

Forum: Environmental Commission

Issue: Measures to promote the conservation of mountain ecosystems, including their biodiversity

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Introduction

Mountains cover almost a quarter of the Earth's land and are home to about a tenth of the world's population, yet the conversation around different ecosystems rarely brings up the topic of these diverse and complex environments. The difference in the temperature and environment of mountains and the land around them allows flora and fauna not generally found in the surrounding region to thrive in a place they otherwise wouldn't be able to. Mountains exist in so many different climates throughout the world, with many having almost completely different ecosystems, and even the difference of the microclimate in different areas of a mountain, such as the windward and leeward sides, can affect ecosystems. These variations in mountain ecosystems due to climates can be quite significant; mountainous regions up high latitudes may be home to plants able to survive in the harshest weather conditions, while in more temperate regions, mountains might be home to the plants like pine and fir trees, those that people are generally more familiar with. Mountains also provide us a lot of our freshwater; the Food and Agriculture Organization of the United Nations (FAO) estimates that mountains provide between 30%-60% of freshwater in temperate regions, and up to between 70%-90% in semi-arid and arid regions.

But mountains are also some of the areas most affected by climate change; the regions are generally quite fragile and sensitive, and are easily affected by not only natural events, like volcanic eruptions and earthquakes, but also by human activities that hurt the environment. As just one of many examples, the United States Geological Survey has stated that the Northern Rockies have "experienced three times the global average temperature increase over the past century," and with mountains being extremely important geographical features, this is alarming. These negative effects not only hurt one of our biggest water sources, but also the homes of endangered species, and can even lead to mountain communities having to leave their homes and move elsewhere. The degradation of mountain ecosystems doesn't only lead to the erasing of species and habitats, but possibly even cultures and languages. This issue has many sides to it, and the dependence on and the importance of mountains

and their ecosystems are both topics that need to be spoken about more, especially when mountains are so heavily affected by climate change.

Definition of Key Terms

Ecosystem

UN Water defines an ecosystem as a complex system of “plant, animal and microorganism communities and their nonliving environment” working together to create an habit in which every part contributes in making sure everything functions as a unit.

Biodiversity

The diversity and variety of living organisms within an ecosystem.

Windward Slope

The slope of a mountain that is hit by wind currents. When wind, usually warm, hits the side of the mountain, it rises and cools due to the altitude, forming clouds. The clouds are blocked, and precipitate on this side of the mountain, giving the windward side a more moist climate than the leeward side.

Leeward Slope

The slope of a mountain that is blocked from receiving most wind by the windward slope, but the wind that does get through from the other side is usually quite dry as most of its moisture has, at that point, been used up while precipitating on the windward side. The air descends down this side of the mountain and warms up while doing that; this gives the leeward slope of a mountain a dryer, but warmer climate than the windward slope.

Arid Climate

Also known as desert climates; arid regions have low precipitation and aren't able to support most vegetation. These climate regions include both hot and cold areas.

Temperate Climate

Climate without extreme hot or extreme cold, and generally distinct seasons.

Microclimate

The climate of a small area, that differs from the climate of the area around it.

Environmental Degradation

The process of the environment being degraded or destroyed, including the reduction of biological diversity, pollution, or through other means. Environmental degradation can be natural at times, but the process tends to speed up or be more damaging due to human activity.

Endemism

The ecological state of an organism or species being unique to, or confined in, a single region in the world, such as the Panther Chameleon, or the Indri- both only found in Madagascar.

Keystone Species

A species that plays a large role in an individual ecosystem, and without which the ecosystem would fail to exist.

Background Information

Climate Change and Mountains

Mountains tend to be early indicators on the effects of climate change due to their “altitudes, slopes, and their orientation to the sun”, all of which subject mountains to harsher treatment earlier than non-mountainous regions according to the Food and Agriculture Organization of the United Nations (FAO). Many scientists believe that the effects of climate change on mountains give us clues as to how it will begin to affect the large population that lives below these high altitudes. Glaciers are melting, plant and animal habitats are degrading, and mountain communities are facing severe hardship; the situation is already extremely bad, but if nothing is done, it will continue to get worse.

The melting of glaciers is impacting water resources throughout the world and is diminishing the already limited freshwater in the world, as freshwater only accounts for 2.5% of the world’s entire water supply. This is especially bad when the water crisis is already depriving 780 million people of clean water according to the Centers for Disease Control and Prevention (CDC). Those living on mountains will find it harder and harder to continue to stay there, forcing many to leave. But that wouldn’t be the only thing forcing them to leave, as the “Mountains and Climate Change” report published by the FAO states that while it’s already fairly difficult to grow food on mountains, it’s becoming harder. Climate change’s severe effect on the regions will “increase climate variability beyond the limits of past experience,” and the higher temperature will also bring an increased risk of disease to these areas, along with an increased

risk of natural disasters such as avalanches and landslides to become more common, and that's already beginning.

Mountain Biodiversity

Mountains boast incredible biodiversity, and are the homes to about a quarter of all terrestrial life. Within mountains, we can find endemic creatures and plants that cannot be found anywhere else in the world. The FAO's "Mountain Biodiversity and Global Change" report states that on average, the alpine belt, the area of a mountain above the treeline- the altitude, which once passed, no tree can grow in a region- of any given mountain system hosts between 500 to 600 different species. There are multiple reasons for why mountain biota- the flora and fauna of a particular region- is so diverse, including the fact that mountain ranges can span hundreds of kilometers and have huge altitudes along with topographic diversity, giving each mountain range quite a few different microclimates that can support different kinds of life. Mountains also have a lot of isolated habitats, and these undisturbed areas are great places for species' to flourish.

Different regions in the world have different mountains- there's a notable difference between the Andes range in the subtropical climate, and the Pyrenees in the temperate region- and in turn, they have different flora and fauna in that region. For example, mountains in tropical and subtropical regions support a lot of plants, and are known for their plant species diversity; this includes mountains such as those in the Atlantic forests in Brazil and in the eastern Himalaya-Yunnan region. Mosses and ferns are in huge abundance in these tropical regions, making up a large part of this flora diversity, and the Andes mountain range hosts some of the highest numbers of moss species in the world. Mountains in Iran are also known for their beautiful flora, and a large number of endemic plant species' that can't be found anywhere else. Cloud forests, residing in mountain forests, sustain the lives of so many different species of birds, mammals, amphibians, and reptiles- in Peru alone, 30% of endemic animal species live in cloud forests. The previously mentioned FAO report on mountain biodiversity states that "evergreen tropical cloud forests harbor a disproportionately large number of the world's species."

Mountain biodiversity isn't only important because it's so diverse and interesting though, these plants and animals are, as the FAO says, "nature's insurance system," and "security comes from multiple players that mitigate the risk of losing system integrity or functioning." With so many species functioning together as one ecosystem, biological diversity can often mean that these ecosystems are more likely to survive events like fires or the introduction of an invasive species. Keystone species, such as Black Bears in the Great Smoky Mountains, are also extremely important and are another example of the importance of mountain biodiversity, as without them, ecosystems cannot function. If we don't protect the biodiversity, it could also lead to the degradation of steep mountain slopes, as they depend on different types of plants to cover them and keep them structurally sound. But protecting these flora and fauna also has an economic benefit- for example, in Kenya, mountains, due to the tourism they bring in, the

electricity and agriculture they bring in, they account for between 30 to 40 percent of the country's GDP; many goods and services that we find important come from mountains, such as timber, medicinal plants, and even tourism. In efforts to protect mountain biodiversity, we have seen various treaties and agreements that have acknowledged the importance of mountain ecosystems and biodiversity and their need for protection, but there have been no international binding treaties or agreements that deal specifically with this problem. There have been regional ones, but the issue of this threat to mountains doesn't just affect singular regions- it affects everyone.

Climate Change's Effect on Mountain Biodiversity

The "Mountains and Climate Change: A Global Concern" report published by the International Mountain Society states that "Half of the global biodiversity hotspots are in mountainous regions." With rapidly warming temperatures in some mountains, species are being forced upwards to cope, giving them less and less habitat area and forcing them to compete for resources with other species in the same situation. The warming is even forcing spring to come earlier in these regions, and with all these species working together to create one ecosystem, when one is affected negatively, it affects a lot of the others as well.

The Sustainable Development Goals

Sustainable Development Goal 15 states that it aims to "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss." Recognizing the importance of ecosystems and biodiversity, this goal works to get nations to protect their flora and fauna in the face of industrialization, urbanization, climate change, and other factors. While we're still grappling with this goal, that isn't to say that absolutely no progress has been made; for example, while we're still losing many forests, the net forest loss has been cut in half since the 1990s due to governments becoming more aware of the negative effects of deforestation, and nations are increasingly covering important and diverse environments by protected areas. SDG 15 also has more specific targets that affect mountain ecosystems: SDG 15.1 and 15.4. SDG 15.1 aims to work for the sustainable use of different ecosystems, including mountains, but SDG 15.4 tackles the issue more directly, stating that it aims to conserve mountain ecosystems and their biodiversity. SDG 13, which works to "Take urgent action to combat climate change and its impacts," is also heavily related to this issue, as it's the root of many of these problems.

Major Countries and Organizations Involved

Food and Agriculture Organization of the United Nations (FAO)

The FAO has long been working to help solve so many environmental related issues, including the issue of the conservation of mountain ecosystems. The FAO has lead many studies that outline the issues we're facing regarding mountains today, and what needs to be done. Two previously mentioned reports, "Mountains and Climate Change" and "Mountain Biodiversity and Global Change" were both published by the FAO, and these are just two of the many reports they've written and published. The FAO is heavily involved in bringing the SDGs to fruition, and it's Mountain Partnership Secretariat is the "custodian agency" that works to implement SDG 15.4 specifically. The FAO's Mountain Partnership, which the Secretariat runs out of, is an alliance with different government, NGOs, and other major groups that are dedicated to helping mountain communities and ecosystems. The Mountain Partnership has also created the Mountain Green Cover Index, which measures the change in vegetation of mountains and measures their "health" using this. Using the Index, the FAO can track forest exploitation, fires, and other reasons for the reduction of a mountain's green cover, and it can also track its increase.

International Centre for Integrated Mountain Development (ICIMOD)

The ICIMOD created the Kailash Sacred Landscape Conservation and Development Initiative which operates along the borders of China, India, and Nepal, working to facilitate transboundary cooperation to protect fragile mountain ecosystems in these countries. The ICIMOD works with the United Nations Environment Programme (UNEP) and the governments of the countries they're working in to do so. This isn't the only transboundary operations the ICIMOD has been working on though; some of their other projects include the Hindu Kush Karakoram-Pamir-Landscape Initiative and The Landscape Initiative for Far Eastern Himalayas, or HI-LIFE. The ICIMOD has been working in some of the most mountainous regions in the world to protect these landscapes and also those that live among them with their adaptation and resilience building programs such as the Himalayan Climate Change Adaptation Programme by monitoring mountains and their ecosystems, promoting cooperation beyond borders, and working to enhance resilience with the governments of the countries they work in.

International Union for Conservation of Nature (IUCN)

The IUCN's Mountain Ecosystems Specialist Group uses an integrated approach to promote mountain biodiversity and help protect mountain regions at risk. The group works with local communities in multiple countries, such as Lesotho, India, and many others, to help do this, and states that they "recognize the role of communities as being central to effective ecosystem management." The IUCN has done intense research on mountain ecosystems and their sustainable development, and works with member states and organizations to not just research what can be done to help, but implement this research into the real world. Currently, one of the area's the IUCN is working in, is in the Himalayan region, to research the region's sustainable food systems for the FAO.

Andean States

The Andean States are the five main countries that the Andes Mountain range cuts through: Columbia, Ecuador, Peru, Bolivia, and Venezuela. While the mountain range also goes through Argentina and Chile, they're not considered Andean States as not enough of the countries are a part of the mountain range to be officially considered Andean States. The mountain range has suffered heavily from human activities, and the tropical Andes region is considered one of the endangered biodiversity hotspots. It's estimated that only a quarter of the original tree cover still exists on the mountain range. The Andean States have been taken action to combat these effects, like creating protected areas such as the Sangay National Park and Podocarpus National Park, both UNESCO World Heritage Sites. Some of the countries, like Ecuador, have been running conservation projects to protect endangered species as well.

Irano-Anatolian Region

This region includes parts of Iran, Iraq, Turkey, Turkmenistan, Georgia, Azerbaijan, and Armenia, and the mountains in the region are another large biodiversity hotspot. The "Hotspots Within a Global Biodiversity Hotspot - Areas of Endemism are Associated with High Mountain Ranges" report published earlier this year, speaks about the Irano-Anatolian regions mountains, and correlates the high altitudes in the region directly with high biodiversity, and specifically with high levels of endemic species. Human activity, notably military activity, has caused great degradation within the region, along with mining and overharvesting. NGOs in the region, especially in Iran, have taken conservation action to protect the mountains and their ecosystems, but many government's don't see this issue as a priority, so while there have been some efforts, the problem is still largely going unsolved.

Eastern Afromontane Region

The Eastern Afromontane region is quite scattered across Eastern Africa and close areas, but the region can be split up into three main parts. The first two are the Eastern Arc Mountains and Southern Rift, which together take up parts of Kenya, Tanzania, and Malawi, and a few smaller areas in Zimbabwe and Mozambique. The third part is the Albertine Rift, in parts of Rwanda, Burundi, the Democratic People's Republic of Congo, Uganda, and Tanzania. While these are the three main parts, the Eastern Afromontane region stretches up into the Arabian Peninsula with the Asir Mountains that spread through Saudi Arabia, Yemen. Despite being so scattered, the mountains of the region all host similar ecosystems. The region is home to over a thousand endemic plant species, and many endemic animals, including over a hundred bird species that are found nowhere else in the world. The Albertine Rift in particular has more endemic species than anywhere else in the continent. But human activity in the region threatens these species- logging, foresting, and hunting are just some of the threats. Only about 10% of the area's original vegetation still remains, but the countries in this region are trying to take action to restore these beautiful lands. The Virunga National Park, for example, protects 8,000 square kilometers of land throughout Rwanda, Uganda, and the Democratic Republic of Congo. There are a

number of national parks throughout the Eastern Afromontane region, but still not enough is being done to protect these mountains and ecosystem from the numerous threats.

Timeline of Events

Date	Description of Events
November 7, 1991	The gathering of the first Alpine Convention.
June 3-14, 1992	The Rio Earth Summit takes place, and the Convention on Biological Diversity was opened to be signed.
April 25-27, 2001	The "International Workshop on Mountain Ecosystems: A Vision of the Future" takes place in Peru, and during which the Cusco Declaration on Sustainable Development of Mountain Ecosystems is adopted by the attendees.
2002	United Nations' International Year of Mountains
November 1, 2002	The Bishkek Global Mountain Summit met in Kyrgyzstan, and adopted the Bishkek Mountain Platform which outlined plans for sustainable mountain development.
September 11, 2012	The "The Future We Want" outcome document was adopted during the United Nations Conference on Sustainable Development, or Rio+20 Conference.
September 25, 2015	The Sustainable Development Goals were adopted

Relevant UN Treaties and Events

- Quito Declaration Charter for World Mountain People, 4 September, 2003.
- The Future We Want, 11 September 2012 (A/RES/66/288)
 - o Points 210 through 212
- Sustainable Mountain Development, 12 February 2014 (A/RES/68/217)
- Transforming our world: the 2030 Agenda for Sustainable Development, 21 October 2015, (A/RES/70/1)
 - o Goal 15

Previous Attempts to solve the Issue

The implementation of multiple agreements and treaties have been used to protect mountain ecosystems and their biodiversity, such as Sustainable Development Goal 15. Nations and organizations

have been working to implement the SDGs as well as they can, and there have been reductions in harmful activities such as forest loss, but species and ecosystems are still very much at risk. Many nations, in attempts to protect their mountainous regions, have also turned these areas into national parks, such as the aforementioned Virunga National Park the Eastern Afromontane Region. Treaties and agreements with nations including the SDGs and the Convention on Biological Diversity have also made some progress on the issue by bringing people together to collaborate to solve these problems. Various other conferences and conventions have also met and discussed the issue, and organizations and nations alike are monitoring mountains and their ecosystems, but it's still rampant, as while actions have been taken and treaties have been signed, the issue still isn't being taken seriously enough, and few are doing everything that needs to be done to improve the situation. And with large and influential nations such as the US and Brazil who have administrations in power that don't find the issue, or other climate related issues important to the nation's well being, it's uncertain as to the future of this issue.

In some places though, innovative solutions are being used to combat the problem. One example is the work of the Mountain Institute, which has been working with communities living on mountain areas to create solutions to the problems they face. The Institute also has quite a few other projects going on to protect mountains and their communities, such as the Alpine Conservation & Restoration Project and the High Mountains Adaptation Partnership with the United States Agency for International Development (USAID).

Another example is the Carpathian Convention, adopted by the Czech Republic, Ukraine, Serbia, Romania, Hungary, Poland, and Slovakia. The convention aims to protect the Carpathian mountains in the region using both regional and transboundary cooperation to do so. But what makes this convention most interesting is its cooperation with other nations and organizations outside of the region; it's most notable partnership is the Alpine-Carpathian partnership to share ideas and work together with countries in the Alpine region. The FAO's Mountain Partnership is working to bring this collaboration even farther to other mountain regions worldwide. But while the actions that have been taken are great, the issue is that it still isn't enough; without more global cooperation, mountain ecosystems and biodiversity will continue to be threatened.

Possible Solutions

Human activity has severely affected mountainous regions, and it's caused the endangerment of many species. While a number of treaties, agreements, and resolutions have gone into effect and make mention of mountain ecosystems and biodiversity, there have been few that are specifically dedicated to this issue, and not enough countries have legislation in place to protect their mountains. This stems from a place of simply not understanding; mountain ecosystems, despite being some of the most threatened

places on earth due to human activity, are just rarely brought up when we speak about how humans have affected the environment. Governments and their citizens need to understand the importance of mountain ecosystems and what they can do to protect them. The lack of awareness from governments has been extremely detrimental in creating more progress on this issue, and that needs to be rectified.

The creation of national parks has been a huge help in protecting these areas, and the creation of more would protect the flora and fauna of the regions, and it's a feasible option for nations that don't have the resources to do much more- national parks also bring in tourism, possibly boosting the economy of these countries. It's also important to listen to, and understand the communities living in these regions, as they know the areas the best. The Mountain Institute, as previously mentioned, has been working with communities to restore traditional methods of doing things like managing water systems in these areas, which cuts back on negative human effects on the environment. By restoring older techniques of water management and irrigation, they've increased the amount of water available to these communities. Indigenous and native communities that have been living in areas for decades, or even centuries, are known to have deep understanding of the land around them, and working together with these communities helps keep these areas safe.

The FAO's "Mountain Biodiversity and Global Change" report also outlines some great ways to work to protect these areas. The report acknowledges the need to work around climate change and other harmful actions that affect mountains, and states that "To accommodate climate change and to protect biodiversity, mountain protected areas should be extended downslope to the lowlands and, in some places, to the sea." It goes on to give other examples of what can be done, such as creating protected areas and maintaining wilderness areas, or conserving connectivity corridors, areas that connect different parts and different microclimates of mountains together or with the regions around them, between political borders and allowing them to stay open, to give animals in these areas "to evolve, adapt and to move." Global and transboundary cooperation is also a solution that we've seen work in the past with International Centre for Integrated Mountain Development (ICIMOD) and other organizations doing similar work. Many nations don't have the resources to tackle this issue alone, and mountains often pass through political borders without care, making it so that the issue cannot be solved without transboundary cooperation. Cooperation with other nations is essential for this issue, and will help ensure that eventually, this issue no longer affects us.

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Appendix

- I. <http://www.fao.org/docrep/017/i2869e/i2869e00.pdf> - Mountains and Climate Change report

The FAO’s “Mountains and Climate Change” report, while long, gives a lot of insight into the effect of climate change on mountains and why it’s been so severe. It also mentions different mountains and mountain ranges throughout the world and gives some insight into them, along with giving examples of organizations working to help promote mountain ecosystems and their biodiversity.

- II. <http://www.fao.org/docrep/017/i2868e/i2868e00.pdf> - Mountain Biodiversity and Global Change report

Another FAO report, this document goes into more depth on mountain biodiversity than the previous report, how it’s changing, and why it’s changing. It mentions the biodiversity hotspots found throughout the world and why mountains are so many of them, and gives great ideas on what can be done to protect mountain biodiversity.