



Understanding and Protecting the Global Fresh Water Cycle

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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. These forests play a major role in protecting the watersheds, which all rivers depend upon. However, worldwide too much of these indigenous forests have been cut. Approximately 28% of the world's forests were indigenous mixed mountain forests. Humanity cut it by 75% globally. Approximately 21% of the world's forests were therefore cut and destroyed. This was largely replaced by, monoculture pine plantations, for fast profit. These are lethal to the majority of other plants and local biodiversity. They also do not do the necessary job of precipitation. Mixed deciduous mountain forests play a vital and crucial role in the hydrological cycle. Due to their massive loss, glaciers and mountain snow cannot be adequately replenished. Temperatures rise as the solar reflector is diminished and thins. This factor is almost invisible and has mostly been disregarded when talking about reasons for 'Global Warming'.

An understanding of mixed forest in mountains and its protection and fast regeneration is vital in achieving any of our goals for long-term sustainability and equity. To protect and regenerate Earth's fresh water cycle these indigenous forests need replanting on a vast scale throughout mountain regions worldwide imminently. Without adequate mixed deciduous forests in mountain regions the fresh water cycle and temperature regulation mechanisms cannot be maintained and if not remedied will break down regardless of all other actions. If all the forests worldwide were saved and regenerated and the mountain regions were ignored they would all die of drought as glaciers and mountain snows disappeared and rivers dried up.

We at Active Remedy Ltd believe that all indigenous mountain forest needs to be protected and that 25% of mountain regions worldwide need replanting with mixed indigenous mountain forest as a matter of urgency for global environmental stability.

We 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. Nowadays many factors need to be seen in relation to one another for us to take appropriate action and bring about truly lasting advantageous results.

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. .

It has been recognized and confirmed that people living with water scarcity is expected to climb from 1.7 billion to 3.2 billion by 2080 (IPCC, 2008). It could also be much higher, depending on the compounding of factors involved in the rate of glacial retreat and breakdown in the global hydrological cycle.

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 (Roots and Glen 1982).

Mountain regions cover approximately 25% of the Earth's land surface and source between 60% and 80% of Earth's fresh water (U.N General Assembly 29/9/05). All of Earth's rivers have their headwaters and origins in them (Viviroli et al. 2007). They are also known as the 'Water Towers' of the world. (Bandyopadhyay 1995). 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 (UNCED 1992 Agenda 21). 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.

“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).

Mountains and the Regulation of Global Temperatures: Apart from the fundamental and vital part that mountains play in maintaining the regenerative fresh water cycle they play a major part in the regulation of Earth's temperature. Their snow, ice caps and glaciers form a powerful solar reflector, which very much affects the regulation of Earth's overall heat. Nowadays glaciers are retreating, shrinking and thinning in all regions of Earth (UNEP WGMS 2008) and the degradation of permafrost is accelerating. This is very likely to have significant effects on water available for both mountain and downstream communities worldwide (Stern et al. 2006). 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.

“In the greater Himalayas, a substantial proportion of the annual precipitation falls as snow, particularly at high altitude (above 3000m). In the higher reaches, snowfall builds up from year to year to form glaciers that provide long-term reservoirs of water stored as ice. The high Himalayan and inner Asian ranges have the most highly glaciated areas outside the polar region” (Dyurgerov and Meier 2005).

Nowadays they are not being replenished as fast as they should be. Rapidly retreating glaciers and mountain snows swiftly wastes the supplies of fresh water available and needed for all life. This scenario threatens the fresh water and food supplies for hundreds of millions, if not billions of people, along with all life on Earth (UNEP WGMS 2008). When this ice melts, some of it evaporates thus increasing the quantity of water vapour in the atmosphere.

Water vapour H²O 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 (Santer 2007). It has also recently been proven that the ice and snow on the high Himalayas regulate the climate for the entire Northern Hemisphere (Zhang Yongze).

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 21st century.

“The 15 000 Himalayan glaciers that create the “Water Tower of Asia” —the largest block of fresh water outside the Polar Ice Caps—have been melting forever. But they are suddenly melting so fast that they are drying up. It will take decades, but at the rate the earth is warming, they may simply disappear” (Schifrin 2008).

Understanding the Science of the Water Cycle: 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.

“The availability and especially the quality of water are strongly influenced by forests and thus depend on proper forest management” (FAO 2007).

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 H²O 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. Worldwide, plants release more than 550 million metric tons of the hydrocarbon isoprene into the atmosphere each year (FAO 4 September 2006, Rome). 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 (F Paulot et al 2009).

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 (*Bishkek, Global Mountain Summit. 2002*). They also play a vital role in ensuring the quality and quantity of rivers and streams by preventing and reducing slope and soil erosion (U.N General Assembly 29/9/05). 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, so renewing many ground water sources. 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.

The recharging of groundwater resources are closely linked to the renewing cycling of fresh water, through which aquifers and underground sources are periodically replenished. However its regeneration is dependent upon sufficient precipitation. Between 1.5 billion (UNEP 1996) and 3 billion people (UN/WWAP 2003) worldwide are dependent upon groundwater supplies. These forests 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 forests are still intact (Maggio, Gregory F. and Owen J. Lynch. 1996).

This implies that 75% is missing. This is approximately 21% of the world's forests. It is an enormous loss and surely adds to the problems of global warming; considering that these forests are the natural mechanism, which plays a vital role in the making of mountain snows and replenishing glaciers, thereby regenerating the global fresh water cycle. Through the wide mixed variety of plants and trees they would also be producing oxygen and absorbing CO² at high altitudes. Some indigenous mountain plants are very fast growing and have very high oxygen producing capacities. Also it is generally assumed the rise in green house gas is mostly caused by burning oil and gas yet according to the U.N:

“Between 25% and 30% of the greenhouse gases released into the atmosphere each year – 1.6 billion tons – is caused by deforestation” (FAO 4 September 2006, Rome).

Mountain cloud forests are particularly valuable for their capture of water that is combed from mists and moving clouds. They are also of immense importance in maintaining a steady supply of fresh water to all the lowlands and downstream areas (Hamilton, L.S. 1996). The deforestation of high-altitude forests negatively affects watersheds and ecosystems downstream. The health of entire watersheds can depend on preventing environmental degradation in these areas. In South America, the loss of Andean cloud forests has upset the hydrological cycle and exacerbated landslide and flood damage related to El Niño (FAO (2007)).

This has serious effects on climatic conditions throughout the entire Southern hemisphere.

If approximately 25% of Earth's land surface is upland mountain regions then that indicates that approximately 75% of Earth's land surface 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).

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 can understand what is happening with the vast system that sustains us and why, then we can naturally progress from this knowledge to understanding how to solve it with methods that complement the system, harmonise with it and open up its own strengths and resources, including human ones, to help its recovery. Just as problems are seldom isolated but are interconnected so can solutions be. Therefore fixing one issue can naturally harmonise and produce excellent results for others.

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. 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. Time is of the essence as mountain areas are very fragile.

They are particularly vulnerable to changing climatic conditions due to their altitude, steep slopes, shallow soils widely varied, extreme climatic conditions, and geological variability. They are one of the world's most sensitive ecosystems (Sonesson and Messerli 2002).

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. Often monoculture pine is invasive and wipes out other species in an area. It also does not do the necessary job of precipitation at the levels required and needed.

Repairing the Roof of the World: 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 Common'.

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, thereby supporting all life.

Mountain communities have developed conservation practises over long periods of time. These are based on well-founded observations that document the most effective methods to sustain the local resources. They have been passed through the generations even into present times (Ohmagari and Berkes, 1997). Mountain people are the natural stewards of the water sources and 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, including wealthy urban ones 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.

“Logging, both illegal and government-sponsored, dam construction in areas of high seismic activity, and inappropriate reforestation programs are responsible for far more damage than that caused by so-called ‘ignorant’ subsistence mountain farmers” (D.Knight 2002)

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, as well as specific local understanding 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.

"Indigenous cultures, traditions and knowledge, including in the field of medicine, are to be fully considered, respected and promoted in development policy and planning in mountain regions, and underlines the importance of integrating indigenous knowledge, heritage and values in all development initiatives" (U.N, 2006).

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 Earths 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’.

It is important to understand that in proposing this solution and claiming it to be viable and sustainable we do not in any way underestimate the scale and magnitude of the problem we describe here.

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 new 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 (FAO, 2001). Between the rich varieties of species are many plants potentially capable of providing all that is needed for re-establishing indigenous mountain forests fast.

Some of these plants are capable of growing in some of the most badly eroded and degraded soils (Dhar, 2002). There are also some, which are 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. (Mark, 2003). These plants can also help prevent wind, rain, and groundwater from carrying pollution away to other areas (Shimp, et al, 1993).

Amongst these mixed indigenous mountain region plants, there are some, which 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 still exist in many countries around the world (*Hughes and Chandran, 1997*). 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 (Gadgil M. and Vartak V.D. 1975).

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 (Hughes and Chandran, 1997). 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. (M. Malagnoux, E.H. Sène and N. Atzmon, 2007). 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, herbs, medicinal plants and vegetables. Through the knowledge of companion planting, these can be intermixed to grow on mixed levels in the same vicinity. This is similar to and replicates natural forest systems. (Jacke and Toensmeier 2005). 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 the natural environments. Permaculture systems are proving to be successful in every ecosystem, including the tropics, deserts, mountains and oceans (Bill Mollison and Reny Mia Slay, 1991).

CONCLUSION:

"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).

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.

"Due to an increasing demographic pressure on the earth's ecosystems, the demand on mountain resources (e.g. on water) will increase in future and the potential for conflicts over their use will grow. To avoid severe conflicts as well as to conserve and sustainably develop one of the most precious environments on earth, it is crucial to improve the management and protection of mountain ecosystems, to deepen observations as well as to link networks."
(Terrestrial Ecosystem Monitoring Sites)

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. It has already been recognized that:

“Indigenous cultures, traditions and knowledge, including in the field of medicine, are to be fully considered, respected and promoted in development policy and planning in mountain regions, and underlines the importance of promoting full participation and involvement of mountain communities in decisions that affect them and of integrating indigenous knowledge, heritage and values in all development initiatives” (U.N 2006)

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 for diverse communities to work 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. Nowadays many factors need to be seen in relation to one another for us to take appropriate action and bring about truly lasting advantageous results.

“Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.”
(UNCED 1992 Agenda 21, Principle 1)

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. There are numerous ways of going about this. 10% annually of the Green Climate Fund could cover the costs while saving all long term economies and generating new ones.

This is a long-term global defence strategy. 1% of the defence budgets of all countries in the U.N could conceivably cover the expenses. 1% of the U.N budget annually could be used. This could be considered as a viable U.N savings plan when weighed again expenditure related to environmental disasters and conflict. Time should also be factored into concepts of green economy and true sustainability of wealth as it makes a difference whether all is used and wasted within 100 years or lasts for many generations. 1% of the income given to the FAO could be given specifically to regenerating the global mountain forests.

One could say that Sustainable Development is in its true nature a global defence strategy. Therefore defence budgets could legitimately pay for it. This would save far more than it would cost and potentially generate new green economies for many generations. Many viable green economies based on environmental sustainability would naturally come about in time. Sustainable Development is in itself a way of mitigating disasters. 1% spent wisely now would create far greater wealth over time than the sum spent.

“Those sharing in the benefits of mountain resources should also share in the responsibility for their sustainability” (FAO 1997)

Millions of lives are being lost and many are suffering from severe conditions due to the break down in the global fresh water system and drought related to it. This will become incalculably worst if a globally connected action plan is not implemented. Once the scanty soils in mountain regions have gone and only rock remains it is impossible to plant forests regardless of how much energy is focused upon them. Even now it is a demanding task but still within the realm of possibility. The evolution of nature including humanity has shown itself to be incredibly adaptive and has survived many adverse conditions but we cannot adapt to virtually 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.

Paragraph 122 of The Future We Want states:

“We recognize the key role that ecosystems play in maintaining water quantity and quality and support actions within the respective national boundaries to protect and sustainably manage these ecosystems.”

Recognition of the key role that ecosystems, especially wetlands, mountains and mixed indigenous mountain forests play, in maintaining fresh water quantity and quality and giving focus to supportive efforts that protect, sustainably manage and restore these ecosystems, could be of immense benefit if acted upon promptly.

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