



LIFE08 ENV/IT/436

# PROJECT ACT

## ADAPTING TO CLIMATE CHANGE IN TIME

### Impact assessment on tourism

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# CLIMATE CHANGE & TOURISM

With its close connections to the environment and climate itself, tourism is considered to be a highly climate-sensitive economic sector.

Climate change is not a remote future event for tourism, as the varied impacts of a changing climate are even now becoming evident at destinations around the world and climate change is already influencing decision-making in the tourism sector.



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# PROJECTED CLIMATE CHANGES RELEVANT FOR TOURISM

- Temperature
- Sea level rise
- Extreme weather events



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# VULNERABILITY OF TOURISM TO CLIMATE CHANGES

- Exposure
- Sensitivity
- Adaptive capacity



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# EXPOSURE

## *Potential indicators*

### Mechanisms/climate variable projections

Mean temperature increase



*Share of tourist arrivals in the summer season*

Extreme weather events



*Number of tourist facilities and infrastructure that might be affected by extreme weather events*

Sea Level Rise



*Number/area of tourist facilities and infrastructure located on low lying coastal zone;*

Transverse



*•Number/area of tourist protected areas and/or touristic natural sites  
•Number of employees in the coastal/summer tourism sector*



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# SENSITIVITY

## *Potential indicators*

### Mechanisms/climate variable projections

### Indicators

Mean temperature increase



*share of arrivals visiting for leisure purposes*

Extreme weather events



*the percentage of population annually affected by meteorological extreme events*

Sea Level Rise



*km of beach length to be nourished in order to maintain important tourist resort areas*



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# IMPACT

## *Description*

- 1) *Direct climatic impacts.*** Changes in the length and quality of climate-dependent tourism seasons (e.g., sun-and-sea or winter sports holidays) could have considerable implications for competitive relationships between destinations and therefore the profitability of tourism enterprises.
- 2) *Indirect environmental change impacts.*** Changes in water availability, biodiversity loss, reduced landscape aesthetic, altered agricultural production (e.g., food and wine tourism), increased natural hazards, coastal erosion and inundation (caused by sea level rise), damage to infrastructure and the increasing incidence of vector-borne diseases will all impact tourism to varying degrees.
- 3) *Indirect societal change impacts.*** Climate change is thought to pose a risk to future economic growth and to the political stability of some nations. Any such reduction of global GDP due to climate change would reduce the discretionary wealth available to consumers for tourism and have negative implications for anticipated future growth in tourism. Climate change is considered a national and international security risk that will steadily intensify, particularly under greater warming scenarios.



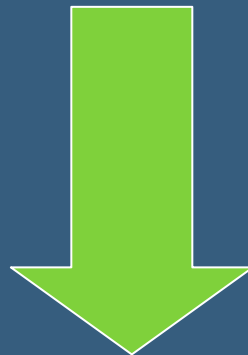
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# IMPACT

## *Methodologies and indicators*

One of the key aspects in analyzing the impacts of climate change on the tourism sector is expressing the impacts of climate change in a *suitable physical indicator* that can be used to model the attractiveness of the climate to tourists.



## Tourism Climate Index (TCI)

developed by Mieczkowski (1985).

This index is used also in the *UE PESETA project* and in particular in the section related to the physical impact assessment for tourism.



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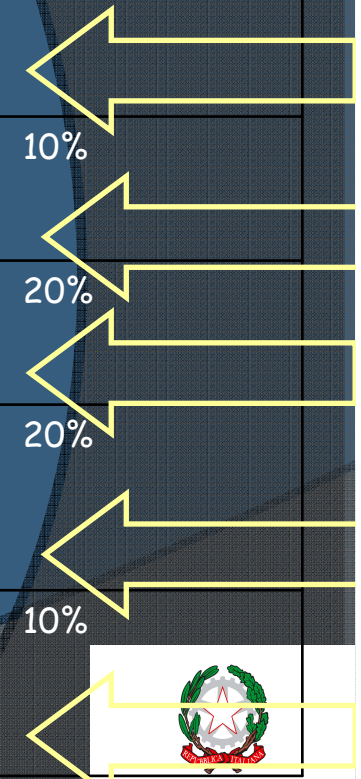
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# Tourism Climate Index (TCI)

The index is based on the notion of "*human comfort*" and consists of five sub-indices, each represented by one or two monthly climate variables.

Sub-Index	Monthly Climate Variables	Influence on TCI	Weighting in TCI
Daytime Comfort Index (CID)	maximum daily temperature [in °C] & minimum daily relative humidity [%]	Represents thermal comfort when maximum tourist activity occurs	40%
Daily Comfort Index (CIA)	mean daily temperature [in °C] & mean daily relative humidity [%]	represents thermal comfort over the full 24 hour period, including sleeping hours	10%
Precipitation (P)	total precipitation [in mm]	reflects the negative impact that this element has on outdoor activities and holiday enjoyment	20%
Sunshine (S)	total hours of sunshine	rated as positive for tourism, but acknowledged can be negative because of the risk of sunburn and added discomfort on hot days	20%
Wind (W)	average wind speed [in m/s or km/h]	variable effect depending on temperature (evaporative cooling effect in hot climates rated positively, while 'wind chill' in cold climates rated negatively)	10%



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# Tourism Climate Index (TCI)

The index is calculated as follows:

$$TCI = 2 * [(4 * CID) + CIA + (2 * P) + (2 * S) + W]$$

where *CID* = daytime comfort index, *CIA* = daily comfort index, *P* = precipitation, *S* = sunshine, and *W* = wind speed.

With an optimal rating for each variable of 5 (minimum -3).

Mieczkowski took *light outdoor activities* as the point of reference for his rating system.

The maximum TCI score is 100 and the minimum TCI scores is -30.



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# Tourism Climate Index (TCI)

## *Tourism Climatic Index Rating System*

Numeric value of index	Description of comfort level for tourism activity
90 - 100	Ideal
80 - 89	Excellent
70 - 79	Very good
60 - 69	Good
50 - 59	Acceptable
40 - 49	Marginal
30 - 39	Unfavourable
20 - 29	Very unfavourable
10 - 19	Extremely unfavourable
Below 9	Impossible

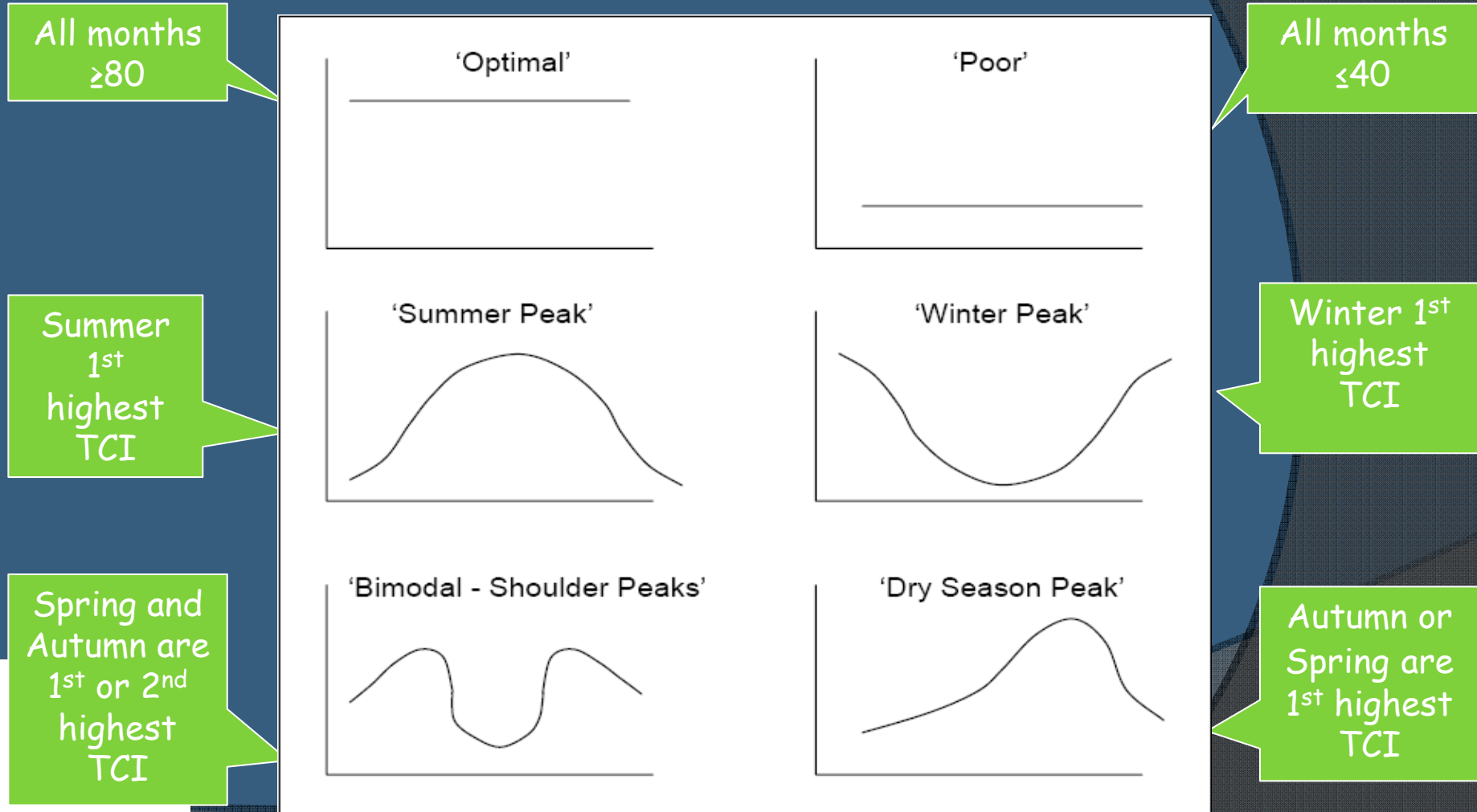


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# Tourism Climate Index (TCI)

## Conceptual tourism climate distributions

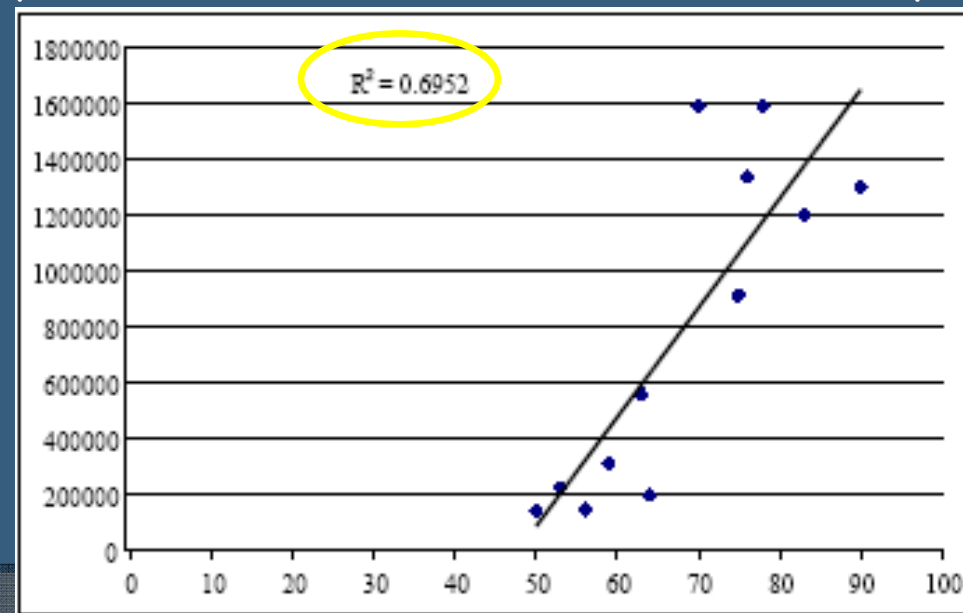


# Tourism Climate Index (TCI)

## Limitations and uncertainties

- 1) climatic conditions are by no means the only determinant of tourist patterns;
- 2) not only the climatic conditions per se are important, but also the conditions relative to those of competing areas;

In the context of the PESETA project, a statistical analysis of the relationship between tourists' arrivals and the TCI has also been carried out for the Mediterranean countries. The predictive power of the TCI is high, with an  $R^2$  of 0.72, a value very similar to the one obtained for the example of Mallorca.



*TCIs can be effective indicators for the climatic attractiveness of tourist destinations.*

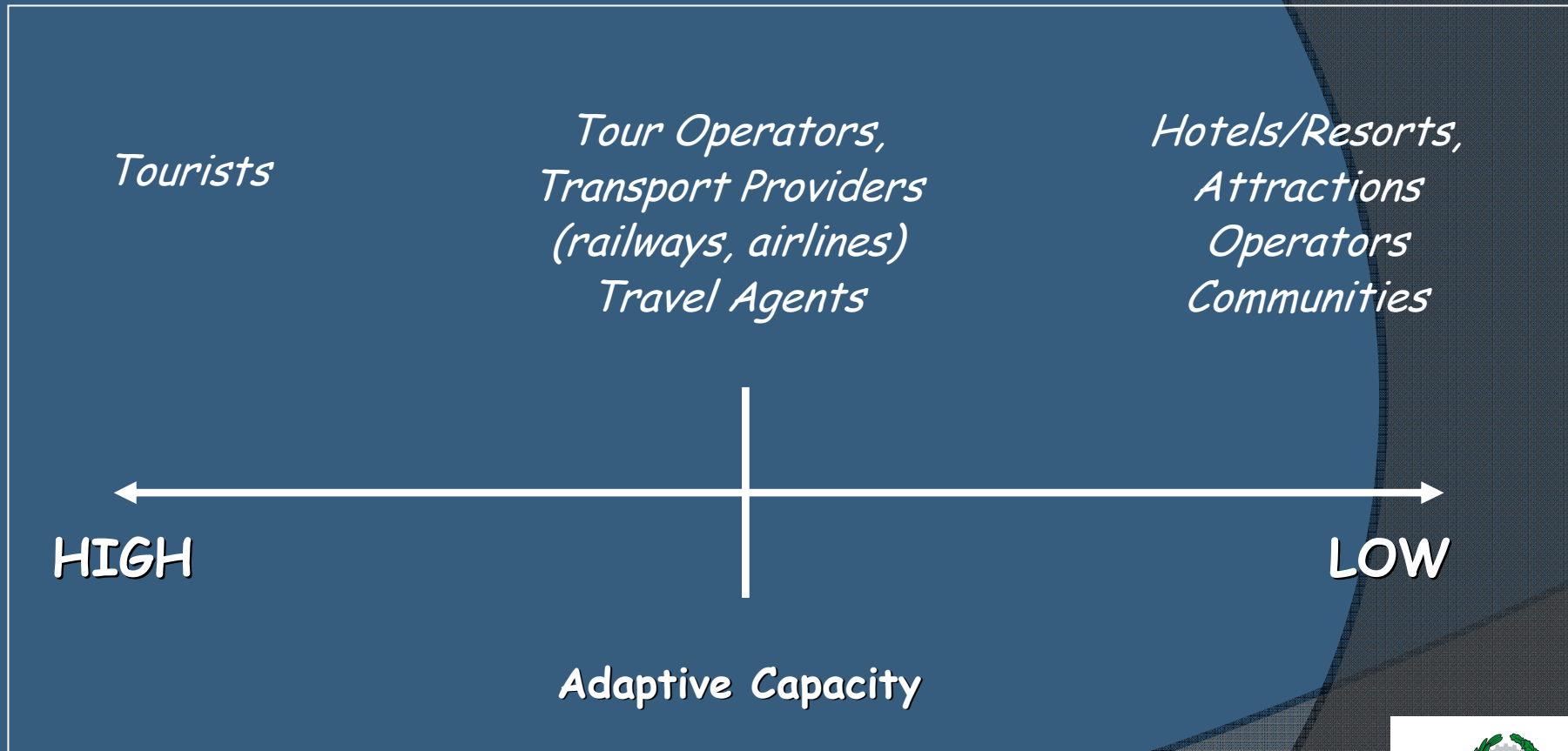


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# ADAPTIVE CAPACITY

## *Relative Adaptive Capacity of Major Tourism Sub-sectors*



Source: UNWTO-UNEP-WMO 2008



# ADAPTIVE CAPACITY

## *A Portfolio of Climate Change Adaptations Utilized by Tourism Stakeholders*

Type of Adaptation	Tourism Operators/ Businesses	Tourism Industry Associations	Governments and Communities	Financial Sector (investors/ insurance)
Technical	<ul style="list-style-type: none"> <li>-Snowmaking</li> <li>-Rainwater collection and water recycling systems</li> <li>-Slope contouring</li> <li>-Cyclone-proof building design and structure</li> </ul>	<ul style="list-style-type: none"> <li>-Enable access to early warning equipment (e.g. radios) to tourism operators</li> <li>- Develop websites with practical information on adaptation measures</li> </ul>	<ul style="list-style-type: none"> <li>-Reservoirs, and desalination plants - Fee structures for water consumption</li> <li>-Weather forecasting and early warning systems</li> </ul>	<ul style="list-style-type: none"> <li>-Require advanced building design or material (fire resistant) standards for insurance</li> <li>- Provide information material to customers</li> </ul>
Managerial	<ul style="list-style-type: none"> <li>-Water conservation plans</li> <li>-Low season closures</li> <li>-Product and market diversification</li> <li>-Regional diversification in business operations</li> <li>-Redirect clients away from impacted destinations</li> </ul>	<ul style="list-style-type: none"> <li>-Snow condition reports through the media</li> <li>- Use of short-term seasonal forecasts for the planning of marketing activities</li> <li>- Training programmes on climate change adaptation</li> <li>- Encourage environmental management with firms (e.g. via certification)</li> </ul>	<ul style="list-style-type: none"> <li>-Impact management plans (e.g., 'Coral Bleaching Response Plan')</li> <li>-Convention/ event interruption insurance</li> <li>-Business subsidies (e.g., insurance or energy costs)</li> </ul>	<ul style="list-style-type: none"> <li>-Adjust insurance premiums or not renew insurance policies</li> <li>-Restrict lending to high risk business operations</li> </ul>
Policy	<ul style="list-style-type: none"> <li>-Hurricane interruption guarantees</li> <li>- Comply with regulation (e.g. building code)</li> </ul>	<ul style="list-style-type: none"> <li>-Coordinated political lobbying for GHG emission reductions and adaptation mainstreaming</li> <li>- Seek funding to implement adaptation projects</li> </ul>	<ul style="list-style-type: none"> <li>-Coastal management plans and set back requirements</li> <li>-Building design standards (e.g., for hurricane force winds)</li> </ul>	<ul style="list-style-type: none"> <li>-Consideration of climate change in credit risk and project finance assessments</li> </ul>
Research	<ul style="list-style-type: none"> <li>-Site Location (e.g., north facing slopes, higher elevations for ski areas, high snow fall areas)</li> </ul>	<ul style="list-style-type: none"> <li>- Assess awareness of businesses and tourists and knowledge gaps</li> </ul>	<ul style="list-style-type: none"> <li>-Monitoring programs (e.g., predict bleaching or avalanche risk, beach water quality)</li> </ul>	<ul style="list-style-type: none"> <li>-Extreme event risk exposure</li> </ul>
Education	<ul style="list-style-type: none"> <li>-Water conservation education for employees and guests</li> </ul>	<ul style="list-style-type: none"> <li>-Public education campaign (e.g., 'Keep Winter Cool')</li> </ul>	<ul style="list-style-type: none"> <li>-Water conservation campaigns</li> <li>-Campaigns on the dangers of UV radiation</li> </ul>	<ul style="list-style-type: none"> <li>- Educate/inform potential and existing customers</li> </ul>
Behavioural	<ul style="list-style-type: none"> <li>-Real-time webcams of snow conditions</li> <li>-GHG emission offset programs</li> </ul>	<ul style="list-style-type: none"> <li>-GHG emission offset programs</li> <li>- Water conservation initiatives</li> </ul>	<ul style="list-style-type: none"> <li>-Extreme event recovery marketing</li> </ul>	<ul style="list-style-type: none"> <li>- Good practice in-house</li> </ul>

Source: Adapted from UNWTO-UNEP-WMO 2008



# ADAPTIVE CAPACITY

*Potential indicators for all climate variable projections*

- Number of resorts that are part of an early warning system (n.)
- Money invested into adaptation measures and technology (€)
- Diversification touristic activities (%)
- Plans or programs including climatic variable in its programming (n.)





# VULNERABILITY ASSESSMENT

## *Methodologies*

- Polsky et al. (2007) developed the vulnerability scoping diagram (VSD) as a tool for visualization and comparison between different vulnerability assessment.
- Moreno and Becken (2009) developed a five-step methodology for assessing tourism's vulnerability and applied the VSD in the framework of the third step specifically focusing the "vulnerability assessment" .
- Perch-Nielsen S. L. (2009), analyse vulnerability of beach tourism by means of an index approach.
- IUCN (Herr D, Galland G. R., 2009), as regards vulnerability of community and ecosystem, suggest to use Ecosystem-based Adaptation (EbA) in order to enhance resilience and reduce vulnerability by limiting exposure and building adaptive capacity.

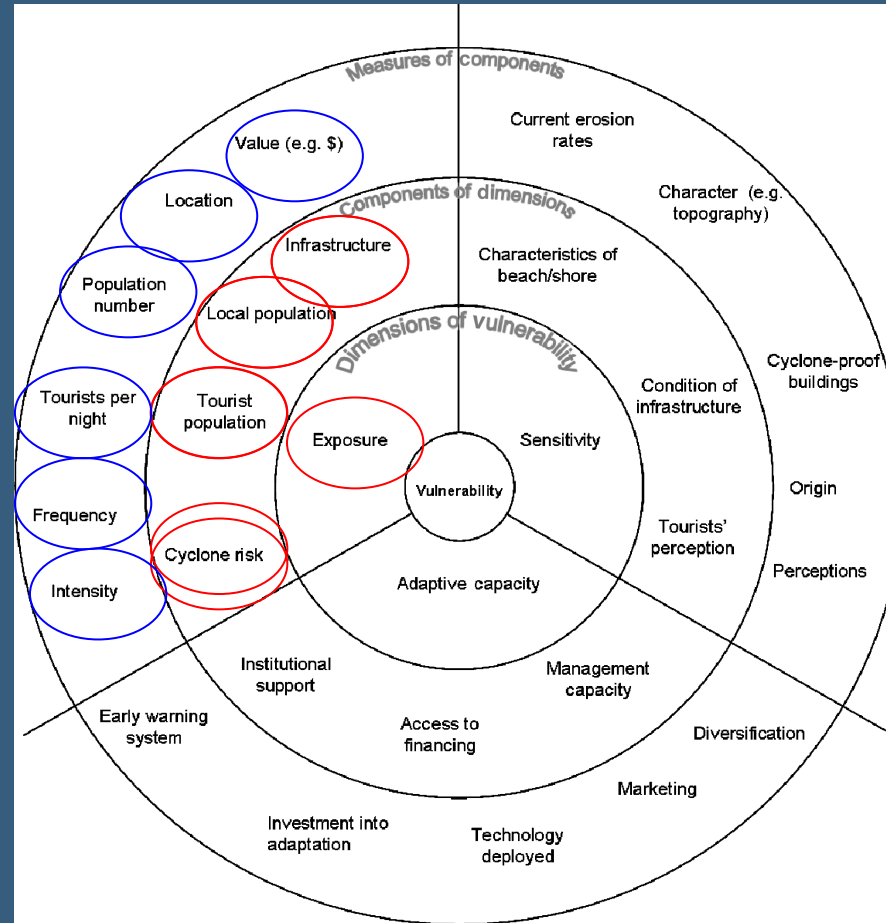


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# VULNERABILITY ASSESSMENT

## Methodologies - VCD



Source: Moreno and Becken, 2009

Vulnerability Scoping Diagram for the "beach-cyclone" sub-system



# CONCLUSION

- Scientific literature still reveal a key weakness of the vulnerability concept itself;
- Extensive application of the vulnerability assessment framework to different tourism destinations is required;
- Coastal areas and leisure tourism in general, are among the most vulnerable tourist sectors. They are not only exposed and sensitive to climate change, but in many cases their adaptive capacity is low;
- Knowledge about vulnerability to climate change will therefore play an important role in present and future management strategies of tourism destinations.



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# THANKS FOR YOUR ATTENTION!!!

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