

ECOLOGICAL RESTORATION: AN OVERVIEW



A FAQ document intended to give a broad overview of the concept and practice of ecological restoration to the reader.

“Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect”
- **Chief Seattle**

ECOLOGICAL RESTORATION: AN OVERVIEW

1. What is ecological restoration?

Ecological restoration is the exercise aimed at restoring an ecosystem that has been disturbed, degraded or impaired to as close its original state as possible. In most restoration situations, such disturbance or degradation is a direct or indirect result of human activities. In rare instances restoration of critical sites may be taken up after natural disasters like major floods or fires.

2. How is ecological restoration different from afforestation and reforestation?

The terms afforestation, reforestation and restoration are often used interchangeably. However these mean different things. Afforestation is the process of establishing vegetation in an area that was not a forest earlier. Species selection focus is often mono-cultural or a few fast growing species as in plantations, with a view to harvesting them. Reforestation is growing vegetation back on what was previously a forest area, but has lost all or most of its original vegetation due to various reasons.



It also generally involves the activity of planting saplings but diversity of introduced species could be greater than in afforestation. Species integrity is generally not a priority in reforestation and exotic species e.g. *Eucalyptus* may also be introduced. An example is Europe where many natural forests have been reforested over the last two centuries using species that are useful for humans. Afforestation and reforestation, therefore, often do not create forests that represent biodiversity. Ecological restoration, on the other hand, is about assisting, and/or accelerating, the revival of impaired ecological processes that are vital for an ecosystem to function normally and support the biodiversity typical of that ecosystem. The focus is on multiple aspects like soil alleviation, hydrology, filling species gaps, etc. Ecosystem integrity and species integrity are high priorities in ecological restoration (see question 7 below on principles governing restoration activity).

3. Does ecological restoration apply only to forest ecosystems?

This can be answered in two parts. Firstly, contrary to the terms afforestation and reforestation that are used with reference to terrestrial forests with tree cover, ecological restoration includes a wide variety of ecosystems that may or may not have tree cover e.g. terrestrial, marine, fresh water, wetland, coastal, desert, etc. Secondly, ecological restoration is not necessarily limited to forest areas and could include areas outside designated forest areas e.g. abandoned mining or industrial sites, urban ecosystems including lakes,



rivers and beaches, rural areas like village sacred groves, etc. It could even be carried out in privately owned lands e.g. estates being restored to original forests.

4. Can ecological restoration restore an eco-system to its original state?

Ecosystems are in a constant process of evolution and it is impossible to restore one to its original state. The objective of ecological restoration, therefore, is to put an ecosystem back on its original trajectory which existed before the disturbance or impairment took place.

5. Is restoration essential? Will not ecosystems restore themselves if left alone?

Whether restoration is required or not depends on the degree of impairment of ecological processes that the ecosystem has suffered. A good analogy is the human body. Where the immune system of a person is reasonably intact, he or she can recover from a health setback. However where the immune system is severely compromised, medical intervention is needed. Similarly, where an ecosystem is mildly impaired, it may be able to recover on its own with merely the cessation of causes of the impairment. However where the degree of impairment or degradation is high, intervention in the form of restoration would be needed in a majority of cases.

6. What are the risks of not restoring an ecosystem that is moderately or severely impaired?

Not restoring such an ecosystem could have three ecological consequences. Firstly, the ecosystem might not be able to restore by itself and therefore remains in a degraded state. A good example is an urban marshland that has been used as a garbage dumping ground, as in the case of *Pallikaranai Marsh* near Chennai. Second, assuming the ecosystem can recover on its own, this process might take a very long time. This is the case with abandoned mines or areas affected by invasive weeds. The capability of such an ecosystem to deliver ecosystem services may hence be deferred interminably. Thirdly, the ecosystem might recover on its own in a manner that does not reflect its earlier state. For example, degraded/disturbed areas generally witness high incidence of exotic and invasive plant species/weeds. Therefore the character of the ecosystem might undergo a change.

7. What are the key principles of ecological restoration?

There are three key principles of restoration. The first is maintaining ecosystem integrity. One should not try to create an ecosystem that is different from the original ecosystem type. For instance, one should not try and create a grassland in place of a dry deciduous forest or vice versa. The second is species integrity. This is about ensuring that only the right types of species that are indigenous or native to the target ecosystem are introduced in the restoration process. The third is the principle of least possible intervention.



This involves using passive restoration techniques as far as possible and using active methods only where passive methods are not feasible. The focus should be on reviving the ecological processes and bringing the ecosystem to a self-sustaining level where the rest of the restoration process can be taken over by nature.

8. What do we mean by passive restoration methods?



Passive restoration involves the use of low-intensity techniques that aim at leveraging natural ecological processes for achieving the restoration goals. Let us take the case of a terrestrial forest. The focus of passive restoration is on reviving the soil, water and natural vegetation cycles. Introduction of outside plant or seed material is kept to a minimum to address species gaps. A typical restoration activity would be rain water harvesting in places that have high water run-off due to degradation or soil compacting. The increased moisture level enables natural establishment of grass species. Grass helps alleviate the soil and also in attracting seed dispersal agents like birds and herbivores. Grass is a good successional species that nurtures other plant species by protecting seeds, providing moisture, etc. When new plants get established they in turn improve the water and soil cycles. Passive restoration, by creating a virtuous cycle where various ecological parameters support each other in a symbiotic

manner, is able to create a framework that accelerates restoration. While the example given above is that of a terrestrial forest, similar relationships can be found in all ecosystems.

9. What are active restoration methods and when are these used?

Active restoration involves the use of moderate to high intervention techniques e.g.in a terrestrial forest this could include sapling planting, seed broadcasting, invasive species management, etc. These are generally used selectively where passive methods are infeasible or inadequate to achieve the restoration goals. A good example is correcting native plant species imbalances in a degraded area. It is possible that over a period of time some of the key native species representative of the target ecosystem have disappeared or are at below self-sustaining levels. In such a situation it might be necessary to re-introduce these species. Another example is a lake or land that has been severely impacted by exotic or invasive species, where management of such vegetation may be essential.

10. Does ecological restoration make use of biological or chemical agents?

Ecological restoration generally does not use biological or chemical agents. The use of biological agents to address ecological challenges has led to severe adverse consequences in many parts of the

world and hence no longer adopted by serious restoration practitioners. The same is the case with chemical agents which are not used in natural ecosystems and are restricted to artificially managed areas like plantations. Further, the use of biological and chemical methods is prohibited in many designated wilderness areas.

11. How is the success of ecological restoration measured?

Like in any other conservation project, the success of a restoration project is measured against the objectives set out at its outset. These objectives generally consist of a combination of biotic and abiotic parameters drawn up with reference to what is called a “reference site”. Where evidence is available about the target ecosystem before its degradation, this could by itself be the reference site. Otherwise this could be a healthy site of the same ecosystem type in a comparable landscape. In a terrestrial forest ecosystem, the parameters could include soil alleviation, plant species diversity, rate of natural recruitment of seedlings, canopy levels, moisture retention capabilities, etc. Biodiversity, represented by richness and abundance of flora and fauna species, would be important parameters in such an assessment. The return of fauna to the site is generally a good overall indicator of restoration success as this means the ecosystem is able to provide the services that make it a healthy habitat.



12. What is the duration of an ecological restoration project?

Ecological restoration projects are long term in nature and could typically span many years. The duration of a project would depend on factors like the ecosystem type, extent of physical area being addressed, the degree of degradation, etc. For instance, restoring a scrub forest of 200 hectares might take between 5 and 8 years of sustained effort.

13. Is scale important in ecological restoration projects?

An ecological restoration project can be of any size. It could vary from a project involving an entire river, to one of restoring a small lake. While large projects have greater impact, smaller projects have value in capturing learnings and fine tuning methodologies. It is generally recommended to start with smaller pilots and scale up gradually.

14. How do we ensure that a restored plot does not get degraded again?

This requires actions at three levels. First, anthropogenic influences that can cause re-degradation have to be managed. A good example is firewood collection, which can be minimised by distribution of LPG cook stoves. Second, there has to be continuous monitoring of the site for at least 4-5 years post completion of restoration, and maintenance actions identified and implemented. Third, ensuring active involvement of local community members in restoration projects is critical for sustainability. A restoration activity by itself could generate alternate livelihoods during its implementation, creating a collaborative relationship between people and the ecology. Future revenue streams linked to sustained conservation of restored sites through activities like eco-tourism might also be important.

15. Is ecological restoration a general or specialised activity?

Ecosystems are unique and distinct. Therefore ecological restoration has evolved as a highly specialised activity. There are restoration scientists and practitioners specialising in different ecosystems like forests, water bodies, mines, urban landscapes, etc. Sub-specialisation based on the



ecosystem type or the landscape is common. An example of an ecosystem type within the broad classification of forest ecosystems would be rain forests and dry deciduous forests. An example of landscape-based sub-specialisation would be grasslands in Africa and North America, each of which may require different approaches, knowledge and methodologies. As can be observed, there could be further sub-classifications based on degree of uniqueness of the target ecosystem.

16. What is the status of development of ecological restoration as a conservation discipline around the world?

Ecological restoration has emerged as a major discipline around the world. Significant bio-diversity and climate change programmes that have been launched in recent times, like the Rio Conventions, Aichi Targets and Bonn Challenge, have brought ecological restoration to the forefront in many continents. Leading restoration groups play a key role in policy formulation at a global scale. Today ecological restoration has a number of active sub-disciplines like seed management, genetic diversity of plant material, invasive species management, restoration ethics and philosophy, community engagement, etc. The ecological restoration community now consists of multiple participants e.g. policy makers, researchers, grassroots practitioners, communicators, etc.

17. What is the relationship between ecological restoration and wildlife conservation?

Ecological restoration addresses two of the main threats to wildlife around the world – habitat loss and habitat degradation. By improving the health of existing habitats and creating additional habitats, restoration plays both a direct and a complimentary role in wildlife conservation. The direct role arises from the fact that ecological restoration is holistic in nature and enables sustaining greater biodiversity that represents a variety of species. The complimentary role is in activities like threatened species' conservation where the success depends, among other factors, on healthier habitats. Improvement in habitat health also has the potential to reduce human-wildlife conflicts and scientific study is needed to validate this hypothesis. There is, therefore, significant potential for collaboration between ecological restoration and other streams of ecological and wildlife conservation.



18. What is the interface between restoration science and practice?

There is active co-ordination and interface between restoration science and practice. In fact, restoration practitioners work closely with different research agencies and researchers (not necessarily limited to restoration science) to access knowledge on specific ecological and allied parameters. Similarly, researchers find it useful to work with restoration practitioners to get feedback on their hypotheses at a scale significantly larger than that of a laboratory.

19. Is ecological restoration a part of the curriculums for wildlife conservation?

Ecological restoration and wildlife conservation, as discussed above, have strong complimentary elements. Many wildlife conservation projects could include habitat restoration efforts to varying degrees. There is an increasing trend of curriculums for academic courses on wildlife conservation incorporating the basic concepts of ecological restoration, so that there is adequate working knowledge of the subject.

20. What are the socio-economic opportunities available through ecological restoration?

Ecological restoration has a high potential to involve local communities and thereby generate alternate livelihoods. For instance, restoring a 100 hectare scrub forest plot could generate around 8000-10000 person-days of employment. The extent of degraded ecosystems is high in many parts of the world. For instance, over 50% of wilderness areas in India are outside designated 'Protected Areas' and degraded to various degrees. This could be a significant way to generate rural livelihoods

in a sustainable and eco-friendly manner. Also, ecological restoration has the ability to re-connect indigenous communities with their roots and thus help preserve their traditional ecological knowledge and conservation practices.

21. Are there useful reference materials on ecological restoration?

Society for Ecological Restoration (SER) (<http://www.ser.org/>) is a leading global body on restoration matters and disseminates knowledge and information through newsletters, discussion forums, conferences, etc. They also have chapters in many parts of the world.

The [Centre for Environmental Management of Degraded Ecosystems](#) (CEMDE), a Centre of Excellence set up by the MOEF, is also a good source of research material and practical guidance.

IUCN has published a booklet on “[Ecological Restoration for Protected Areas](#)” which is available online and gives detailed guidelines on the topic.

[Island Press](#) publishes a number of useful books on the subject.

Note

Junglescapes is a non-profit based in Bangalore, India and has been working for the last 9 years on developing grassroots methodologies for restoration of degraded scrub and dry deciduous forest ecosystems. This FAQ document is intended mainly to give a broad overview of the concept of ecological restoration to the reader. The views expressed in this FAQ document are based on a combination of our own field experience and resources available on the topic in the public domain. We welcome feedback comments from readers which may be emailed to info@junglescapes.org

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