LIFE08 ENV/IT/436

PROJECT ACT

ADAPTING TO CLIMATE CHANGE IN TIME

Adaptation to climate change: key concepts

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Structure of the presentation

- Definitions
- Key concepts
- Types of adaptation
- Adaptation vs. mitigation
- Vulnerability and adaptation in the Mediterranean basin
- The role of traditional knowledge

Definitions of adaptation

- “Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation” (IPCC 4AR, 2007)
- “Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. For example, flood walls should be built and in numerous cases it is probably advisable to move human settlements out of flood plains and other low-lying areas…” (UNFCCC)
- “…a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented” (UNDP, 2005)
- “The process or outcome of a process that leads to a reduction in harm or risk of harm, or realization of benefits associated with climate variability and climate change” (UKCIP, 2003)

Responding to climate change

At the international level, the challenge of responding to climate change with its related impacts has been addressed through two main approaches:

MITIGATION

A strategy which aims at preventing climate change by addressing causes of anthropogenic forcing

Objective

Reducing greenhouse gas sources and enhancing greenhouse gas sinks

ADAPTATION

A strategy which addresses the consequences of climate change

Objective

Limiting the vulnerability of environmental and socio-economic systems to the adverse effects of climate change, reducing damage from current and future impacts and exploiting possible beneficial opportunities

These **strategies** are not alternative but rather **complementary**: the greater is the commitment for mitigation, the lower will be the demand for adaptation and viceversa

Key concepts

EXPOSURE

Relates to the magnitude and rate of change in climatic variables such as temperature, rainfall, wind, snow or humidity that are known to cause impacts on natural systems and society.

X

SENSITIVITY

The degree to which a system (e.g. water resources, crop production, forest, human health) is affected by climate variability or change.

POTENTIAL IMPACTS

The effect of climate change on natural and human systems, without considering adaptation (residual impacts after adaptation has occurred).

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ADAPTIVE CAPACITY

The ability of a system to adjust to climate change (includng climate variability and extremes to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

RISK

Is the probability that a substance or situation will produce harm under specified conditions. Risk is a combination of two factors, the probability (P) that an adverse event will occur and the consequences (I) of the adverse event

R = (P X I)

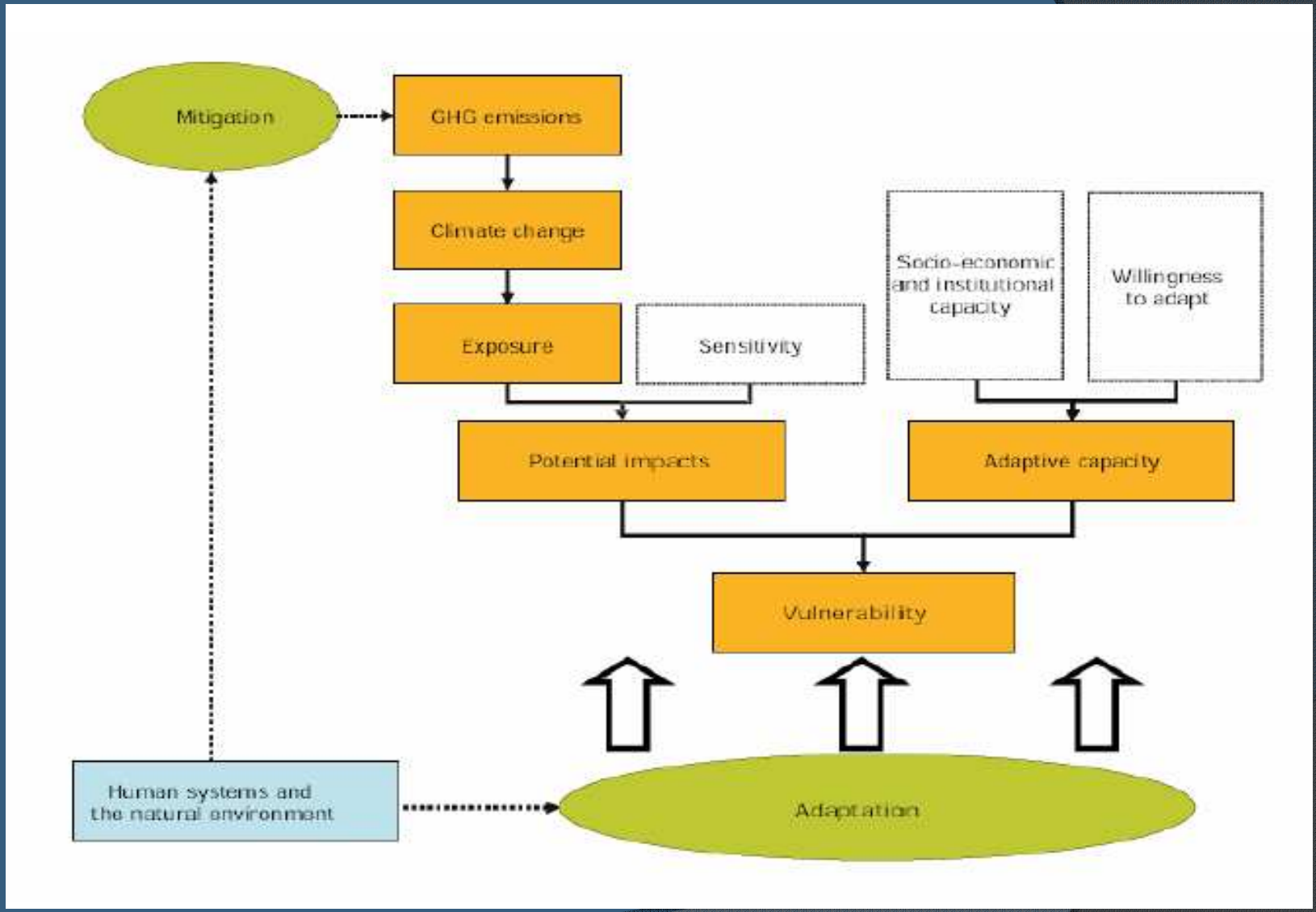
VULNERABILITY

The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extreme events.

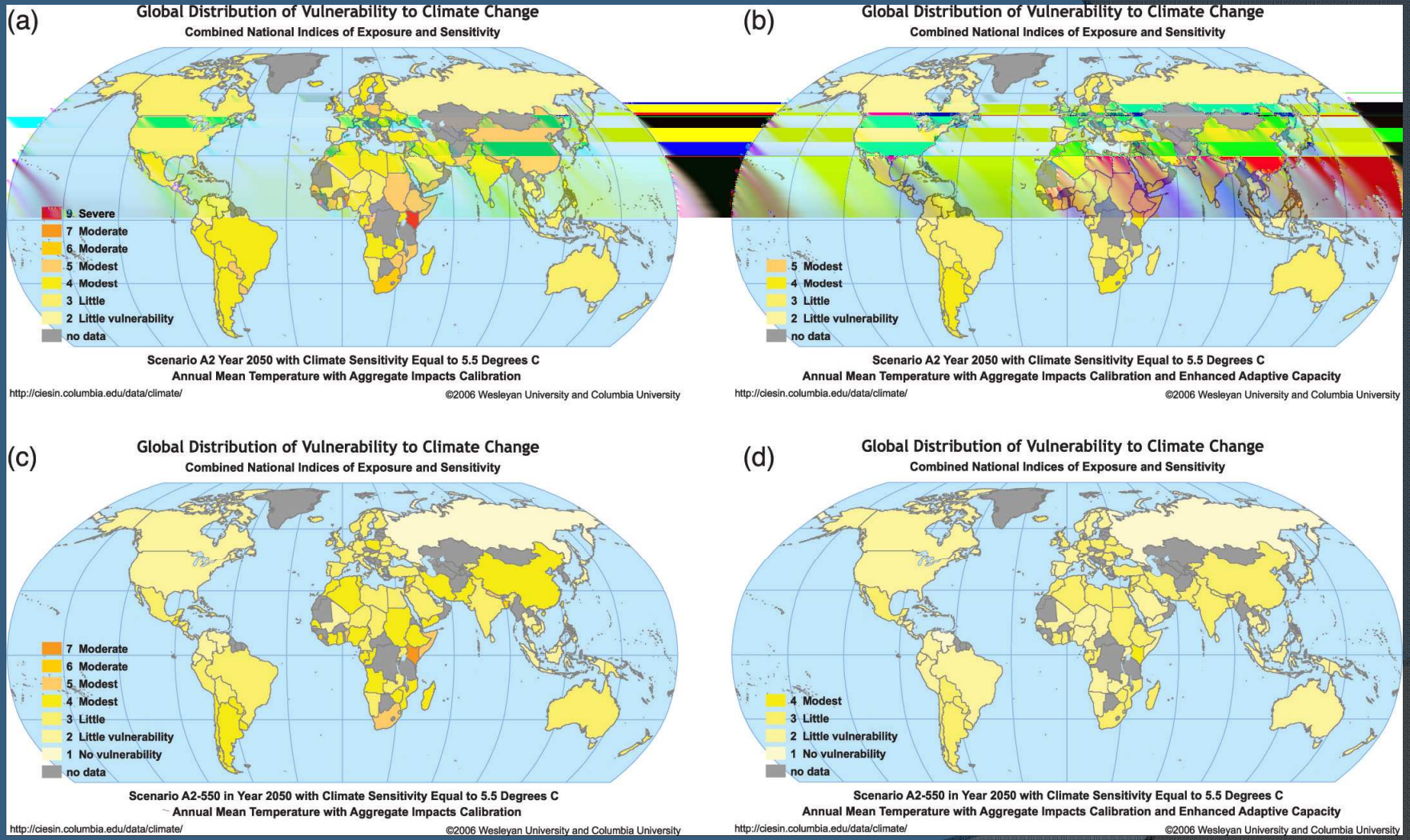
V = f (magnitude and rate of climate change, exposure, sensitivity, adaptive capacity)

	HIGH RISK	LOW RISK
HIGH VULNERABILITY	HIGH PRIORITY	MEDIUM PRIORITY
LOW VULNERABILITY	MEDIUM PRIORITY	LOW PRIORITY

Conceptual diagram

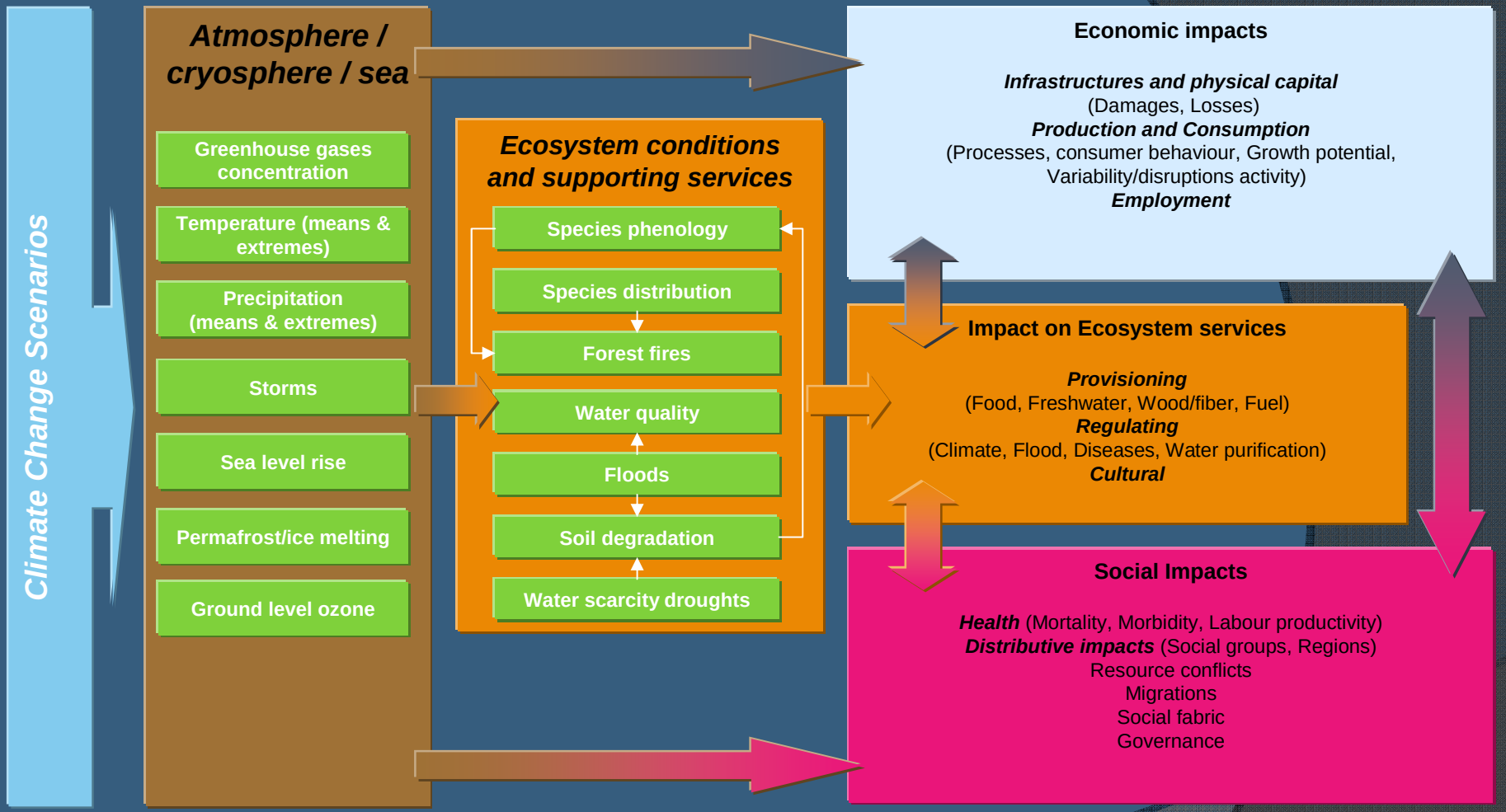


Geographical distribution of vulnerability



Source: IPCC Fourth Assessment Report, Working Group II

Potential impacts of climate change



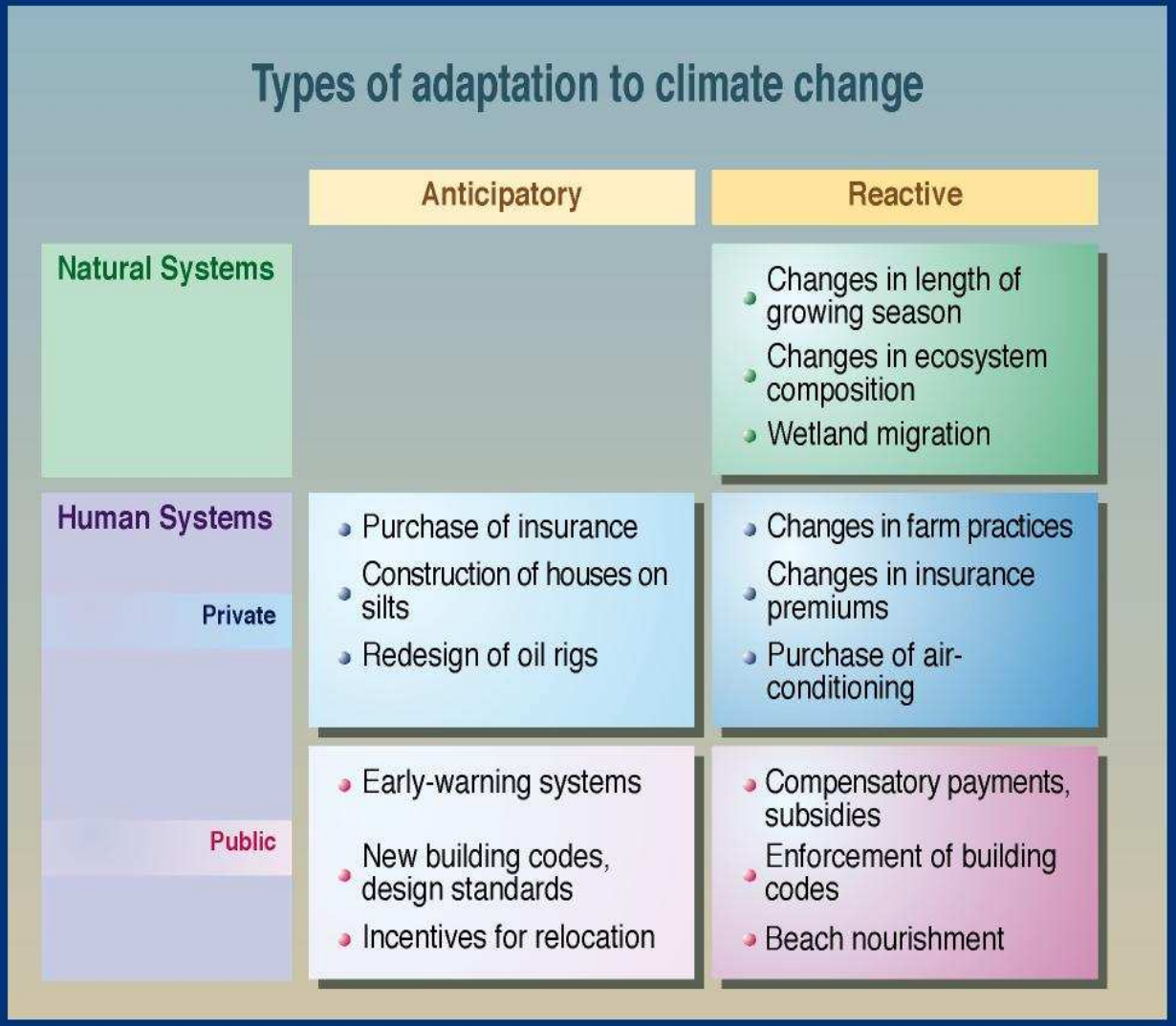
Source: Environment DG based on (EEA, 2008) , OECD 2008 and TEEB. **Potential impacts are** all impacts that may occur given a projected change in climate, without considering adaptation.

Adaptation: possible criteria for classification

Concept or Attribute	Type of adaptation
Purposefulness	Autonomous → Planned
Timing	Anticipatory, Preventive → Reactive, Responsive
Temporal Scope	Short term → Long term
Spatial Scope	Localised → Widespread
Function/Effects	Retreat – accommodate – protect – prevent
Form	Structural – legal – institutional
Valuation of Performance	Effectiveness-efficiency-equity-feasibility

Source: Adapted from Samuel Fankhauser, Joel B. Smith and Richard S.J. Tol , 1999

Types of adaptation to climate change

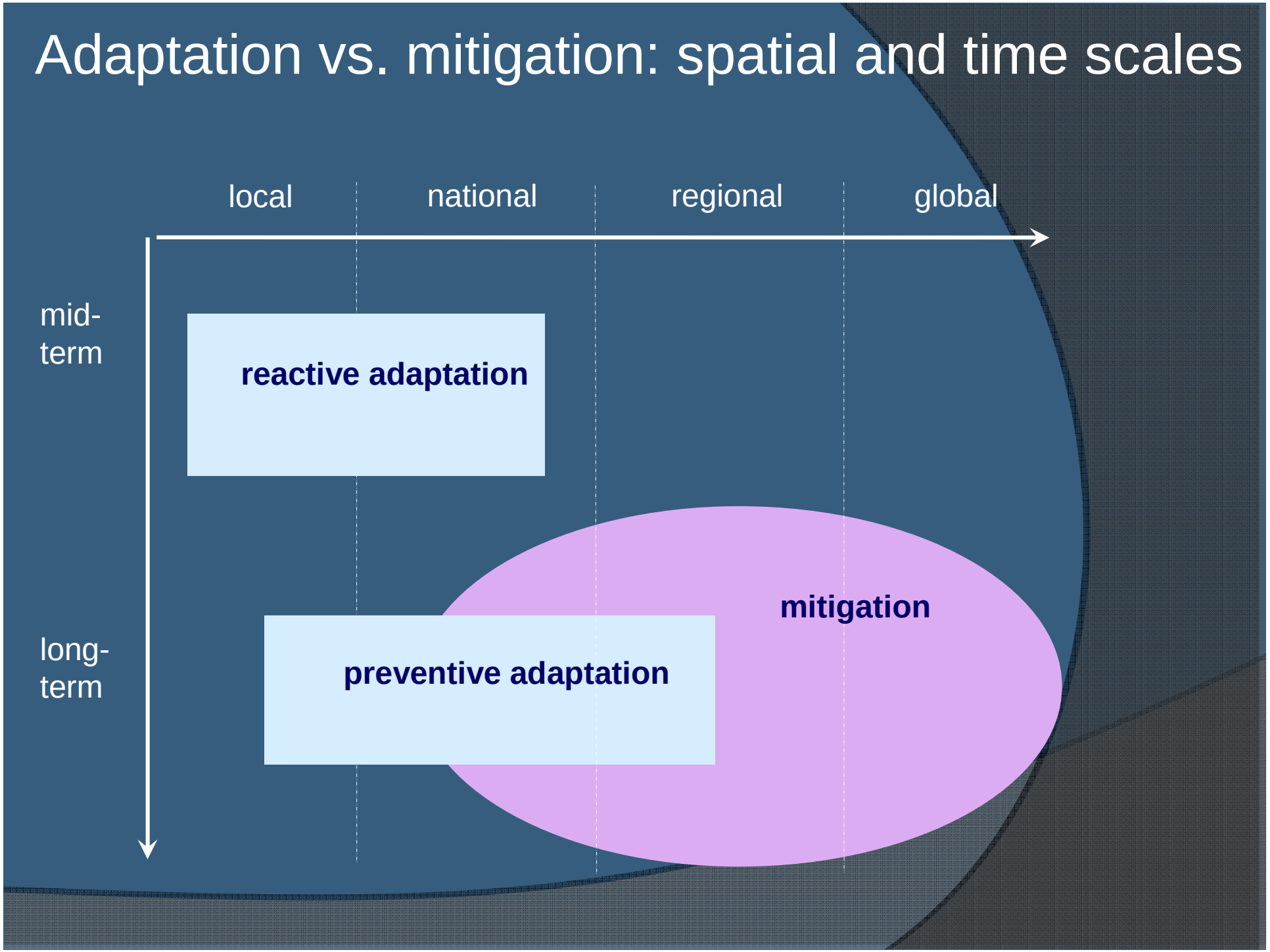


WG2 - FIGURE TS-9

Adaptation vs. mitigation (1)

- Mitigation and adaptation work at different spatial and time scales.
- Mitigation is “global” and “long term” while adaptation is “local” and “shorter term”.
- Mitigation can be considered as a “permanent” solution to anthropogenic climate change.
- Adaptation is more temporary as it typically addresses current or expected damages. It thus may require adjustments should the damage change or be substantially different from what was originally expected.
- Many important synergies exist between preventive adaptation and mitigation. This applies, in particular, to developing and least developed countries, to agroforestry, to the energy sector and to coastal areas.

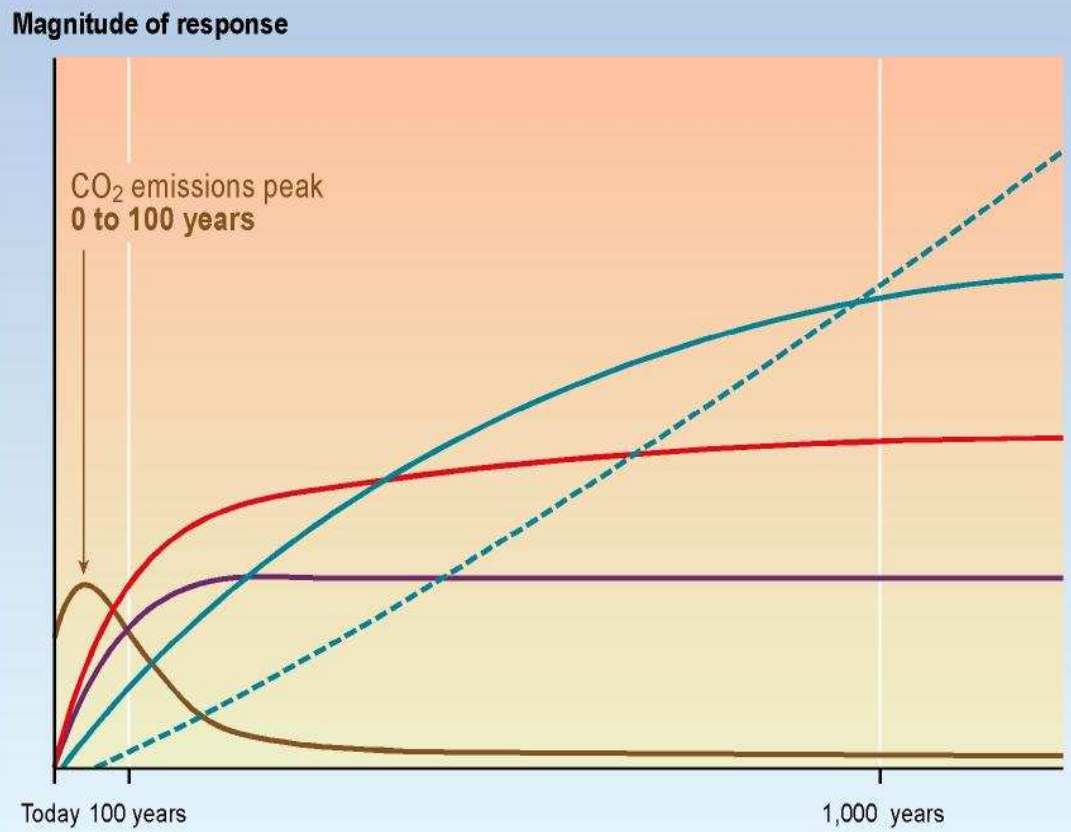
Adaptation vs. mitigation: spatial and time scales



Adaptation vs. mitigation (2)

- Adaptation alone is not expected to cope with all the projected effects of climate change, and especially not over the long term as most impacts increase in magnitude
- A portfolio of adaptation and mitigation measures can diminish the risks associated with climate change
- Adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions
- Past emissions are estimated to involve some unavoidable warming (about a further 0,6℃ by the end of the century re lative to 1980-1999) even if atmospheric greenhouse gas concentrations remain at 2000 levels
- After CO_2 emissions are reduced and atmospheric concentrations stabilize, surface air temperature continues to rise by a few tenths of a degree per century for a century or more, thermal expansion of the ocean continues long after CO_2 emissions have been reduced, and melting of ice sheets contribute to sea-level rise for many centuries

CO_2 concentration, temperature, and sea level continue to rise long after emissions are reduced



Time taken to reach equilibrium

Sea-level rise due to ice melting:
several millennia

Sea-level rise due to thermal expansion:
centuries to millennia

Temperature stabilization:
a few centuries

CO_2 stabilization:
100 to 300 years

CO_2 emissions

SYR - FIGURE 5-2

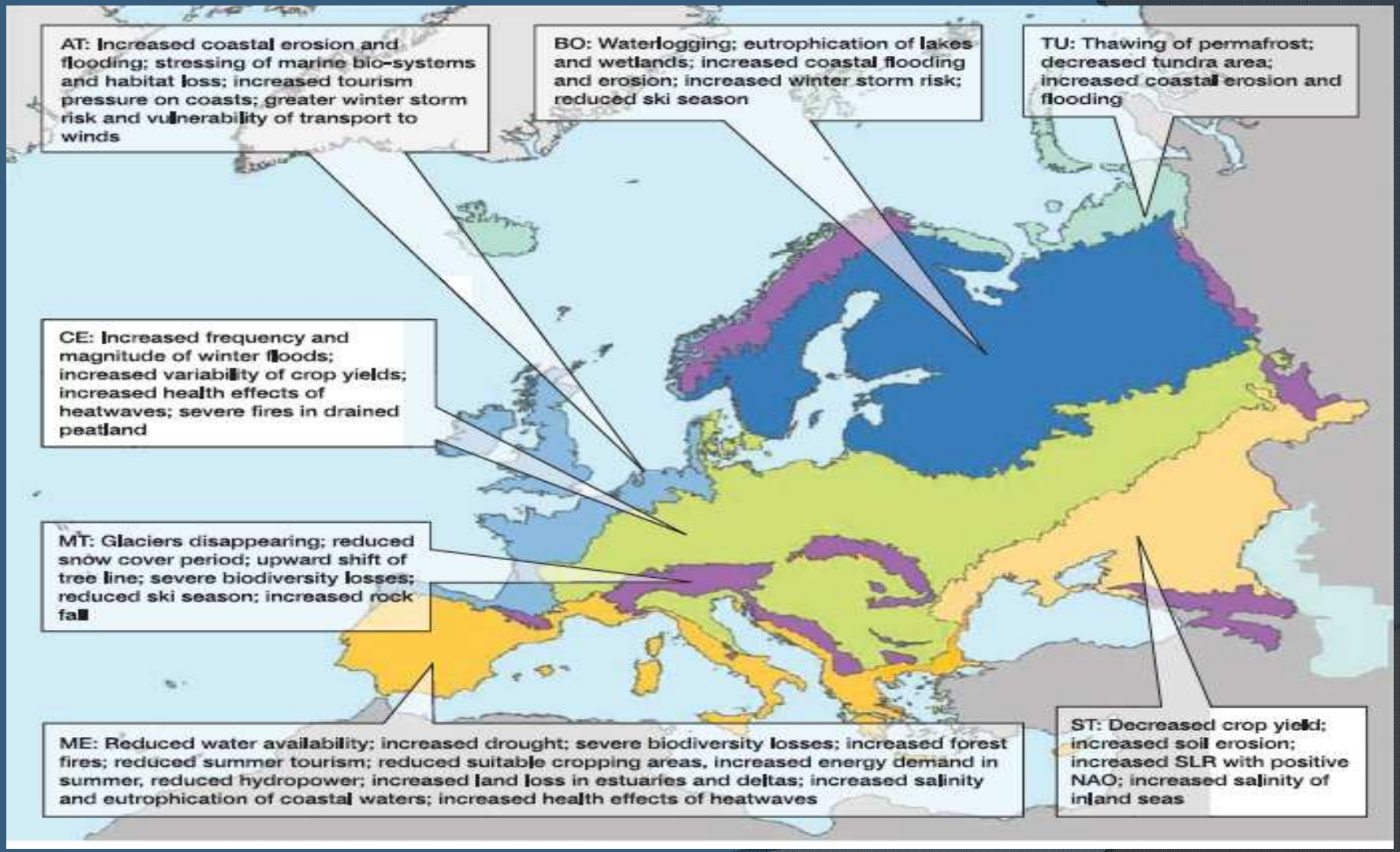
Climate variability

Climate variability refers to variations in the mean state and other statistics (such as standard deviation, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability).

Natural climate variability and climate change

- The distinction between natural climate variability and climate change is clear enough in theory, but it is much less evident in practice. At the moment it remains, for example, difficult to say precisely whether a particular drought is the result of climate change or not. In the decades to come it will be impossible to distinguish with certainty the tangible effects of natural climate variability from the impacts on climate change of human origin.
- Over the centuries, individuals and societies have always tried to adapt to natural climate variability, so as to minimize the damage of extreme events. In practice, adaptation to natural climate variability also reduces vulnerability to climate change. Adaptation projects already implemented are mostly adaptations to climate variability: for example, projects of irrigation and water management, or mechanisms for disaster management (information, early warnings, insurance...).
- This means that adaptation to climate change can build on the experience and the know-hows provided by adaptation to natural climate variability. However, human societies, from the poorest to the richest, are still insufficiently adapted to natural climate variability.

Vulnerability of the European continent in the 21st century



Source: EEA, Impacts of Europe's changing climate: an indicator-based assessment, Report No 2/2004

Current vulnerability of the Mediterranean basin

Natural causes

- The Mediterranean basin is characterized by several specific climatic and environmental conditions which include a structurally low availability of water resources
- It is also exposed to non-climatic risks such as earthquakes and tsunamis caused by the intense tectonic activity

Anthropogenic causes

- Increasing population, intensification of agriculture, industrialization and intense and poorly managed urbanization exert considerable pressure on ecosystems and water resources
- Mediterranean soils are by nature volatile and have been subject to deforestation in recent decades, which has accentuated erosion problems
- The availability of water resources, already scarce in origin, is under pressure due to increasing consumption in the agricultural, domestic, and industrial sectors.

Adaptation in the Mediterranean basin

Adaptation to natural variability

- Mediterranean societies have always had to deal with a high level of natural climate variability (which is often increased by non-climatic risks).
- They have thus developed a high adaptive capacity (especially as regards the management of water resources)

Adaptation to anthropogenic climate change

- The effects of anthropogenic climate change overlap with those of natural variability, thus increasing the severity of the phenomena to be faced.
- Areas hitherto immune from phenomena such as drought, flooding, submergence could be affected in the future.
- The rates with which these phenomena occur is expected to increase.
- The financial commitment required will tend to increase, and may become prohibitive for LDCs and for this reason, the UN Framework Convention on Climate Change provides specific forms of cooperation and assistance.

Autonomous vs. planned adaptation

- Autonomous adaptation is the use of current knowledge and techniques already available to respond to changes in climate that are already occurring.
- Planned adaptation is the increase in the adaptive capacity through the mobilization of institutions and implementation of policies with the aim to create or strengthen conditions favorable to effective policy intervention and investment in new technologies and infrastructure.
- Given the current speed of climate change, planned adaptation is expected to play an increasingly important role.

Traditional knowledge

In Saharan Africa and throughout the Mediterranean a number of traditional techniques have developed over time, in particular concerning the following subjects:

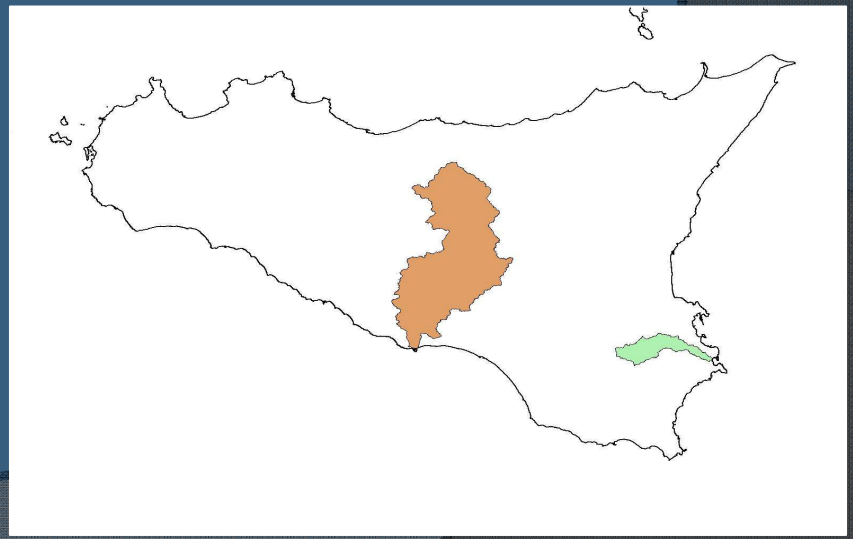
- fight against wind or water erosion;
- hydric system for water conservation;
- improvement of soil fertility;
- vegetation protection;
- forestry;
- social organization;
- architecture and energy.

The United Nation Convention to Combat Desertification and UNESCO supported the inventory of traditional knowledge (TK) and technologies, in order to protect natural resources and combat desertification. Traditional knowledge and practices may be revitalized and applied in conjunction with modern technologies in order to adapt to climate change.

Water resources management (Italy)

Reuse of sewage water for irrigation purposes (Ostuni, Br)

Use of brackish waters for irrigation (Licata, Ag)



Use of rainwater on steep slope by digging holes (Niger)

Small soil barriers to keep rain water, improve yields, and reduce soil erosion (Niger)

Collection of organic waste used to transform the sand into fertile soil (Shibam, Yemen)

Traditional wooden houses with green roofs in the Alps

Modern building equipped with green roof to reduce energy consumption (Fukuoka, Japan)

Adaptation projects in the Mediterranean region

Project	Country	Duration	Budget ($)	Sectors	Funder	Project Executor
Development of an adaptation strategy for climate change in Tunisian agriculture	Tunisia	2005 - 2007		Agriculture, tourism, environment	GTZ	Ministry of Agriculture and Water Resources (MARH)
Adaptation of the Tarmkiste Oasis to climate change	Morocco	2009 - 2011 (2 years)	172,000	Ecosystems, Agriculture	UNDP-GEF	Rural Area Association Tarmguist
Adaptation of the Iguiwas Oasis to climate change	Morocco	2009 - 2011 (2 years)	114,000	Ecosystems, Agriculture	UNDP-GEF	Tiflis Association for Development
Adaptation of the Nile Delta to climate change through integrated coastal zone management	Egypt	Sept 2009 - June 2014 (5 years)	16 million	Coastal areas, all sectors	UNDP-GEF	Ministry of Water Resources and Irrigation
Identification and implementation of adaptation measures in the Drini-Mati deltas	Albania	May 2008 - May 2012 (4 years)	2 million	Ecosystems	UNDP-GEF	Ministry of Environment, Water and Forest Administration
Venice Safeguard Project	Italy	1984 - ?	15 billion	Coastal areas, infrastructure	Multiples	Multiples

Final recommendations

- Despite the uncertainties that still affect them, climate scenarios are an essential tool: they must be used to explore possible future developments, rather than to assess quantitatively magnitude and rate of expected changes
- Start from "no regret" measures, that are beneficial under different climate scenarios, and even without taking climate change into account (e.g. dune restoration, implementation of plans for the prevention of natural hazards)
- Important synergies exist between anticipatory adaptation and mitigation, in particular for agroforestry, for the energy sector and for coastal zones
- Do not forget traditional knowledge: traditional techniques are forms of adaptation to climate vulnerability already in place
- Take adaptation as a global challenge, in which industrialised countries must provide resources to developing ones, but they also have much to learn from the experience of the latter