

# MEDICAL ACADEMY NAMED AFTER S.I. GEORGIEVSKY OF VERNADSKY CFU



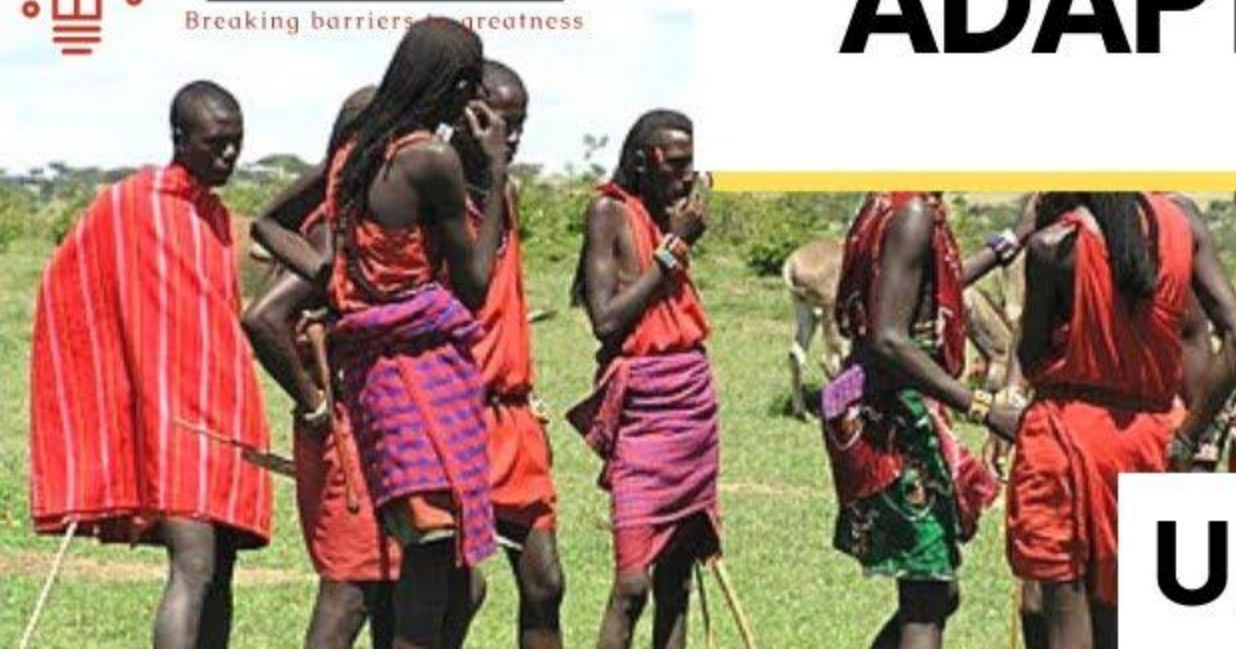
## NON-SPECIFIC HUMAN ADAPTATION

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# HUMAN ADAPTATION



## UPSC ANTHROPOLOGY



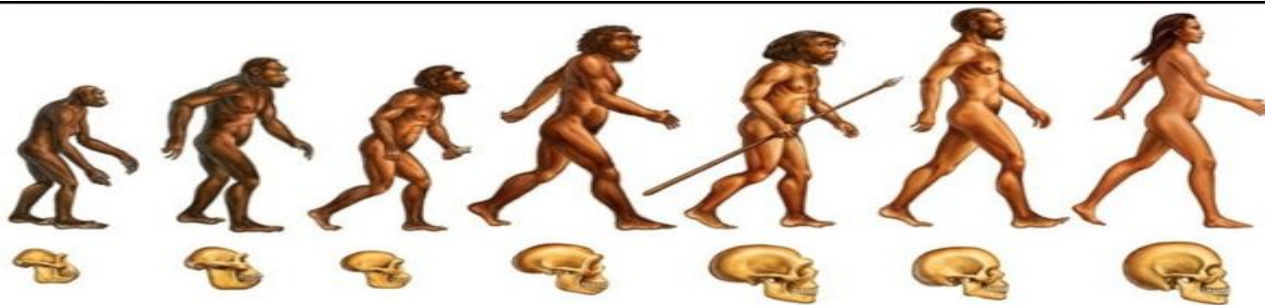
# ADAPTATION



## MEANING OF ADAPTATION

Derived from Biology a process that takes place under natural selection whereby an organism becomes better suited to its habitat.

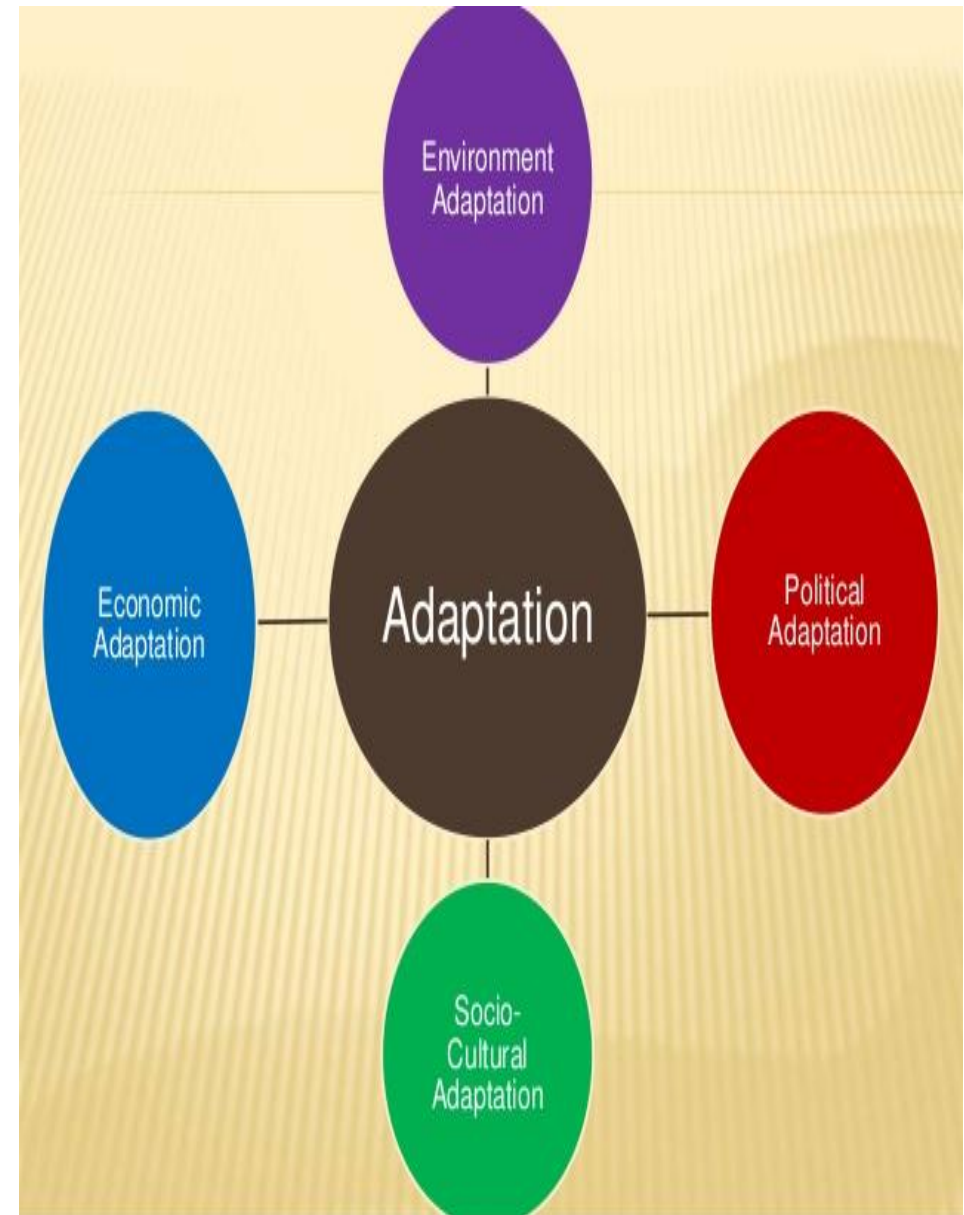
In sociology, It refers to some characteristics which stand out as being especially significant in the survival of an individual in society.



- **Evolution** = Theory that groups of organisms change over time
- Occurs over many generations due to **selection** and **adaptation** to changing environments.

## What are adaptations?

**Adaptations – an inherited characteristic that helps an organism to survive long enough to reproduce more successfully in its changing environment and can either be structural or behavioral**





## DEFINITION OF ADAPTATION

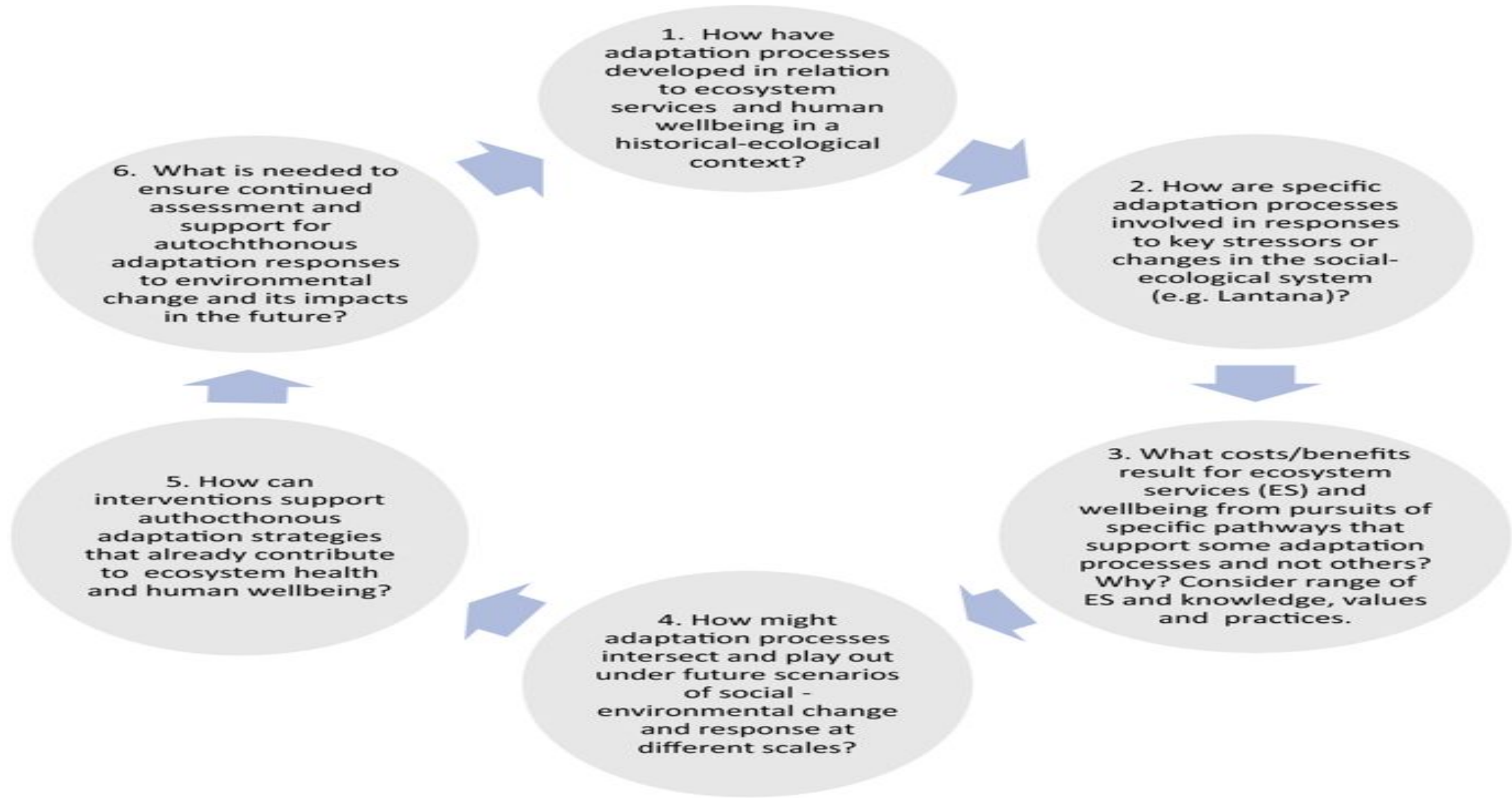
“**Adaptation** refers to changes that occur in order to maintain various aspects of a social system’s culture or structure or to aid in survival.” **By Ashely Crossman**

Adaptation refers to change in structure, function or behavior by which a species or an individual improves its chance of survival in a specific environment.

## CHARACTERISTICS OF ADAPTATION

- **Universal and dynamic in nature**
- **Continuous process**
- **Flexibility**
- **Social learning**
- **Adjustment**





# nonspecific

## 1<sup>st</sup> Line of Defense External Barriers (non-specific)



- External barriers are **non-specific**, meaning they will work to keep out all foreign invaders
- The human skin, if unbroken, forms an almost impenetrable barrier against microorganisms
- Cells in the nasal passages and pharynx secrete sticky mucus that traps microorganisms and digestive enzymes in the mucus can destroy most microorganisms
- The **stomach** also contains strong acid and enzymes that can kill pathogens



**possible endurance running adaptations in human**  
*arguments for the endurance running hypothesis*

*species: Homo sapiens & archaic Homo*  
*proposed natural habitat: forest-grassland mosaic*

- human performs well at **endurance running** compared to other primates ①  
 - enables **persistent hunting & strategic scavenging** ①②  
 - wider **range of running speeds** as upright body decoupled respiration from running gait ①③

**expanded venous circulation** in the braincase cools the head via **countercurrent heat exchange** ①

**tightly coiled hair** impedes UV radiation ④  
**scalp hair** blocks sunlight ④

**enlarged semicircular canals** (posterior & anterior) increase the sense of balance ①

**improved vestibulo-ocular reflexes** adjust eye movements to stabilize images ②

**stabilization (head)**

**stabilization (body)**

**tall, narrow body form** helps cool down the body ①

**short snout & neck ligament** stabilizes the head ①

**loosen, low, wide shoulders** with **decoupled head** help swinging of upper body to counter leg movements ①

**shorter arms** reduce effort in arm-swinging ①

**thermoregulation**

**respiration**

**dark skin pigment** blocks sunlight in tropical open grasslands ④

**eccrine sweating** with **reduced body hair** dissipates heat via evaporation ①

**tall, narrow waist** allow greater counter rotation of the trunk ①

**larger back & buttock muscles, stabilized spine-hip joint** stabilize the trunk ①

**more mouth breathing** allows more efficient ventilation ①



**expanded joint surfaces** in lower body (spine, hip, legs) reduce stress in the skeleton ①

**shorter femoral necks** reduce bending stress ①

**larger thyroid & adrenal glands** allow more efficient utilization of energy stores (carbohydrates, fats) ③

**longer legs & lighter feet** increase stride length with low stride rate, reduce energetic cost ①

**larger heel bones** absorb shock ①

**energetics**

**shorter toes** decrease mechanical work ①

**inward, projected big toe & compacted mid-foot** restrict the rotation of feet ①

**tendons & ligaments** in legs act as springs to store & release elastic energy ①

**well-developed Achilles tendon** ①

**foot arches** act as springs to store elastic energy & absorb shock ①

**skeletal strength**

References: ① Bramble DM, Lieberman DE (2004) Endurance running and the evolution of Homo. *Nature* 432 (7015): 345–352 ② Lieberman DE, Bramble DM, Raichlen DA, Shea JJ (2009) Brains, Brawn, and the Evolution of Human Endurance Running Capabilities. In Grine FE et al. (eds.) *The First Humans: Origin and Early Evolution of the Genus Homo: 77–92*. Springer ③ Carrier DR et al. (1984) The Energetic Paradox of Human Running and Hominid Evolution. *Current Anthropology* 25 (4): 483–495 ④ Jablonski NG (2006) *Skin: a natural history*. University of California Press





# Sectoral Risks & Potential for Adaptation: Human Health

- Until mid-century, projected climate change will impact human health mainly by exacerbating health problems that already exist . Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low income
- Examples include greater likelihood of injury, disease, and death due to more intense heat waves and fires; increased likelihood of under-nutrition resulting from diminished food production in poor regions; risks from lost work capacity and reduced labor productivity in vulnerable populations; and increased risks from food- and water-borne diseases and vector-borne diseases.
- The most effective adaptation measures for health in the near-term are programs that implement and improve basic public health measures such as provision of clean water and sanitation, secure essential health care including vaccination and child health services, increase capacity for disaster preparedness and response, and alleviate poverty

## Regional Risks: Europe

Climate-related drivers of impacts										Level of risk & potential for adaptation	
Key risk	Adaptation issues & prospects			Climatic drivers	Timeframe	Risk & potential adaptation					
<p>Increased economic losses and people affected by flooding in river basins and coasts, driven by increasing urbanization, increasing sea levels, coastal erosion, and peak river discharges (high confidence)</p> <p>[23.2-3, 23.7]</p>	<p>Adaptation can prevent most of the projected damages (high confidence).</p> <ul style="list-style-type: none"> <li>• Significant experience in hard flood-protection technologies and increasing experience with restoring wetlands</li> <li>• High costs for increasing flood protection</li> <li>• Potential barriers to implementation: demand for land in Europe and environmental and landscape concerns</li> </ul>			  	<p>Present</p> <p>Near-term (2030-2040)</p> <p>Long-term (2080-2100)</p> <p>2°C</p> <p>4°C</p>	<p>Very low</p> <p>Low</p> <p>Medium</p>					
<p>Increased water restrictions. Significant reduction in water availability from river abstraction and from groundwater resources, combined with increased water demand (e.g., for irrigation, energy and industry, domestic use) and with reduced water drainage and runoff as a result of increased evaporative demand, particularly in southern Europe (high confidence)</p> <p>[23.4, 23.7]</p>	<ul style="list-style-type: none"> <li>• Proven adaptation potential from adoption of more water-efficient technologies and of water-saving strategies (e.g., for irrigation, crop species, land cover, industries, domestic use)</li> <li>• Implementation of best practices and governance instruments in river basin management plans and integrated water management</li> </ul>			  	<p>Present</p> <p>Near-term (2030-2040)</p> <p>Long-term (2080-2100)</p> <p>2°C</p> <p>4°C</p>	<p>Very low</p> <p>Low</p> <p>Medium</p>					
<p>Increased economic losses and people affected by extreme heat events: impacts on health and well-being, labor productivity, crop production, air quality, and increasing risk of wildfires in southern Europe and in Russian boreal region (medium confidence)</p> <p>[23.3-7, Table 23-1]</p>	<ul style="list-style-type: none"> <li>• Implementation of warning systems</li> <li>• Adaptation of dwellings and workplaces and of transport and energy infrastructure</li> <li>• Reductions in emissions to improve air quality</li> <li>• Improved wildfire management</li> <li>• Development of insurance products against weather-related yield variations</li> </ul>				<p>Present</p> <p>Near-term (2030-2040)</p> <p>Long-term (2080-2100)</p> <p>2°C</p> <p>4°C</p>	<p>Very low</p> <p>Low</p> <p>Medium</p>					



## Sectoral Risks & Potential for Adaptation: Human Security

- Climate change over the 21st century is projected to increase displacement of people.
- Displacement risk increases when populations that lack the resources for planned migration experience higher exposure to extreme weather events, particularly in developing countries with low income.
- Expanding opportunities for mobility can reduce vulnerability for such populations.
- Climate change can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks.

## Sectoral Risks & Potential for Adaptation: Food Security

- Projected changes in yields vary a lot by region and crop. Declines are larger in low latitudes and declines increase in all regions over time.
- Adaptation measures include development of more resilient varieties, shifts to crops that are less affected by climate change, changes in timing of crops and increased efficiency in the use of water.
- A part of this is autonomous but a part involves public decision-making.

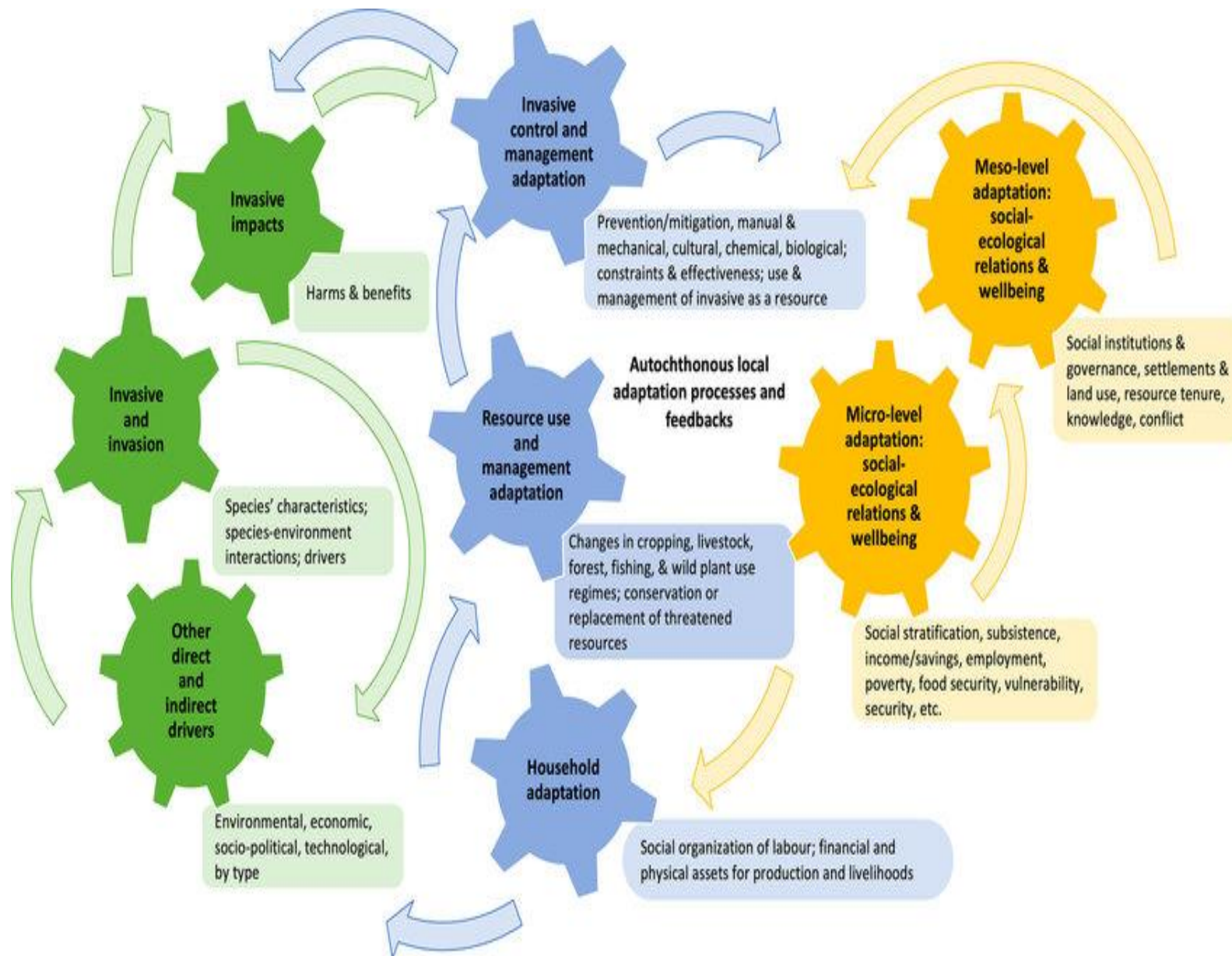
## Impacts on Economic Sectors

- In most sectors other factors such as change in population, age structure, technology, relative prices and governance have bigger impacts than climate change.
- CC is expected to change energy demand between heating and cooling, location choices, demand for water. For increases in temperature of around 2°C losses are estimated between 0.2 and 2% of income. But there are large differences between countries and losses go up with temperature.

## High Temperature Increases...

- Now the average annual high temperature in European cities (e.g. London) is about 17°C
- With an increase of 8°C it would become like Cairo, which may be manageable. But with another 8°C Cairo would become like Dadda Ethiopia, which is the hottest inhabited place in the world.
- Not much is produced in Dadda Ethiopia!





## Climate change 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 (IPCC, 2007).

Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting *non-climatic* changes. Adaptation strategies and actions can range from short-term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities (Moser and Ekstrom, 2010).

## Mitigation and/or Adaptation

- The optimal level of emission reductions results from equating the marginal costs of one unit of additional emission reduction with the discounted stream of additional avoided damages.
- What discount rate do we take for this? Major debate in climate economics.
- The least-cost emission pathway implies a small reduction in the absolute level of emissions until 2030 and a more rapid reduction afterwards. The lower the equilibrium climate sensitivity, the lower the benefits from emission reduction are, and hence the larger the flexibility to adjust the timing of emission reductions in the least-cost emission pathway. With high ECS the reductions have to be much greater early on (e.g. Weitzman type function).

## Interactions Between Mitigation and Adaptation

- The role of adaptation is much smaller when damages are limited by least-cost mitigation action.
- Adaptation and mitigation are both powerful instruments to limit climate damages.
- In terms of cost minimisation, both policies are needed.
- Next figure clearly shows that adaptation cannot be a perfect substitute for mitigation. If only adaptation policies are available damages are substantially larger than when only mitigation policies are available



## Principles for Effective Adaptation

1. Adaptation is place and context specific: no single approach will work in all settings.
2. Adaptation planning can be enhanced through complementary actions: protecting vulnerable groups, supporting economic diversification, providing information and improving coordination across levels of government and partnerships between private and public sectors.
3. A first step in adaptation is to reduce vulnerability to current climate variability.

## Principles for Effective Adaptation

4. Recognition of diverse interests, circumstances and contexts can benefit decision-making.
5. The decision support is most effective when it is sensitive to context and diversity of decision types, processes and constituencies.
6. Existing and emerging economic instruments can foster adaptation by providing incentives for anticipating and reducing impacts.

## Principles for Effective Adaptation

7. Common constraints that impede adaptation include limited financial and human resources, limited integration of governance, uncertainties about projected impacts etc. Underestimating the complexity of adaptation as a social process can create unrealistic expectations of outcomes.
8. Poor planning, emphasizing short term outcomes or failing to anticipate consequences can result in maladaptation.

## Principles for Effective Adaptation

9. Limited evidence indicates a gap between global adaptation needs and the funds available for adaptation.
10. Significant co-benefits, synergies, and tradeoffs exist between mitigation and adaptation and among different adaptation responses; interactions occur both within and across regions. Increasing efforts to mitigate and adapt to climate change imply an increasing complexity of interactions, particularly at the intersections among water, energy, land use, and biodiversity



## Conclusions

- IPCC WGII has made a sober assessment of the impacts of climate change. They are significant, vary by region and country and pose important threats to our future.
- The report concludes that while impacts in the next 30 years or so are not dependent on mitigation, after that time they depend a lot on what emissions scenario we face. Adaptation options post 2050 are much more limited with high emissions

## Conclusions

- On adaptation it is more optimistic for several areas. We can adapt to a significant extent if we take the right actions.
- The key is to focus on developing adaptation strategies that are inclusive, flexible, that look at the wider picture and that are based on a realistic estimate of the benefits.
- Not all regions and not all problems can be solved in this way but many can.
- For some problems we have a more difficult agenda but even for these there is some hope.



*Thank You!*

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