A Climate-Smart Approach to Protecting Outstanding Universal Value in the 21st century: Towards a Wilderness Strategy for the World Heritage Convention

The Green Shield

how a wilderness approach can help protect natural world heritage from climate change and other pressures

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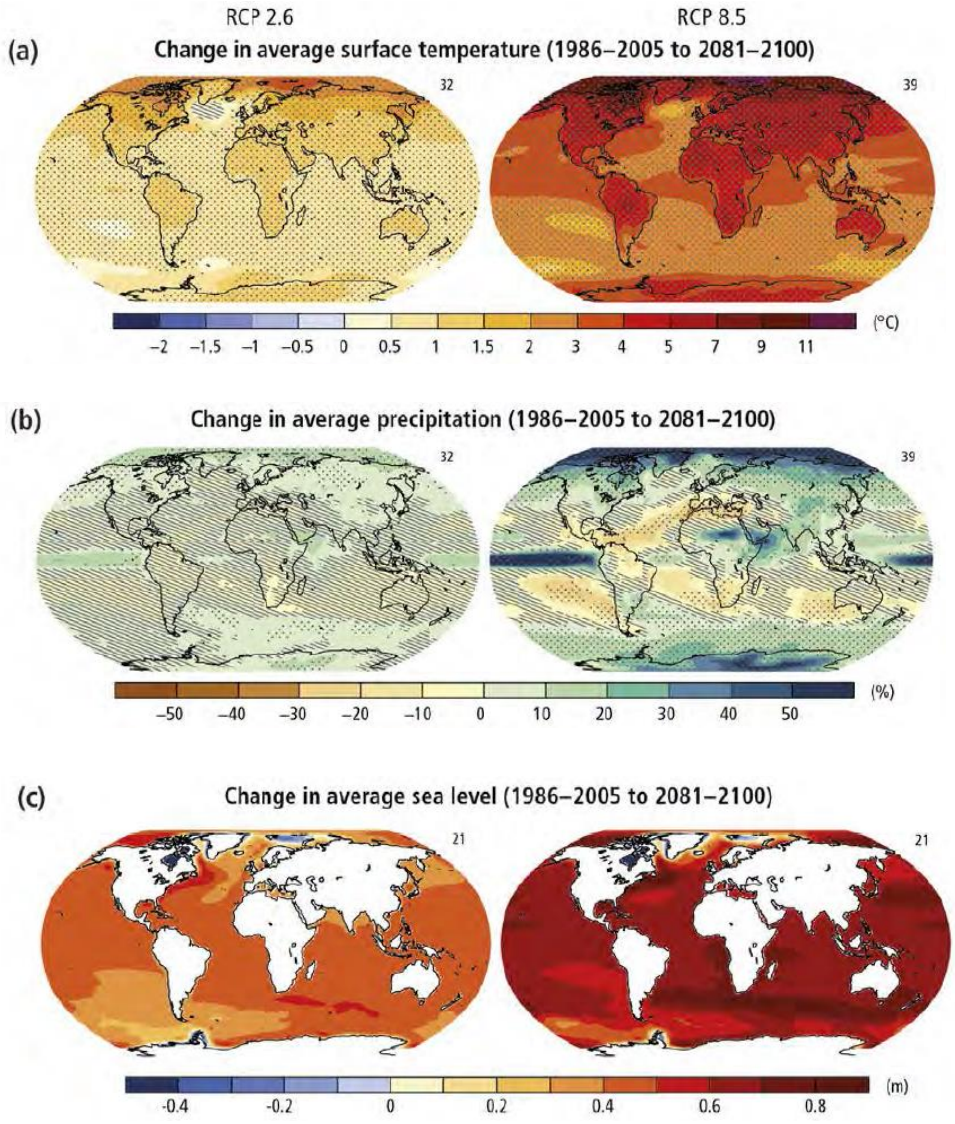
When it comes to climate change adaptation, bigger parks are better for biodiversity

Buffering Capacity & Stability

Biological Diversity & Adaptive Capacity

Climate change impacts are all pervasive



Source: IPCC AR5

Biological, ecological & evolutionary response to climate change impacts include…

- ✓ Species distributions
- ✓ Ecological community composition
- ✓ Vegetation structure
- ✓ Terrestrial carbon dynamics
- ✓ Stoichiometry & nutrient cycles
- ✓ Co-evolutionary relations
- ✓ Trophic interactions
- ✓ Evolution (inheritable genetic change in a population)

Natural adaptive processes are the key

It is biodiversity attributes and related processes that confer buffering, stability, resilience, adaptive capacity, and transformative potential on an ecosystem and biodiversity

We need to consider:

- Scale at which the attribute or process operates, where “stand, landscape, regional scales” are comparable to “alpha, beta, gamma diversity”

- Potential impact of climate change on the effectiveness of the characteristics and processes to confer resilience

Source: Thompson I., Mackey B., McNulty S. and Mosseler A. (2009). *Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/ resilience/stability relationship in forest ecosystems*. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 43

a) Biodiversity attribute or process	b) Spatial scale	c) Potential impact of climate change
Niche selection or differentiation	Stand	• Changes conditions shift outside driver species optimal conditions, making passenger species more competitive • Changed conditions produce new niches
Functional complementarity	Stand	• Loss of historic synergies and development of new ones with changing climatic stress
Functional diversity	Stand	• Loss of historic diversity and development of new ones with changing climatic stress, some 'passengers' become 'drivers'
Adaptive selection	Stand	• Changed environmental stresses could be too rapid for natural adaptive selection to occur
Phenotypic plasticity	Stand	• Changed conditions induce structural changes in dominant canopy species
Microevolution	Stand/ landscape	• Driver species evolve new adaptive traits that enable them to remain competitive in face of changed conditions
Microhabitat buffering	Stand/ landscape	• Changes in canopy density from new climatic conditions alters environmental conditions for ground-dwelling fauna habitats
Source habitats	Landscape/ Regional	• Changed climate may disrupt viability of historic source habitats or make them more productive
Refugia habitats	Landscape/ Regional	• Under new climatic conditions, previously common habitat becomes reduced to a network of locations where topography provides microhabitat buffering, and populations can persist
Regional species pool	Regional	• Migration from source habitats may not be able to keep pace with rapidly changing climate
Synergistic interactions	Stand/ landscape/	• Unknown interaction of stress on ecosystem resilience are likely but difficult to predict

Intact ecosystem landscapes more stable & resilience

The natural biodiversity of IEL provides them with *ecosystem resilience* in the face of external perturbations including climate change delivering: stability + adaptive capacity

Ecosystem resilience capacities:

- Self-regeneration after disturbance such as fire
- Resistance to and recovery from pests and diseases
- Local adaptations to new environmental conditions
- Tight controls on nutrient cycles in mature ecosystems

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