Mapping opportunities for forest landscape restoration

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More than two billion hectares of the world's deforested and degraded landscapes offer potential for restoration – a vast opportunity to reduce poverty, improve food security, reduce climate change and protect the environment.

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The typical response to the loss of forest cover has been to plant trees, usually, but not always, on an industrial scale, and with a limited mix of species. Indeed, planted forests now make up 7 percent of the world's forest area and contribute over 40 percent of the global industrial wood and fibre supply (FAO, 2010).

However, many planted forests have limitations in that they cannot supply the broad range of forest goods and services that society often requires. Therefore, about ten years ago, building on decades of field experience and observation, the concept of *forest landscape restoration* was introduced. Forest landscape restoration is an integrating framework that can, and should, be applied across a range of land uses to ensure that key ecosystem functions and societal requirements are maintained and strengthened.

Importantly, forest landscape restoration does not seek a return to past visions of land use. Rather, it is designed to ensure that present and future generations have key ecosystem goods and services at hand and deal effectively with the uncertainties of climatic, economic and social change.

Forest landscape restoration restores functionality and productivity to degraded lands and forests. Trees in agricultural landscapes can boost food production and resilience. Restored lands can supply clean water, reduce erosion and provide wildlife habitat. Forests and trees mitigate climate change by sequestering carbon.
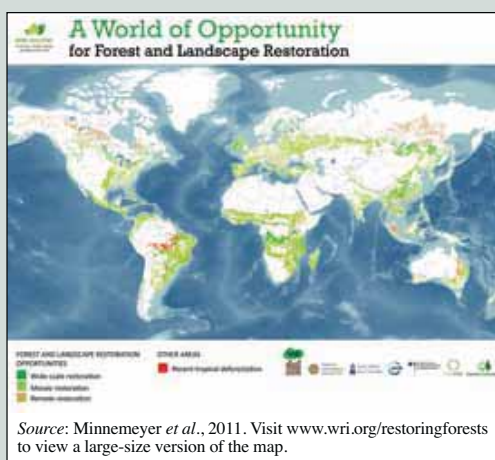
Opportunities for restoration

Experience shows that restoration is possible. Forests have returned to vast, formerly deforested areas in North America and Europe. Costa Rica and the Republic of Korea, among others, have embarked on successful forest restoration strategies. Restoration efforts in China, the Niger and the United Republic of Tanzania are slowing desertification and restoring woodlands with associated dramatic improvements in livelihoods and ecological health. Agroforestry systems are rapidly expanding in many parts of the world, enhancing the productivity of crop and livestock production.

Most countries that have suffered forest loss and degradation have opportunities for restoration. Yet these opportunities are often overlooked. The Global Partnership on Forest Landscape Restoration therefore asked a consortium of organizations led by the World Resources Institute to map the global opportunities for restoration (Figure; Minnemeyer *et al.*, 2011).

Method

The *potential* extent of forests and woodlands, rather than today's extent, was used as the point of departure. Apart from the obvious reason that forests can grow in these areas, potential forest extent is also a useful benchmark for assessing the historical change in forest cover.

Three categories of forests were distinguished: closed forests (canopy cover greater than 45 percent), open forests (canopy cover between 25 and 45 percent) and woodlands (canopy cover between 10 and 25 percent). Land with less tree cover was considered to be either naturally non-forested or converted to some other land use from any of the forest categories above.

Source: Minnemeyer *et al.*, 2011. Visit www.wri.org/restoringforests to view a large-size version of the map.

Lands with opportunities for restoration of forests and landscapes. Forests without restoration needs and croplands on former forest lands are not shown

Only pre-existing information was used. Definitions and data are not particular to individual countries.

We first mapped where forests and woodlands could potentially grow, if soils and climate were the only limiting conditions, i.e. where forests would grow if there were no human influence. Although trees play an important role there, dry areas such as the Sahel were not included, because of their very low potential forest density.

Next, we mapped the current extent of forests and woodlands. Forest maps were derived from global 250 m resolution satellite imagery.

We then identified restoration opportunities by comparing the maps of potential and current forest extent in light of information about current land use. Croplands on former forest land, intact forest landscapes and managed natural forests and woodlands were mapped as having no potential for restoration (although this is not always true).

Then, we considered constraints on restoration by mapping human pressure as a combination of population density and land use. Restoration opportunities in remote, unpopulated areas were also identified.

Finally, deforested and degraded forest lands were divided into four categories, resulting in a map of restoration opportunity areas and other former forest lands:

- **Wide-scale restoration** – Population density of fewer than 10 people per km^2 and potential to support closed forest.
- **Mosaic restoration** – Moderate human pressure (between 10 and 100 people per km^2). Restoration to a mix of people, trees and crops (e.g. into agroforestry parklands, small, frequent patches of woodlands, improved farm fallow and secondary forests and linear arrangements such as hedgerow, contour planting and along water courses).
- **Remote restoration opportunities** – Very low human pressure (density of less than 1 person per km^2 within a 500 km radius). Restoration may not be feasible here.
- **Agricultural and urban lands** – Converted former forest lands with intensive human pressure (density of more than 100 people per km^2), croplands and urban areas

Results

More than two billion hectares (ha) worldwide provide opportunities for restoration. Most of these lands are in tropical and temperate areas. One and a half billion ha are best suited for mosaic-type restoration, and another half a billion for wide-scale forest restoration of closed forests. However, these results must be interpreted with caution. The map is based on significant simplifications, and the underlying information is both coarse and incomplete, and sometimes also of low accuracy. Good information was available on land cover, land use, population density and other factors. Yet many important factors, such as tenure and land-use dynamics, could not be considered, for lack of data.

The map shows landscapes where restoration opportunities are more likely to be found, not the location of individual restoration sites. Many features of the landscape are not visible at the level of spatial resolution of the map (1 x 1 km), and local context could not be considered. No ground validation was conducted.

The map shows the location of land with characteristics that indicate restoration opportunities, but it does not prescribe any particular type of restoration intervention. It is intended to inform the policy-making process at the global level and should be complemented by further investigation at regional and national scales, where more detailed information is needed and available.

Conclusions

Most countries have suffered forest loss or degradation. Opportunities for restoration exist on all continents and are huge in terms of area, although the estimate of their extent is rough.

Mitigation of climate change is a major benefit of restoration, making it an important complement to avoiding additional deforestation and degradation, as well as an opportunity in which many countries can engage, including countries with little or no deforestation left to avoid.

Most areas that present restoration opportunities are located far from ongoing deforestation. The world does not need to wait for deforestation and degradation to cease before it embarks on the path of restoration.

The Bonn Challenge

A global restoration goal has recently been launched – to restore **150 million ha** of lost and degraded forests by 2020. This goal was launched in September 2011 at a ministerial roundtable at the Bonn Challenge on forests, climate change and biodiversity, which was hosted jointly by the International Union for the Conservation of Nature and the German Ministry of Environment on behalf of the Global Partnership on Forest and Landscape Restoration. The Bonn Challenge links the decisions on forests made under the United Nations Framework Convention on Climate Change with those of the Convention on Biological Diversity, which adopted the goal of restoring 15 percent of destroyed or degraded ecosystems by 2020.

The map helped quantify these targets. For more information, see: **ideastransformlandscapes.org**.

While this goal may sound ambitious, it can be achieved through a doubling of current rates of afforestation, forest regeneration and silvipastoral/agroforestry expansion. This effort would meet the Bonn Challenge and help turn the vision of no net forest loss within the next decade into reality.

References

FAO. 2010. *Global forest resources assessment 2010 – main report.* FAO Forestry Paper No. 163. Rome (also available at www.fao.org/docrep/013/i1757e/i1757e.pdf).

Minnemeyer, S., Laestadius, L., Sizer, N., Saint-Laurent, C. & Potapov, P. 2011. *A world of opportunity.* Washington, D.C., World Resources Institute. Available at: www.wri.org/restoringforests.