



## **Sustaining and Maintaining Life on Earth**

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### **Abstract:**

The sustenance of the incredible variety of species and biodiversity on planet Earth throughout millennia has been largely dependent on the abundance of water that exists here. Water covers more than three quarters of the Earth's surface but only 3% of it is fresh water. Of this 2% is found in ice caps and glaciers and 1% in underground sources, rivers, streams, lakes and the atmosphere. However due to numerous factors, fresh water has become and is being seriously depleted worldwide. Countries all around the world, including those whose rainfall was, until only recently very high, are experiencing drought. Millions of lives are being lost and many are suffering from severe conditions due to it. Mountain regions cover approximately 25% of the Earth's land surface and source between 60% and 80% of Earth's fresh water. All of Earth's rivers have their headwaters and origins in them. They are also known as the 'Water Towers' of the world. They provide critical storage of fresh water in the form of glaciers, ice and snow. Many streams and rivers would cease to flow entirely if their headwaters and watersheds were not fed by the seasonal melting of these snows. Such valuable storage of fresh water is vital for all life on Earth. However nowadays glaciers and mountain snows are retreating, shrinking and thinning rapidly in all regions of world, threatening the fresh water and food supply for all. Unlike resources such as coal, oil and gas the fresh water system is a renewable and regenerative one. It has the ability of being replenished. Nonetheless this cycle is utterly dependent upon indigenous mountain forests and plants. They play a major role in protecting the watersheds, which all rivers depend upon. However, worldwide too much of these indigenous forests have been cut or replaced with monoculture plantations, which do not do the same fundamental job. To protect and regenerate Earth's fresh water cycle these indigenous forests need replanting on a vast scale throughout mountain regions worldwide imminently. We at Active Remedy Ltd have formulated a method for doing this. It is a combination of several modern and traditional conservation techniques that address the diverse requirements of this challenging task. The principal is to create many community managed forest patches, within close proximity to mountain communities and to link these with green corridors. Thus creating a network by which biodiversity can spread over great distances, in a short period of time and with minimum resource expenditure. The green corridors would consist of mixed plants, specifically chosen for their environmentally beneficial properties. These corridors could then also provide resources and cottage industry opportunities for local communities.

This is a way of working in a supportive manner with local mountain communities, recognising that they play a fundamental role as stewards of natural resources that maintain global stability. This could be a way of joining many diverse groups and communities together in an interconnected endeavour, for the common purpose of safeguarding environmental sustainability.

## **Protecting and Sustaining the Global Fresh Water Cycle**

The sustenance of the incredible variety of species and biodiversity on planet Earth throughout millennia has been largely dependent on the abundance of water that exists here. Water covers more than three quarters of the Earth's surface but only 3% of it is fresh water. Of this 2% is found in ice caps and glaciers and 1% in underground sources, rivers, streams, lakes and the atmosphere. For the majority of life to exist fresh water is absolutely essential. However due to numerous factors fresh water has become and is being seriously depleted worldwide. Countries all around the world, including those whose rainfall was until only recently very high are experiencing drought. Millions of lives are being lost and many are suffering from severe conditions due to it. The evolution of nature including humanity has shown itself to be incredibly adaptive and has survived many adverse conditions but we cannot adapt to no fresh water. Regardless of status or species all life is presently threatened by this same problem and unless solutions are found and applied, life and evolution on planet Earth may come to an abrupt end. Rather than ignoring or running from this threat, as there is ultimately no where to run to, it would be to our best advantage to face it, understand it and use our best intelligence and resources to work on remedying the problems while still conceivably possible. For this we need to gain a greater understanding and awareness about the global fresh water cycle and the factors it is dependent upon for its healthy continuum. When considering fresh water it is vital to consider mountain regions. They play an extremely crucial and irreplaceable role in the hydrological processes of the planet and in the regional hydrology of all continents.

*"Water is essential to human life, and healthy mountain ecosystems are essential to global water supplies. By taking care of the world's mountains, we help to ensure the long-term survival of all that is connected to them, including ourselves." (Douglas McGuire, head of FAO's Mountain Group.)*

Mountain regions cover approximately 25% of the Earth's land surface and source between 60% and 80% of Earth's fresh water. All of Earth's rivers have their headwaters and origins in them. They are also known as the 'Water Towers' of the world. They provide critical storage of fresh water in the form of glaciers, ice and snow, which melts and is released during warm seasons. Many streams and rivers would cease to flow entirely if their headwaters and watersheds were not fed by the seasonal melting of these snows. Such valuable storage of fresh water is vital for all life on Earth. They are also important in the interception of air circulating around the globe, by forcing it upwards where some of it condenses into clouds and returns to earth again as rain and snow.

Apart from the fundamental and vital part that mountains play in maintaining the regenerative fresh water cycle, their snow, ice caps and glaciers form a powerful solar reflector, which regulate Earth's temperatures. Nowadays they are retreating, shrinking and thinning in all regions of Earth. As they melt and become thinner this function naturally becomes less effective, greatly influencing rising temperatures upon Earth and adding to global warming. This also leads to glacial lake outbursts and land slides, which disrupts the amount and timing of fresh water released to all rivers and lowlands, causing problems with its quality and quantity. Also they are not being replenished as fast as they should be. This scenario rapidly wastes the supplies of fresh water, which are available to all and threatens the fresh water and food supplies for hundreds of millions, if not billions of people, along with all life on Earth. When this ice melts, some of it evaporates and this increases the quantity of water vapour in the atmosphere. Water vapour  $H_2O$  is a very powerful greenhouse gas, which normally stays in the atmosphere for around nine days. However if it is not brought to Earth through precipitation, it rises into the upper atmosphere and increases the problems of the greenhouse effect and exacerbates Global Warming. It has also recently been proven that the ice and snow on the high Himalayas regulate the climate for the entire Northern Hemisphere. Hence wherever we live in the Northern Hemisphere the great glaciers of the Himalayas affect our climate and ecological environments. In a similar manner the Andes affect the climate of the Southern Hemisphere. If this situation continues, it is possible that glaciers may completely disappear from many mountain ranges within the 21<sup>st</sup> century.

Unlike many resources such as coal, oil and gas the fresh water system is a renewable and regenerative one. It has the ability of being replenished through a combination of natural processes and the passage of time. However it can only be renewed through the process of the water cycle, where water from seas, lakes, rivers, and dams evaporates, forms clouds, and returns to earth through precipitation. This cycle is utterly dependent upon indigenous mountain forests and plants. Approximately 28% of all forests on Earth are found in mountain regions. Through their action of precipitation and transpiration they play a crucial role in the creation of rain, snow and ice. Precipitation is the process by which water molecules  $H_2O$  in the air form rain and snow and fall to Earth. This occurs in relation to a combination of different factors, particularly when plants and trees are present, especially deciduous species. Deciduous trees such as oak release large amounts of a powerful hydrocarbon, known as isoprene into the atmosphere. Isoprene breaks down into a compound called dihydroxyepoxide. This is very reactive and forms multitudes of bio-aerosols. These act like a vacuum cleaner of the atmosphere and are an essential factor in cloud formation. It is possible that the formation of clouds at high altitudes would not be possible without them. Even young oak trees produce this chemical and it is worth noting that the oak species is one of the main indigenous trees of the Himalayas. However, because it is slow growing and quite fragile when young, it needs the support of numerous other plants and trees to be able to take root and survive, especially in seriously eroded areas. Another factor in precipitation is known as ice nucleation, whereby bacteria produced by plants and which live on the bark and leaves of plants are blown into the atmosphere. These form the nuclei seeds around which ice crystals form. Snow and most rain begin with the formation of ice in clouds.

As mountain forests disappear there is less precipitation and transpiration, hence less snow and rain at high altitudes is made, land drains more quickly and soil temperatures rise.

The protective function of healthy mountain forests, full of biodiversity, also provides the groundcover and shade needed to delay snowmelt and reduce evaporation from the soil. These actions are vital for the safeguarding of all watersheds, which in turn maintain the stability of all rivers and water tables. They also play a vital role in ensuring the quality and quantity of rivers and streams by preventing and reducing slope and soil erosion. The root systems of indigenous mountain forests are responsible for both holding loose soils together and in channelling fresh water into the underground aquifers and water tables. If they are not present this necessary action cannot take place and springs and wells thousands of kilometres distant from them, dry up and disappear. They form a major part of the natural infrastructure, which protect watersheds and all fresh water sources. However it is possible that only 25% of the Earth's primal indigenous mountain forest is still intact. This implies that 75% is missing. It is an enormous loss and surely adds to the problems of global warming; considering that these forests are the natural mechanism, which would normally be making the mountain snows and replenishing glaciers, thereby regenerating the fresh water cycle. Through the wide mixed variety of plants and trees they would also be producing oxygen and absorbing CO<sup>2</sup> at high altitudes. Some indigenous mountain plants are very fast growing and have very high oxygen producing capacities. To help solve the problem of too much water vapour remaining in the upper atmosphere and adding to the greenhouse gas crisis, it is necessary to establish fast growing, high precipitating, indigenous forest plants throughout mountain regions worldwide as soon as possible. Deforestation of high-altitude forests, mining and unsustainable agriculture are all taking their toll on mountain watersheds and, through impacts that relate to water, on people and ecosystems downstream. The health and vitality of upland watersheds has a massive impact on all downstream areas. The health of entire watersheds can depend on preventing environmental degradation in these areas. If approximately 25% of Earth's surface is upland mountain regions then that indicates that approximately 75% is downstream lowland regions. Whether close or distant all of life on Earth is affected by the health and environmental stability of mountain regions. Even life in the oceans is dependent upon them, as the fresh waters from rivers finally feed into and clean them. Without a steady flow of clean fresh water the oceans become too high in salts and hence too imbalanced to adequately support marine life.

*"Healthy mountain ecosystems are the foundation of healthy people, both in the mountains above and in the plains below. To save civilization, there is no greater urgency today than to regenerate and conserve our mountains. "Their role in regulating our climate and water systems is fundamental to the sustenance of our life on this planet."(Dr Ashok Khosla, Lucerne World Mountain Conference 11/10/2011)*

From this knowledge it becomes transparently obvious that to protect, re-balance and increase the natural regenerative system of the fresh water cycle, indigenous mountain forests need both protecting and regenerating as fast as possible worldwide. Time is of the essence as mountain areas are very fragile.

Due to the vast deforestation and non-sustainable monoculture projects, which have occurred on an enormous scale globally, their soils are very depleted and erosion problems are massive. This almost looks like an impossible situation but it is not necessarily so. It becomes plausible if we take action imminently in relation to the vast store of knowledge that we presently have. Undoubtedly we will acquire more in the process but right now we have sufficient knowledge and resources to proceed and potentially succeed. Nature on Earth is comprised of multitudes of interdependent and interconnected ecological systems and life forms. It is incredibly resilient and vastly intelligent. If we can view Nature from this perspective, we have more chances of working in harmony with it and of solving problems related to it and ourselves. We are after all part of this interrelated natural world and have immeasurable intelligence and capacities when our minds are combined in a common focus for the benefit of the whole. All lives are threatened, so it is in everyone's best interest to join forces and become part of the solution. Much can yet be achieved if we take the necessary precautionary actions required to avert and mitigate crisis before they are too overwhelming and unavoidable.

If we consider the Earth as a home that is comprised of many floors and rooms, 'The Roof of the World' would be all of the Earth's mountainous regions. If the roof becomes destabilized, the rest of the house is undoubtedly threatened. We all have some awareness of what happens in a house if the water tank stops working. The survival of virtually all life upon Earth is utterly dependent upon the services that mountain regions provide. Globally they form an interdependent integrated system and need to be regarded along with fresh water as 'Global Commons'. It is important to recognize that the collaboration with mountain communities is crucial and essential for the effectiveness of this undertaking. It is only by involving and supporting them that an endeavour of this magnitude can be successfully achieved and prove to be long-term sustainable. Mountain communities are the natural stewards of the water sources and natural mountain resources essential for all the lower lands of Earth. Therefore they should be encouraged and supported for their services in regenerating and protecting their environment. Without the recognition of the vital part that they play in being the natural caretakers of the mountain forests, they will be forced by poverty to either degrade these resources even further or to migrate. However if these communities are supported, they can provide the very important service of regenerating, safeguarding and preserving the natural ecologies. It is important to remember that supporting these mountain communities is not simply an act of charity. It is a means by which all lowland communities can safeguard their own long-term interests. It is also important to note that generally it has not been the grass-root communities that have caused the majority of the environmental degradation that has taken place in these areas. It has always been in the interest of these communities to protect the natural resources, which supported their livelihoods. However now that natural resources have become so scarce, the daily necessities of the local rural communities also threatens them. Supporting and educating rural mountain communities is a fundamental part of the method that we are proposing. However it is important to understand that we also need to be educated and that they have vital ancient traditional knowledge that we are lacking. This is the time for indigenous and modern knowledge systems to be integrated and for us to form mutually respectful alliances with one another.

Uniting, supporting and sharing knowledge is the only way we can possibly deal with and overcome the crisis threatening the well being of all life on Earth.

We at Active Remedy Ltd have spent a number of years researching and communicating with many knowledgeable people including those from mountain communities, about the scale of the problems regionally and globally and methods, which could be applied for helping to solve them. From detailed research, it appears to be essential to reforest approximately 25% of Earth's mountain regions with indigenous mixed forest plants within the next thirty years and to protect the indigenous mountain forests presently in existence. In order for them to be effective and successful they need to be comprised of many mixed indigenous plants, which enrich and support the local biodiversity. This would conceivably enable the natural ecological and hydrological systems to re-balance themselves and survive indefinitely. The method that we propose for doing this has been formulated considering both modern and traditional conservation techniques, which have proven themselves to be successful. It could be considered as repairing the 'roof of the world'. It has been created specifically to fit with the requirements and traditions of the different social groups and terrains throughout mountain regions worldwide. We have integrated the methods of sacred groves and green corridors along with Permaculture, forest gardening, companion planting and cottage industry scale cultivation of medicinal plants to create a model that could have the potential to cover all the requirements for the difficult task of Global mountain reforestation. We have termed this method 'The sacred grove and green corridor method for repairing the roof of the World'.

Restoring new mountain forests is a very difficult job when the old forests have been severely diminished and when there is very little topsoil remaining, leaving behind arid lands. This also applies when the remaining soil is too acidic or compacted. To grow a forest in these conditions, one has to re-establish the complex root structures and canopies, to resemble that of a mature forest. Young trees cannot be expected to grow in bare, exposed land. They are too fragile and vulnerable. They need shelter from the harsh weather conditions such as strong winds, heavy rains and intense sunshine, which are common to mountain regions. There are certain plants, indigenous to all mountain regions of the world, which possess properties that can be utilized to solve many environmental problems. Between the rich varieties of species are many plants potentially capable of providing all that is needed for re-establishing indigenous mountain forests fast. These plants are capable of growing in some of the most badly eroded and degraded soils. There are some capable of cleansing the land by removing toxins. This process is known as Phytoremediation. This is a way of using plants to clean up pollution in the environment. Certain plants can help clean up many kinds of pollution including metals, acids, pesticides, and oil. These plants can also help prevent wind, rain, and groundwater from carrying pollution away to other areas. Some of these plants have strong, fast growing root systems. These are capable of holding together the loose earth, so allowing other, slower growing plants such as oak, to connect their tender roots in with a strong web of roots. This root system helps to prevent land erosion and the loss of moisture by holding the soils together on the slopes. Using a combination of fast growing plants, it could be possible to synthesise a natural forest. This would act like a nursery for the young plants and make it possible to introduce many varieties, so encouraging high levels of biodiversity.

These kinds of considerations make it conceivable for young plants to be able to establish themselves and become forests relatively fast. Speed is of the essence and of utter importance in this endeavor. Every time heavy rains fall precious soil is washed away.

Once an area becomes rock, it is no longer possible to introduce plants and all that is left is arid land and desert. Some of the environmental problems being faced have occurred due to the introduction of foreign plants and monoculture into a given area. Although many foreign plants may have some useful qualities, too often they have proven to be invasive and have wiped out local plants, which are vital for the health of the overall general environment. Therefore, the plants, which have already evolved in local environmental conditions, are the ones that would be the most beneficial and successful for fast land reclamation and regeneration. In this respect mixed indigenous companion plants are vital for a successful outcome

When searching through the traditional methods that the mountain communities have applied to preserve the environment, we came across the tradition of 'sacred groves'. These are small, forested areas conserved by the local people, which are intertwined with their traditional, cultural and religious practices. They have proven themselves to be storehouses of valuable medicinal plants and biodiversity, which have many land and water preserving properties. These groves enhance local environmental and cultural wealth. They are similar to temples but with the main emphasis being on the sacredness of the nature in the grove and not on a building. It is an ancient conservation method that many mountain communities are familiar with and still adhere to. Because it is still a living tradition from ancient times it has a natural vibrancy and potential.

The method that we have formulated involves the creation of new sacred groves and the preservation and restoration of existing ones. Numerous new small groves would be created throughout the mountain regions, linking village communities and creating networks across these areas. Each grove could be planted in such a way, as that every village had a five to ten acre grove within its vicinity. By linking new groves with existing ones; the latter already being significantly important for local communities, would mean that these communities would feel more devoted and protective towards the new ones. This would be a way of uniting the old and the new together and would therefore give these groves greater cultural stability. Each village could potentially form a local group to care for, manage and be stewards of these new groves and be funded to do so. Because this tradition has been global it has the capacity to potentially fit with many different cultures, landscapes and situations. These newly established groves could range from religious groves of any faith, to simply being naturally beautiful, peaceful and invigorating forest gardens and peace parks. They would generally be community managed and so bring members of local communities together through education and mutual effort. Involving children and students in this could be a very good way of educating them about the benefits of conservation, from a young age. In this way fast, active, community based programs could be initiated and set into motion.

It has proven itself to be effective in the past and is still so in present times, in conserving natural environments. Hence it could be highly valuable when forming a workable model for regenerating and preserve indigenous mountain forests and supporting mass biodiversity.

*“A scientific understanding of the sacred groves would be significantly important for designing strategies for rehabilitation of degraded landscapes, involving local people’s participation, and training for promotion of traditional and social norms” (Gadgil and Berkes, 1991)*

The long-term sustainability of these new sacred groves would be greatly amplified, if created in combination with the cultivation of different kinds of medicinal plants for cottage industry. This cultivation would preferably take place outside of the groves, in designated strips of land linking the individual groves. They could even potentially serve as important green corridors/belts between larger, officially protected areas such as national parks. Green corridors and belts have proven to be very effective in the reclamation of severely, environmentally damaged landscapes throughout a number of countries in recent years and have proven to be a way which enables much biodiversity to spread and flourish. Isolated and fragmented forest systems have proven to be less effective in supporting wildlife and stabilizing soils. This is because isolated patches of biodiversity and local preservation do not have a very large environmental impact on a global scale. Mixed indigenous plant species could be selected for their environmental restorative and useful properties. Local communities could cultivate plants that they specifically need for providing medicines, fodder, foods and fibre within these green corridors. These could conceivably become local resources that support the needs of the communities, bringing them means of establishing local co-operative cottage industries and employment. In such a way green economies and gender equality would naturally come about and flourish. The Green Belt Movement’ in Kenya founded by Wangari Maathai, has facilitated in the planting of approximately 30 million trees. By planting trees in groupings of 1,000 or more, these green belts have begun to reclaim the ecosystems of Kenya that were rapidly eroding.

There are a few conservation systems that have been developed in the last century, that are inspired by traditional conservation methods. ‘Permaculture’ and ‘Forest Gardening’ are two examples of these. Both of these contain methods, which could prove to be very useful for creating and sustaining groves and corridors which fit with the needs and traditions of the local communities. Forest gardening is a food production and land management system based on replicating woodland ecosystems, but substituting some usual forest trees with fruit trees, bushes, shrubs, herbs, medicinal plants and vegetables which have yields directly useful to humans. Through the knowledge of companion planting, these can be intermixed to grow on multiple levels in the same area, as do the plants in a forest. Permaculture means permanent agriculture and is a way of observing the dynamics of natural ecosystems. This knowledge can be applied in designing and constructing ecosystems that serve the needs of human populations without degrading our natural environment. Permaculture systems are proving to be successful in every ecosystem, including the tropics, deserts, mountains and oceans

One way to support and restore biodiversity is to give local communities the right to protect and manage it. This gives a direct bond and attachment between them and the surrounding environment and can help to secure their support for the project. It would also provide a means of linking mountain communities throughout large areas of mountainous regions and even the world.



It is very important that the interaction of different communities, cultures and knowledge systems from around the world takes place. Our ancestors were fully aware that the natural resources that sustained them must be conserved for the sustenance of future generations. This deep connection between protecting the biodiversity and protecting the ancient rituals and traditions has meant that there are still many beautiful examples of both of these in the present day.

The welfare of all species, communities and groups can only be maintained and improved if there is ample fresh water. The success of this is in every ones best interest. This is a time of diverse communities working together in an interconnected manner for a common purpose and could be a way whereby many seemingly unrelated governments, organizations and individuals could join together in a concerted effort, to support a common global program for the benefit and greater good of the whole. This work need not be overall expensive. Using a small percentage of the resources we have now, to potentially save the whole for an indefinite span of time could be considered a worthy investment. This is a global long-term defence strategy. 1% of the defence budgets of all countries in the U.N could conceivably cover the expense. However it is crucial that it is acted upon without delay. Once the scanty soils in mountain regions have gone and only rock remains it is impossible to plant forests. Even now it is a demanding task but still within the realm of possibility.

*“Where there are threats of serious or irreversible damage; lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” (UNCED, 1992 Principle 15)*