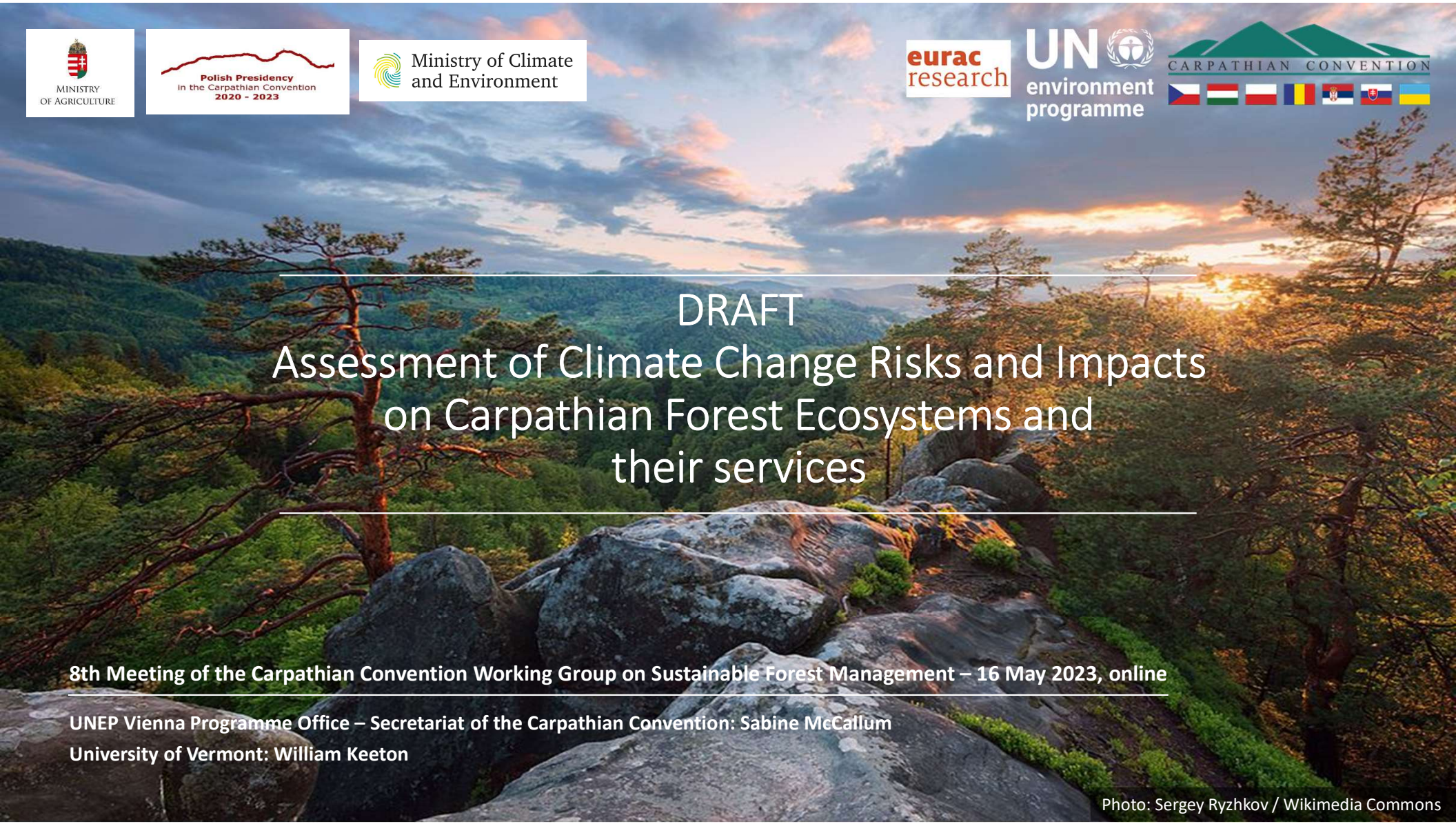


DRAFT

Assessment of Climate Change Risks and Impacts on Carpathian Forest Ecosystems and their services

8th Meeting of the Carpathian Convention Working Group on Sustainable Forest Management – 16 May 2023, online

UNEP Vienna Programme Office – Secretariat of the Carpathian Convention: Sabine McCallum

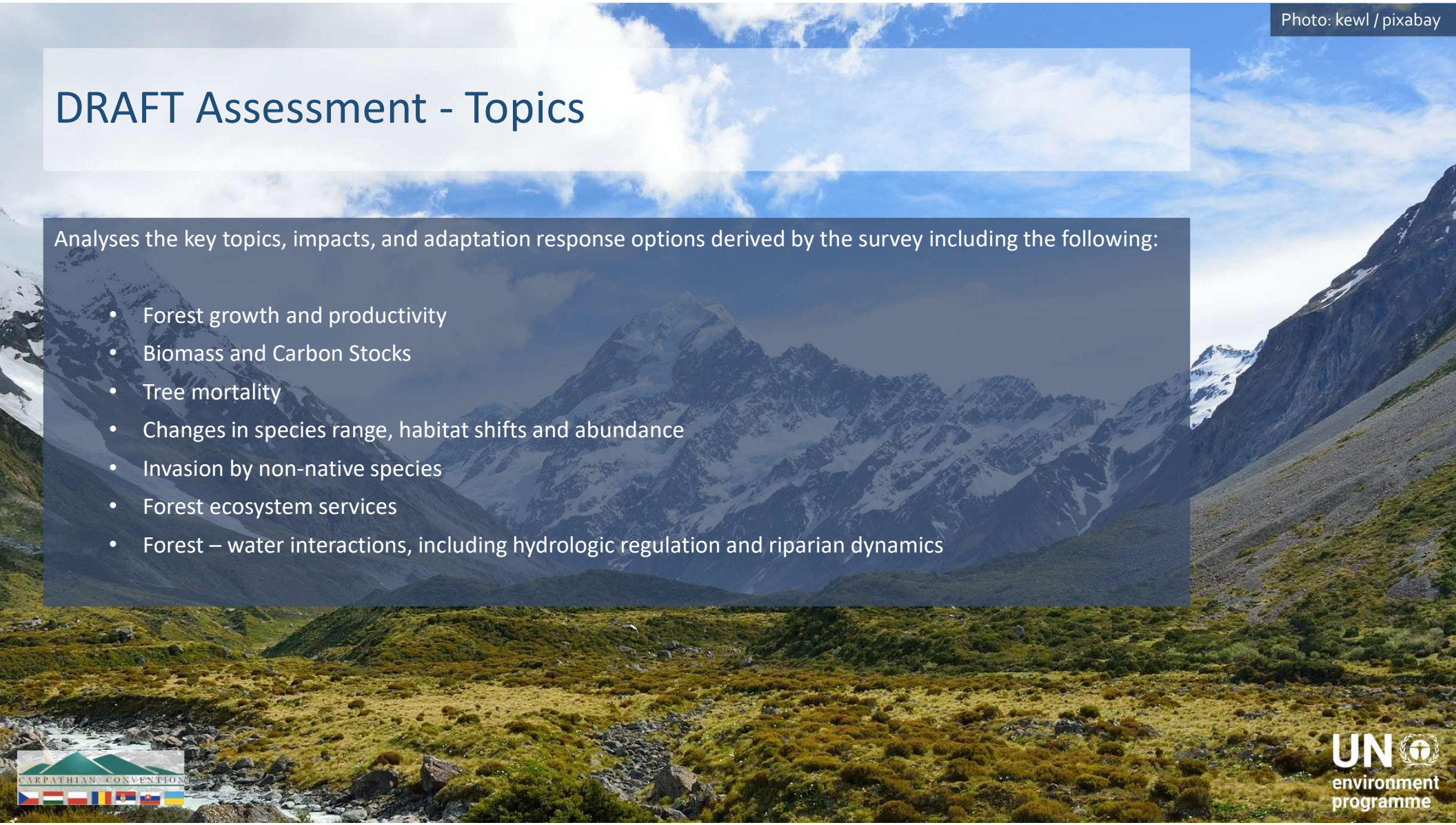
University of Vermont: William Keeton

Photo: Sergey Ryzhkov / Wikimedia Commons

Photo: Sabine McCallum

Brief recap

- The Carpathian Convention Conference of the Parties at its 6th meeting (COP6, 2020) encouraged the development of an **assessment of the impacts of climate change on the Carpathian forests and their ecosystems services** by relevant Convention Working Groups and partners and with support of the Convention Secretariat
- This activity has been included in the Implementation Framework 2030 accompanying the Long-term Vision towards combating climate change in the Carpathians
- The 8th meeting of the Carpathian Convention Working Group on Climate Change, held on 6 May 2021 online, decided on the very first engagement for developing the assessment of the impacts of climate change on the Carpathian forests to take place at the **Forum Carpaticum 2021** (*Special Session and Workshop on Forest ecosystem vulnerabilities to climate change in the Carpathians*)
- A dedicated **informal subgroup** of the Working Group on Climate Change and the Working Group on Sustainable Forest Management has been established after the Forum with experts nominated by the Focal Points of the Carpathian Convention which held it´s **first meeting on 16 November 2021**
- A **subsequent survey** provided the main basis for the scope and topics covered by this draft assessment, supported by a review of European- and regional-scale scientific assessments, interviews with leading research groups and a literature review



DRAFT Assessment - Topics

Analyses the key topics, impacts, and adaptation response options derived by the survey including the following:

- Forest growth and productivity
- Biomass and Carbon Stocks
- Tree mortality
- Changes in species range, habitat shifts and abundance
- Invasion by non-native species
- Forest ecosystem services
- Forest – water interactions, including hydrologic regulation and riparian dynamics

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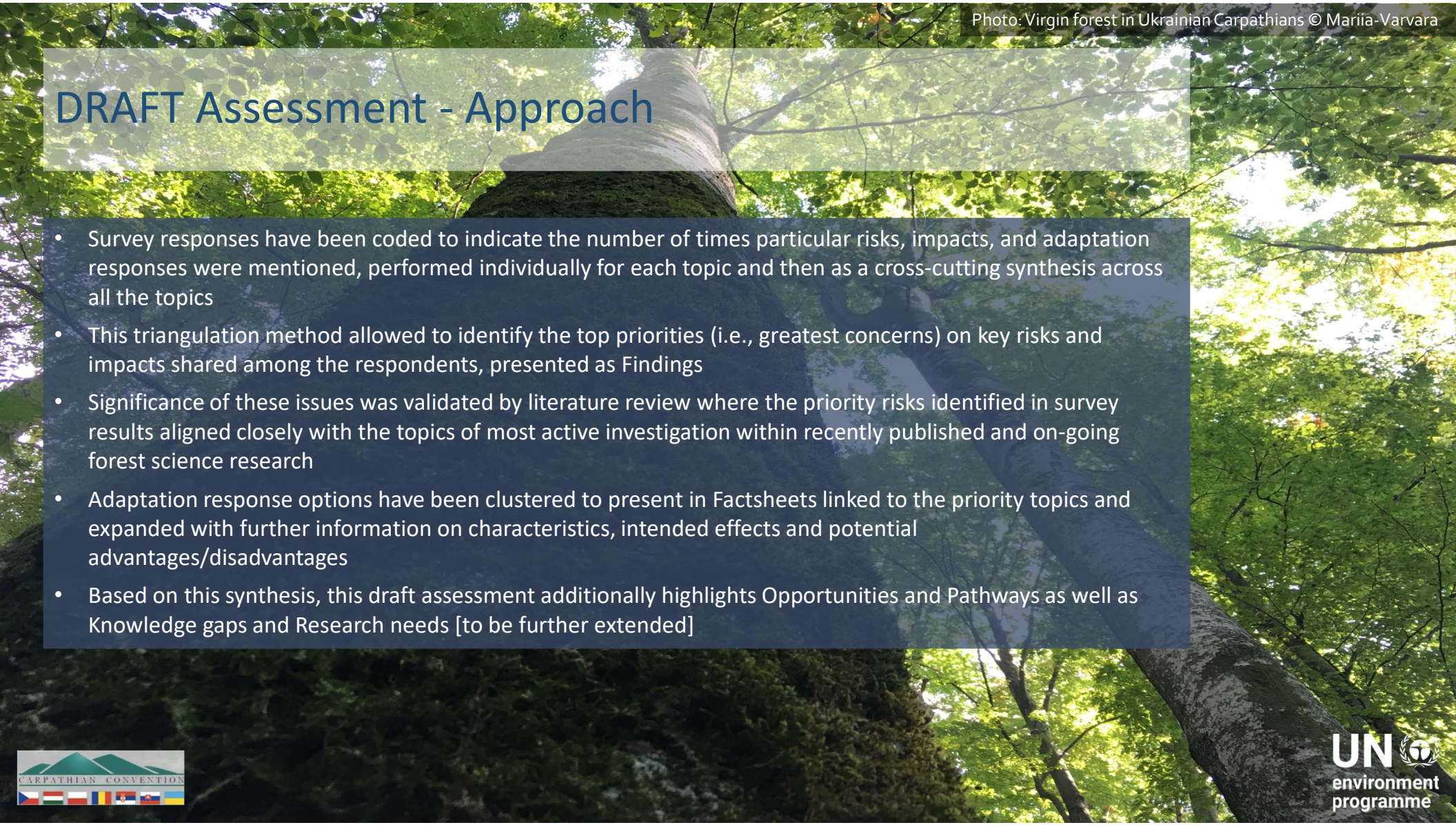

DRAFT Assessment - Approach

- Survey responses have been coded to indicate the number of times particular risks, impacts, and adaptation responses were mentioned, performed individually for each topic and then as a cross-cutting synthesis across all the topics
- This triangulation method allowed to identify the top priorities (i.e., greatest concerns) on key risks and impacts shared among the respondents, presented as Findings
- Significance of these issues was validated by literature review where the priority risks identified in survey results aligned closely with the topics of most active investigation within recently published and on-going forest science research
- Adaptation response options have been clustered to present in Factsheets linked to the priority topics and expanded with further information on characteristics, intended effects and potential advantages/disadvantages
- Based on this synthesis, this draft assessment additionally highlights Opportunities and Pathways as well as Knowledge gaps and Research needs [to be further extended]

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DRAFT Assessment – Findings 1/2

Altered disturbance regimes

- Most frequently mentioned risk to all key topics (forest growth, biomass, tree mortality, etc.) was the effects of climate change on natural disturbances, particularly forest fires, bark beetle outbreaks, and windstorms
- Increased disturbance risks will accelerate overall rates of forest change, exacerbating other threats such as the spread of invasive species, species range shifts, and loss of important habitats for biodiversity
- Disturbance impacts additionally create feedback loops that diminish the provisioning of critical ecosystem services, including timber and non-timber resource production, carbon storage, and hydrologic regulation

Drought risks to forest resources and services

- Second most frequently mentioned risk was drought, posing grave consequences for forest growth and productivity, regional tree mortality rates, biodiversity, and future shifts in species composition
- Drought and associated disturbance risks are increasing within the Carpathian region, esp. in the southern and eastern parts of the range where water availability is limited

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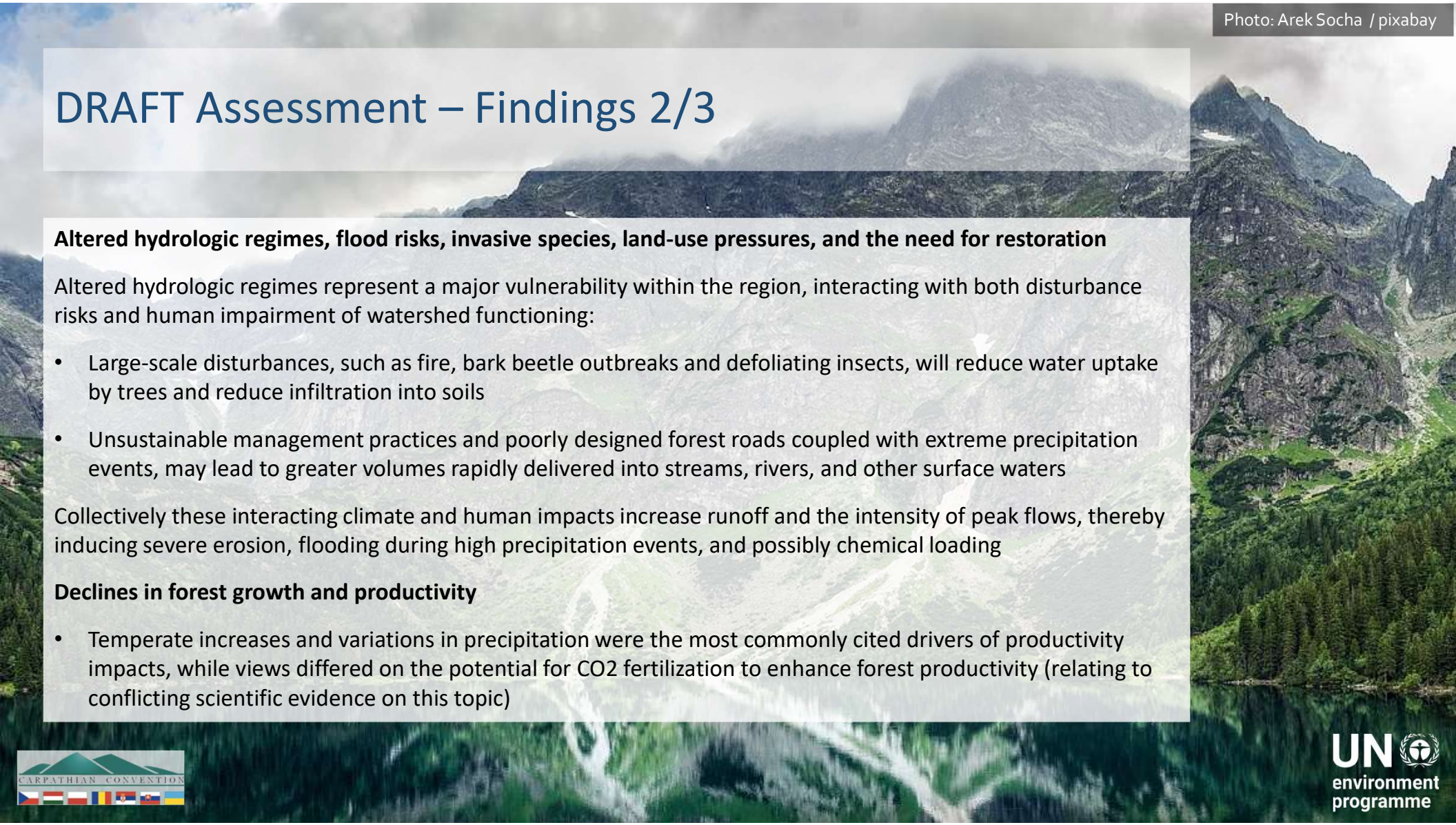

DRAFT Assessment – Findings 2/3

Altered hydrologic regimes, flood risks, invasive species, land-use pressures, and the need for restoration

Altered hydrologic regimes represent a major vulnerability within the region, interacting with both disturbance risks and human impairment of watershed functioning:

- Large-scale disturbances, such as fire, bark beetle outbreaks and defoliating insects, will reduce water uptake by trees and reduce infiltration into soils
- Unsustainable management practices and poorly designed forest roads coupled with extreme precipitation events, may lead to greater volumes rapidly delivered into streams, rivers, and other surface waters

Collectively these interacting climate and human impacts increase runoff and the intensity of peak flows, thereby inducing severe erosion, flooding during high precipitation events, and possibly chemical loading

Declines in forest growth and productivity

- Temperate increases and variations in precipitation were the most commonly cited drivers of productivity impacts, while views differed on the potential for CO2 fertilization to enhance forest productivity (relating to conflicting scientific evidence on this topic)

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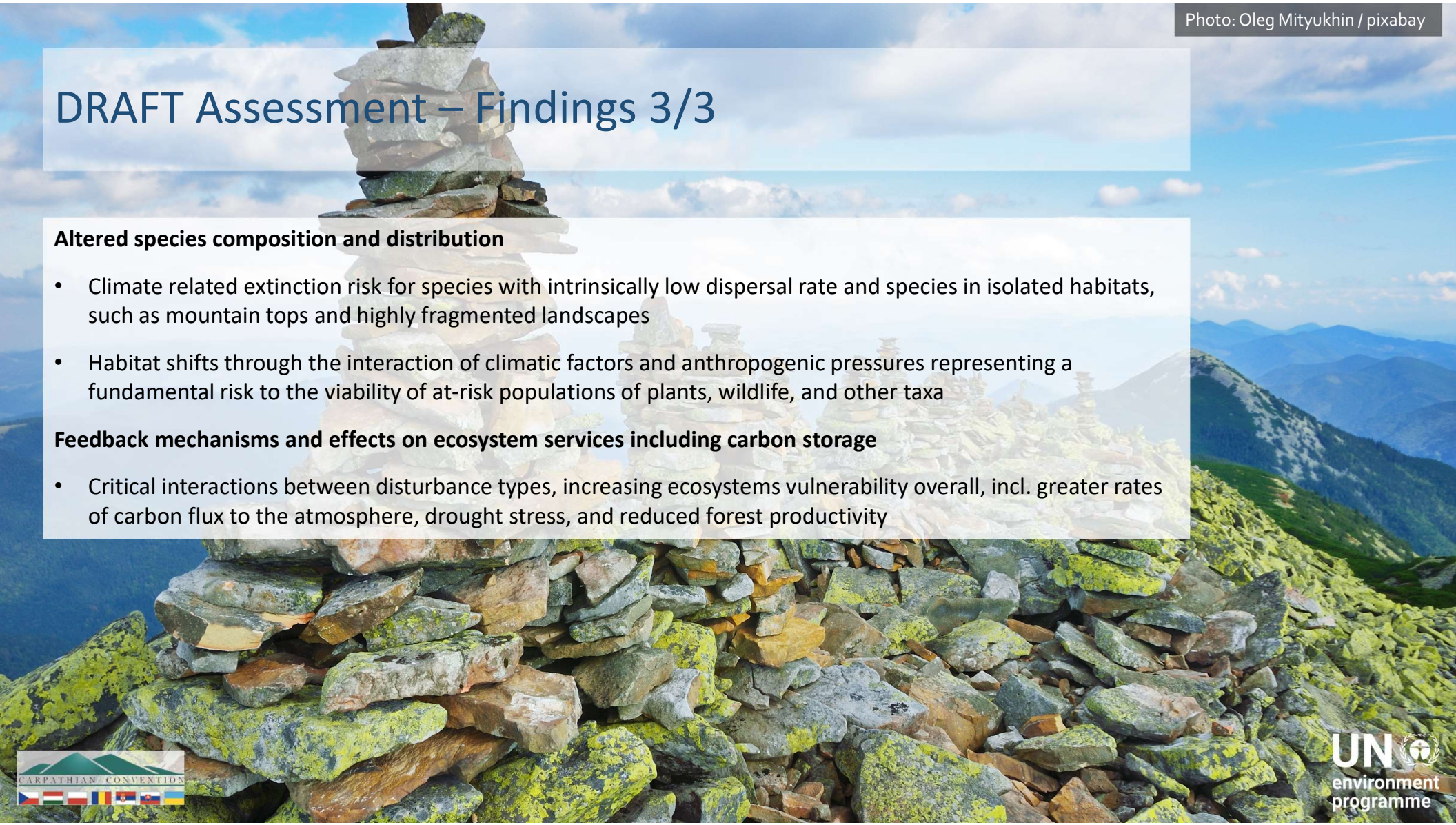

DRAFT Assessment – Findings 3/3

Altered species composition and distribution

- Climate related extinction risk for species with intrinsically low dispersal rate and species in isolated habitats, such as mountain tops and highly fragmented landscapes
- Habitat shifts through the interaction of climatic factors and anthropogenic pressures representing a fundamental risk to the viability of at-risk populations of plants, wildlife, and other taxa

Feedback mechanisms and effects on ecosystem services including carbon storage

- Critical interactions between disturbance types, increasing ecosystems vulnerability overall, incl. greater rates of carbon flux to the atmosphere, drought stress, and reduced forest productivity

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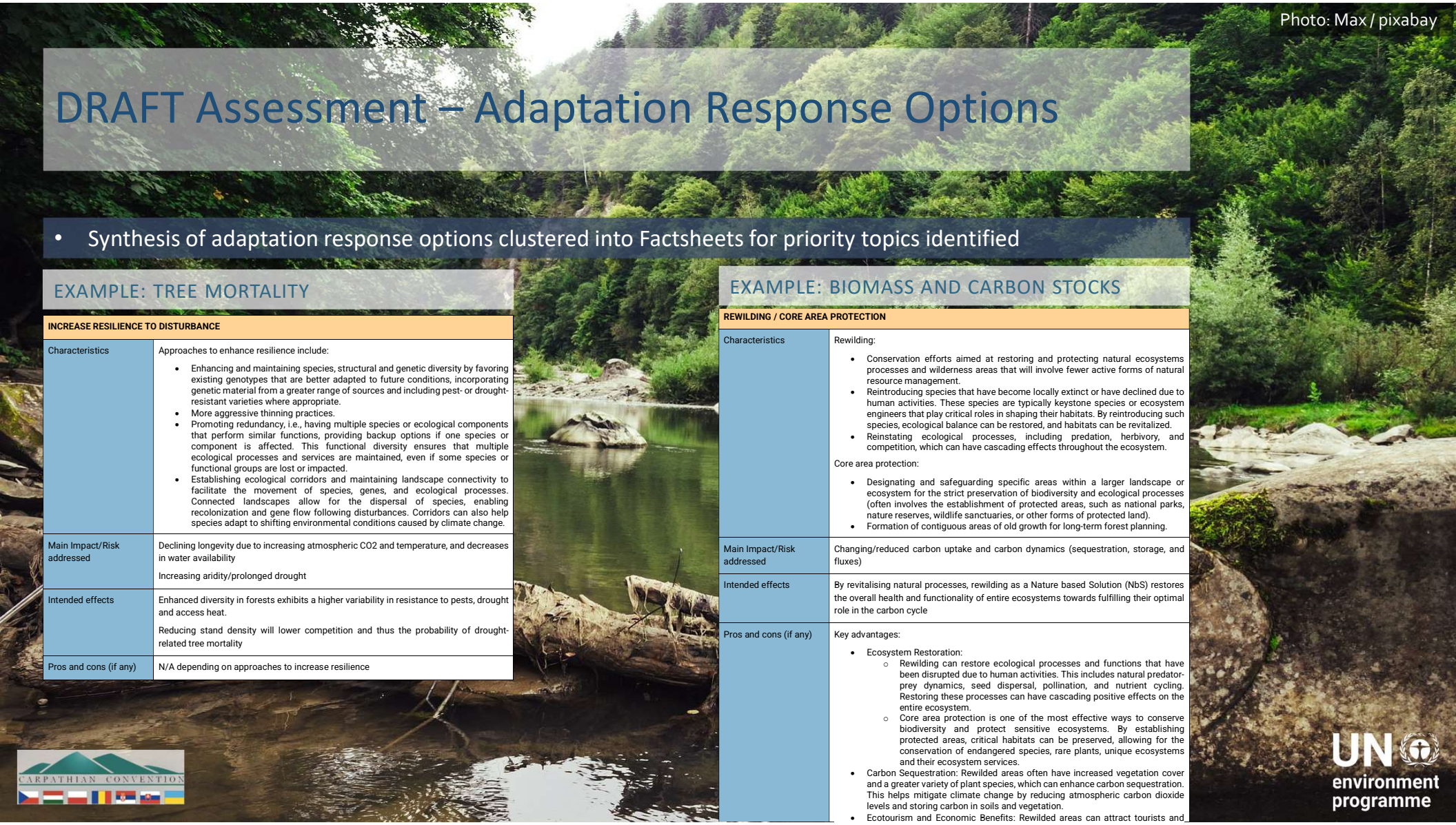

Photo: Max / pixabay

DRAFT Assessment – Adaptation Response Options

- Synthesis of adaptation response options clustered into Factsheets for priority topics identified

EXAMPLE: TREE MORTALITY

INCREASE RESILIENCE TO DISTURBANCE	
Characteristics	Approaches to enhance resilience include: • Enhancing and maintaining species, structural and genetic diversity by favoring existing genotypes that are better adapted to future conditions, incorporating genetic material from a greater range of sources and including pest- or drought-resistant varieties where appropriate. • More aggressive thinning practices. • Promoting redundancy, i.e., having multiple species or ecological components that perform similar functions, providing backup options if one species or component is affected. This functional diversity ensures that multiple ecological processes and services are maintained, even if some species or functional groups are lost or impacted. • Establishing ecological corridors and maintaining landscape connectivity to facilitate the movement of species, genes, and ecological processes. Connected landscapes allow for the dispersal of species, enabling recolonization and gene flow following disturbances. Corridors can also help species adapt to shifting environmental conditions caused by climate change.
Main Impact/Risk addressed	Declining longevity due to increasing atmospheric CO2 and temperature, and decreases in water availability Increasing aridity/prolonged drought
Intended effects	Enhanced diversity in forests exhibits a higher variability in resistance to pests, drought and access heat. Reducing stand density will lower competition and thus the probability of drought-related tree mortality
Pros and cons (if any)	N/A depending on approaches to increase resilience

EXAMPLE: BIOMASS AND CARBON STOCKS

REWILDING / CORE AREA PROTECTION	
Characteristics	Rewilding: • Conservation efforts aimed at restoring and protecting natural ecosystems processes and wilderness areas that will involve fewer active forms of natural resource management. • Reintroducing species that have become locally extinct or have declined due to human activities. These species are typically keystone species or ecosystem engineers that play critical roles in shaping their habitats. By reintroducing such species, ecological balance can be restored, and habitats can be revitalized. • Reinstating ecological processes, including predation, herbivory, and competition, which can have cascading effects throughout the ecosystem. Core area protection: • Designating and safeguarding specific areas within a larger landscape or ecosystem for the strict preservation of biodiversity and ecological processes (often involves the establishment of protected areas, such as national parks, nature reserves, wildlife sanctuaries, or other forms of protected land). • Formation of contiguous areas of old growth for long-term forest planning.
Main Impact/Risk addressed	Changing/reduced carbon uptake and carbon dynamics (sequestration, storage, and fluxes)
Intended effects	By revitalising natural processes, rewilding as a Nature based Solution (NbS) restores the overall health and functionality of entire ecosystems towards fulfilling their optimal role in the carbon cycle

Pros and cons (if any)	Key advantages:
	• Ecosystem Restoration:
	  ○ Rewilding can restore ecological processes and functions that have been disrupted due to human activities. This includes natural predator-prey dynamics, seed dispersal, pollination, and nutrient cycling. Restoring these processes can have cascading positive effects on the entire ecosystem.
	  ○ Core area protection is one of the most effective ways to conserve biodiversity and protect sensitive ecosystems. By establishing protected areas, critical habitats can be preserved, allowing for the conservation of endangered species, rare plants, unique ecosystems and their ecosystem services.
	• Carbon Sequestration: Rewilded areas often have increased vegetation cover and a greater variety of plant species, which can enhance carbon sequestration. This helps mitigate climate change by reducing atmospheric carbon dioxide levels and storing carbon in soils and vegetation.
	• Ecotourism and Economic Benefits: Rewilded areas can attract tourists and

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DRAFT Assessment – Opportunities and Pathways

Building on the Findings for key concerns and adaptation options, the DRAFT assessment highlights several key pathways to further consider for climate-resilient forest management practices, including

- **Forest restoration** and **reforestation efforts**
- **Protecting and conserving natural forests**
  Establishing and effectively managing protected areas, national parks, and nature reserves, also contributing to carbon sequestration and storage
- **Enhancing Forest landscape connectivity**
  Vital for allowing species to migrate and adapt to changing climate conditions
- **Forest Fire Management and Prevention**
  Developing national and regional early warning systems, improving fire suppression capabilities, and promoting community-based fire management approaches
- **Sustainable wood utilization** and **value chains for forest products**
  ***E**ncouraging responsible harvesting practices, supporting local processing industries, and promoting the use of sustainably sourced wood products to enhance economic viability of forests while supporting climate change adaptation*

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DRAFT Assessment – Knowledge gaps / Research needs

Research needs currently formulated relate to

- Improved **regional-scale forest monitoring**, i.e. harmonizing monitoring programs and sharing data across borders to facilitate coordinated adaptation and enable comparison of research results across the region
  - could include an additional layer for forest ecosystem dynamics under climate change, e.g. changes in forest structure, species distribution patterns, and ecosystem functioning
  - could monitor physiological and phenological responses of trees to climate change over time, as well as the interactions between species and their environment as baselines for adaptive capacity assessments
- Further knowledge generation on the importance of **genetic diversity in forest ecosystems** for adaptation, e.g. studying the genetic characteristics of tree species, assessing the adaptive potential of different genetic lineages, and investigating how genetic diversity influences ecosystem resilience and productivity
- Assessing the **effectiveness of various adaptive silviculture practices** in Carpathian forests. Long-term monitoring of adaptive practices will also be important to continuously (re-)evaluate their success
- Assessing the **economic viability and costs** associated with different adaptation approaches, understanding the social acceptability and equity implications, and considering the impacts of adaptation on local communities and livelihoods

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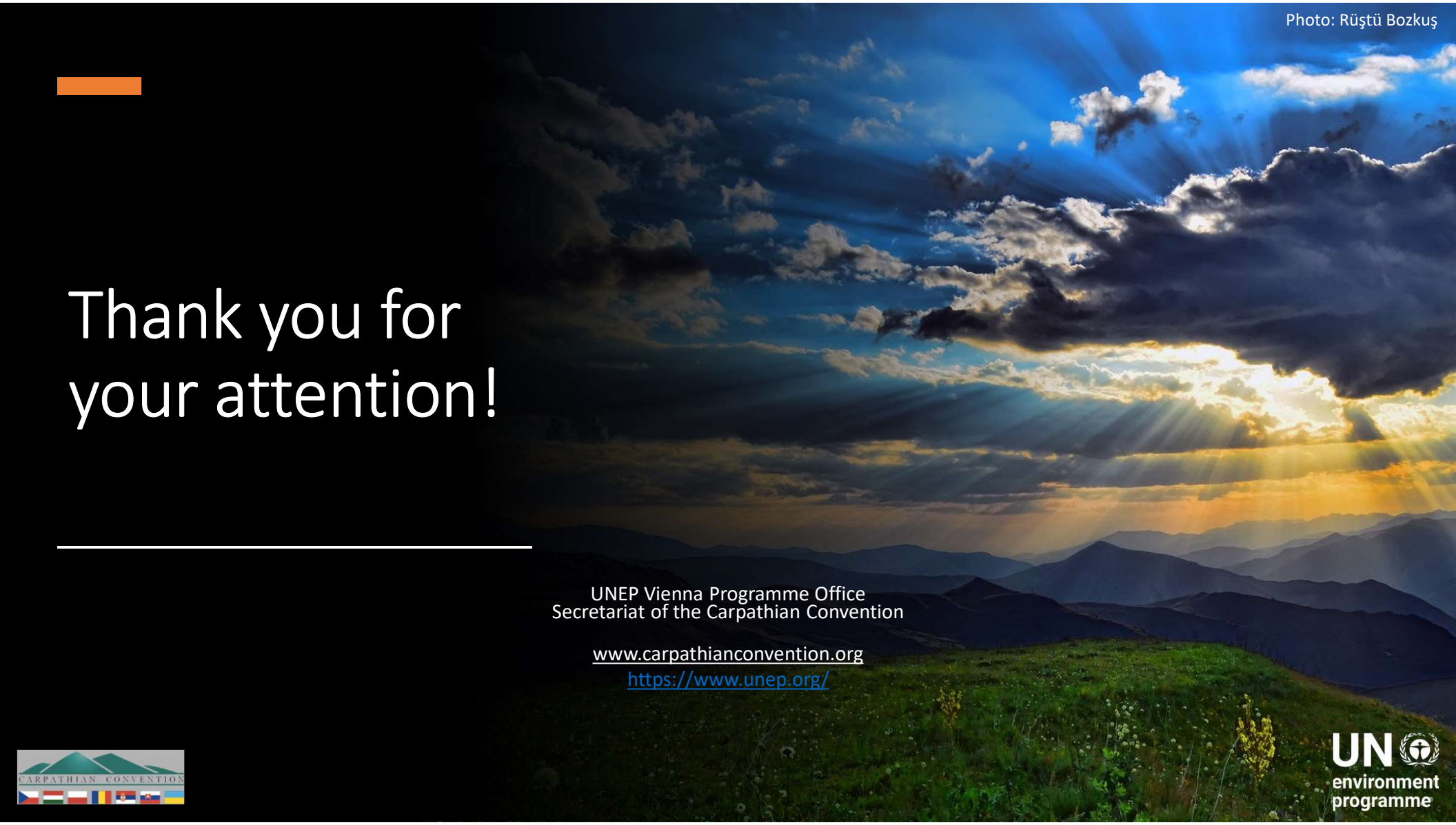
Proposed next steps towards finalizing the assessment

The Secretariat

- much welcomes written feedback to the DRAFT assessment until **31 May 2023**, including additional information on recent practical examples (if any)
- will consolidate feedback and provide an updated/expanded version to the **CCIC meeting on 15/16 June 2023**
- Will further prepare the assessment for **publication and approval by the CC COP in October 2023**



Thank you for your attention!

UNEP Vienna Programme Office
Secretariat of the Carpathian Convention

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