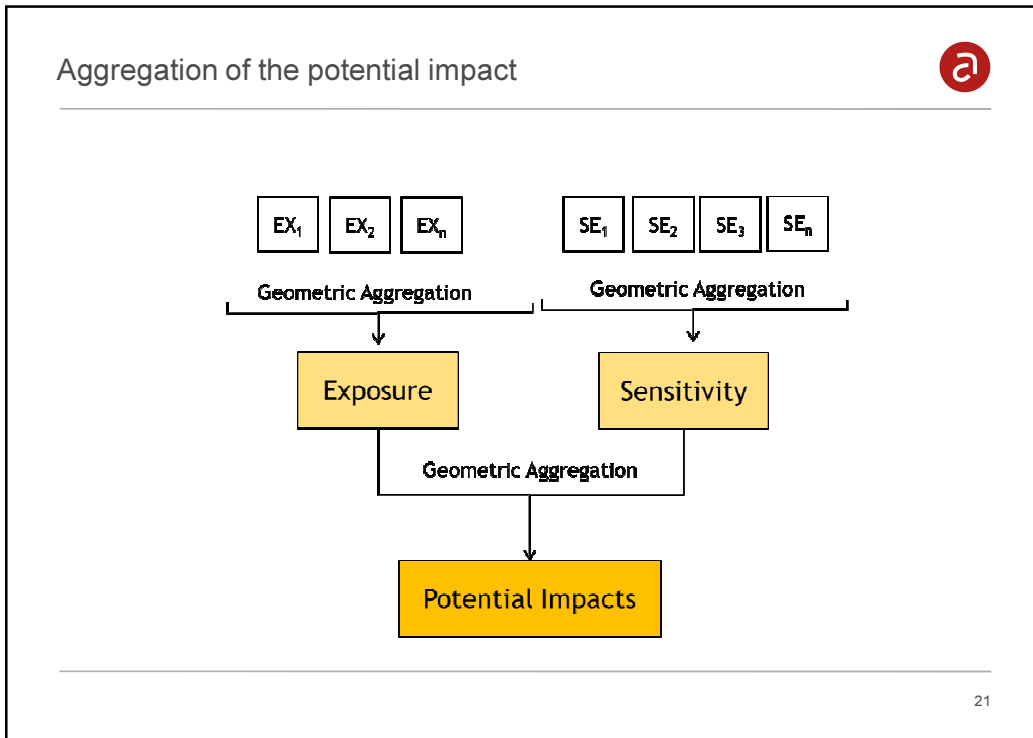⋯❖ Different levels of aggregation:

- Indicators to vulnerability components (exposure, sensitivity, adaptive capacity)
- Components exposure and sensitivity to potential impact
- Components exposure, sensitivity and adaptive capacity to vulnerability
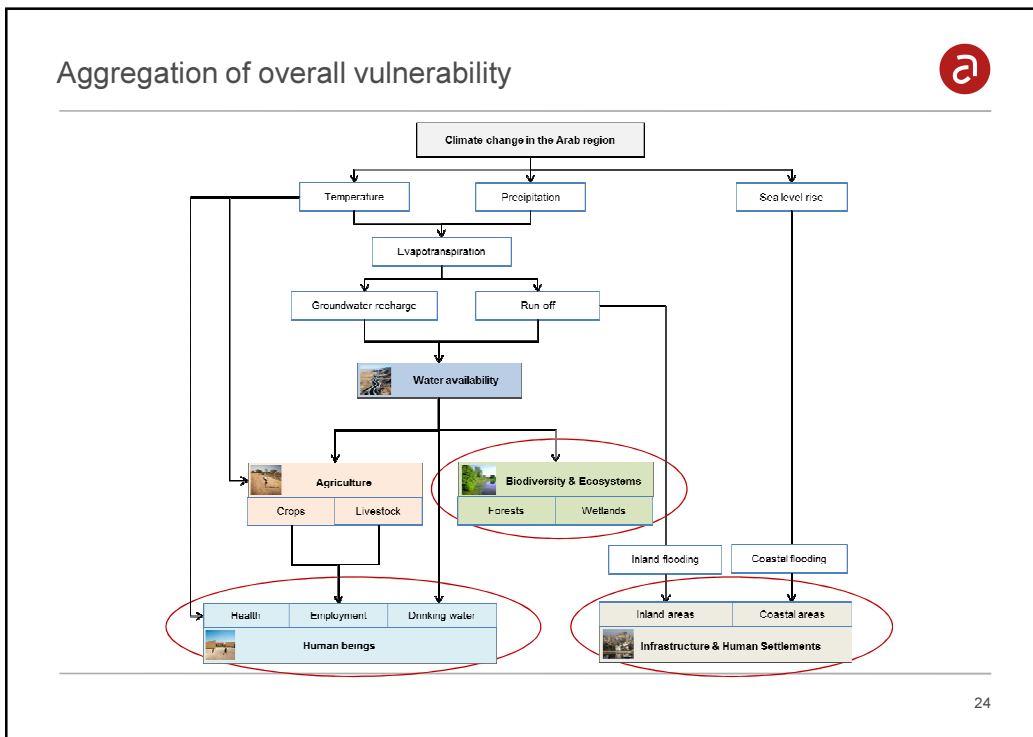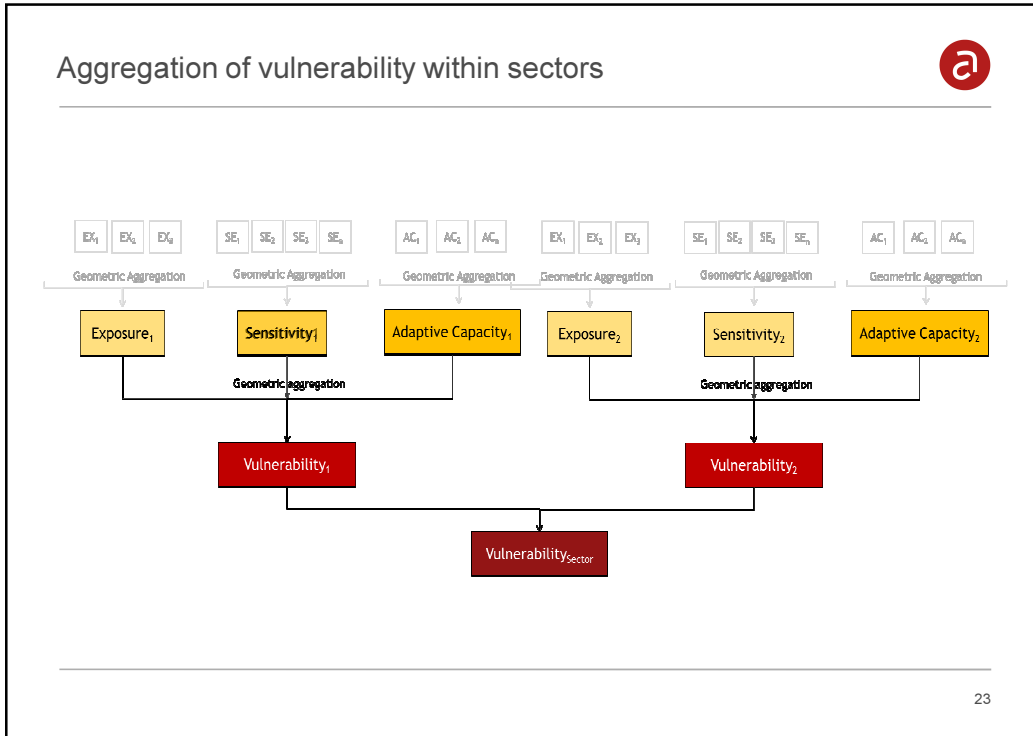- Sectoral vulnerability to overall vulnerability

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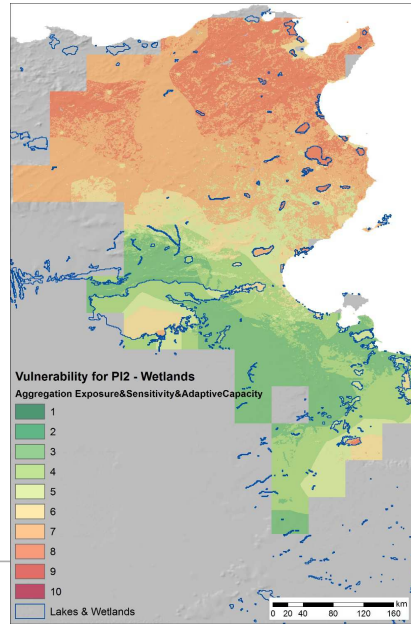## Aggregation of vulnerability components

Aggregation of the potential impact

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Aggregation of sectoral vulnerability

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Aggregation of vulnerability within sectors

23

Aggregation of overall vulnerability

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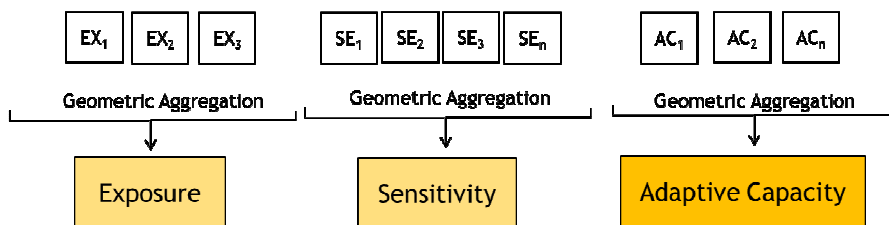
Final Step: Mapping vulnerability (example: wetlands)

Vulnerability for PI2 - Wetlands
Aggregation Exposure&Sensitivity&AdaptiveCapacity

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Lakes & Wetlands

Source: EURAC.

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