WWF

FIELD SERIES

2021

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

EXPERIENCES IN FOREST LANDSCAPE RESTORATION (FLR)

TWENTY YEARS LATER:
Lessons Learnt from Seven Forest Landscape Restoration Initiatives Worldwide

Stephanie Mansourian, Anita Diederichsen and Daniel Vallauri

Acknowledgements:

We would like to thank all contributors to the seven FLR lessons learnt reports that are synthesised and discussed here, and above all, co-authors: Claudia Amicone, Aída Luz (Lucy) Aquino, Eustack Bonifasi, Emma Do Khac, Neli Doncheva, Fabianus Fliervoet, Maria Christina Fung, Hubert Géraux, Ignacio Daniel González Mora, Fredinand P. Lobinsiu, Isaac Malugu, Charles Meshack, Miguel Angel Palmas Tenorio, Appolinaire Razafimahatratra, Greta Spota Diericx, Peter Sumbi, Kostadin Valchev and Daniel Venturi.

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WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global Network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

PREFACE


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Lessons learned from experiences in implementing forest landscape restoration (FLR) are key to improving implementation of solutions. Both successes and failures provide valuable insights to help us improve impact and advance our work.

Combined with protection, sustainable management and strategies to halt deforestation, FLR is critical to bending the curve on biodiversity loss, tackling runaway climate change and improving human wellbeing. Today, we need to upscale our efforts, in terms of size, time (permanence of results), quality of restoration, and in convincing partners to adopt FLR – in other words, we need to accelerate FLR impacts. Only by doing so can we successfully increase both FLR implementation and reach.

WE ARE DELIGHTED TO SHARE OUR FLR EXPERIENCE AS THE UN DECADE ON ECOSYSTEM RESTORATION STARTS.

At WWF, we have a global network that has been active in conservation since the 1960s and in FLR since 2000. Collectively, we have a wealth of experience around the world in crafting and implementing diverse strategies. This report summarises our experience in implementing FLR: it builds on seven reports focusing on lessons learned from FLR projects and pulls together some meta-lessons as well as the valuable experiences emerging from these projects. The report compares and contrasts the projects to help us better understand what constitutes the essence of FLR, what can be found in all projects, what is often missing, as well as the implementation challenges, results achieved, lessons learned, and much more.

We are delighted to share this analysis as the world is about to embark on the UN Decade on Ecosystem Restoration (2021-2030). WWF is proud to be a global partner in the Decade, which represents a decisive opportunity to mobilise efforts around FLR and ecosystem restoration more generally, and enables us to attain much-needed impacts on people and nature.

Fran Price
Forest Practice Leader
WWF International

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Acronyms of Landscapes

Madagascar - Fandriana-Marolambo Landscape → **FM**

New Caledonia - Dry Forest Ecoregion → **NC**

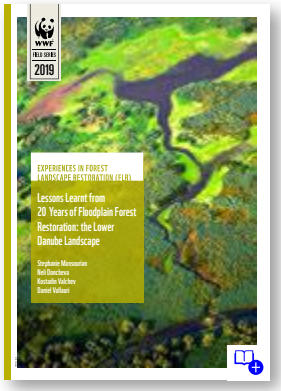
Tanzania - East Usambara Landscape → **EU**

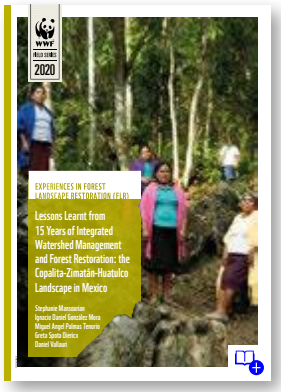
Bulgaria, Moldova, Romania and Ukraine - Lower Danube → **LD**

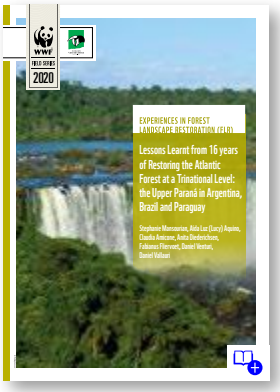
Mexico - Copalita-Zimatán-Huatulco Watersheds → **CZH**

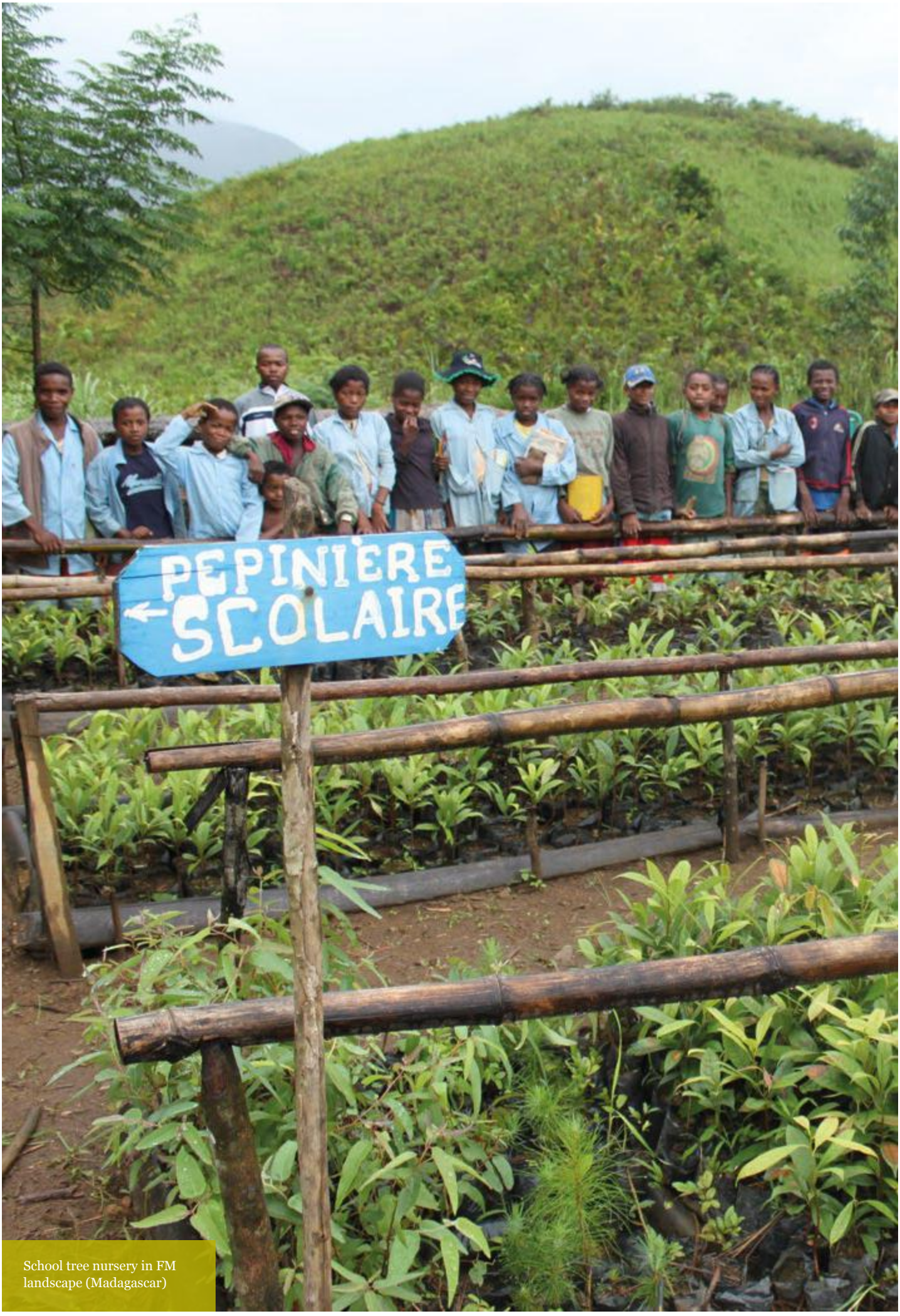
Malaysia (Sabah) - Ulu Segama Malua Landscape → **USM**

Argentina, Brazil and Paraguay - Upper Paraná Atlantic Forest Ecoregion → **UPAF**









School tree nursery in FM landscape (Madagascar)

EXECUTIVE SUMMARY

The year 2021 marks the start of the UN Decade on Ecosystem Restoration. As we continue to lose 10 million ha of forests each year, the role of forest landscape restoration in this Decade is evident. Both governments and corporations are stepping up their commitments to forest restoration, recognising the importance of forests in the landscape.

Between 2018 and 2020 WWF conducted a worldwide review of seven long-term, field-based FLR initiatives from Asia, Africa, Latin America and Europe: Fandriana-Marolambo Landscape in Madagascar, New Caledonia's Dry Forest Ecoregion, the East Usambara Landscape in Tanzania, the Lower Danube in Bulgaria, Moldova, Romania and Ukraine, the Copalita-Zimatán-Huatulco Watersheds in Mexico, the Ulu Segama Malua Landscape in Malaysia (Sabah) and the Upper Paraná Atlantic Forest Ecoregion in Argentina, Brazil and Paraguay. These landscape initiatives have been carried out over a period of between 10 and 20 years. For each FLR initiative, individual reports were produced that reviewed lessons and collated important historical data. This current report synthesises the seven individual reports. It brings them together to identify trends, commonalities and differences, and summarises a total of 14 meta-lessons that result from the analysis of these seven landscapes.

The landscapes vary in size from 17,500 ha to 935,000 ha. They all exhibit different social and ecological characteristics, including a diversity of forest types, from mangroves to floodplain forest, montane forest, dry forests and moist forests. Typical threats to the landscapes include fire, infrastructure, unsustainable production of commodities, among others. Five of the seven landscapes are inhabited. In some cases, such as the landscapes in Madagascar, Mexico and Tanzania, the population is generally poor and much of its subsistence relies directly on natural resources.

FLR FIELD IMPLEMENTATION IN 7 LOCATIONS, OVER A PERIOD OF BETWEEN 10 AND 20 YEARS.

Several activities have been identified that can be organised according to the following overarching categories: planning, knowledge, field activities, governance, communications, finance and monitoring. These reflect the fact that a comprehensive FLR initiative requires much more than tree planting.

Over the years, several anecdotal results were reported in the seven landscapes. To a certain extent, quantifiable results were also provided. These can be organised using the following categories: pressures, biodiversity, protection and management, plantation, restoration of processes, alternative agriculture, livelihoods, awareness and capacity building, governance and empowerment, natural capital and finance. For example, the change in the orangutan population was an important indicator of progress in the USM landscape in Borneo. A key indicator in the East Usambaras, was the increase in household income, reflecting the importance of the social dimension of FLR.

A number of governance issues associated with FLR initiatives also emerged. For example, there is often a perverse incentive to use exotic species since native species are often considered property of the state, as is the case in Madagascar. Expanding the role of local stakeholders in FLR implementation and decision-making is central to its acceptability and sustainability (and is also the first FLR principle).

No single project was funded by just one grant for the entire period, but typically several 3-4 year projects were designed and funded by multiple donors. Funding varied from EUR 135,490 to EUR 491,573 per year.

The analysis of the seven initiatives produced between 9 and 17 lessons per initiative, and 81 lessons altogether. An analysis across the seven landscapes leads to 14 meta-lessons, ranked by frequency of occurrence below.

1. **FLR takes place at a landscape scale but multiple spatial scales must be considered, from sites to ecoregions, as well as the ways in which they inter-relate -** Although the landscape is the key area of focus, it is influenced by actions both above (e.g. at the ecoregional or international level) and below (e.g. at the village or site level).

   86% of the landscapes and ten lessons referred to the importance of different spatial scales.

2. **Several actions in a landscape contribute to a strategic approach to FLR -** In the context of a given landscape, a series of actions contribute to its restoration. Many of these actions relate directly to forests (e.g. active and passive restoration), but many do not (e.g. capacity building or improved agriculture techniques).

   86% of the landscapes and ten lessons referred to the diversity of actions for FLR.

3. **Equitable implementation must be inclusive and build on social realities -** The local social context has to be an integral part of any FLR intervention. Often, FLR takes place in landscapes where local rural populations face numerous challenges. While FLR may prove to be a solution to some of these challenges, it must incorporate their local realities and needs if it is to achieve lasting change in the landscape.

   71% of the landscapes and twelve lessons referred to the need for equitable and inclusive FLR implementation.

4. **Forest restoration can take several pathways -** Both active and passive restoration are viable approaches to restoring forest landscapes, depending on local conditions.

   71% of the landscapes and nine lessons referred to the different pathways for FLR.

5. **Inclusive, local level governance facilitates long-term FLR efforts -** The role of local civil society organisations is critical in FLR implementation as they take ownership of the approach.

   71% of the landscapes and six lessons referred to the need for local level governance.

6. **Addressing the drivers of forest loss and degradation is a key first step in FLR -** Unless drivers are understood and addressed, FLR efforts will be in vain. Thus, addressing these drivers has to be a central component of any FLR strategy and theory of change.

   57% of the landscapes and four lessons referred to the need to address drivers of forest loss and degradation.

7. **The organisation leading implementation must plan for a careful handover strategy to ensure local ownership and continuity -** When FLR is promoted by a partner external to the landscape, a careful handover strategy needs to be designed for when the external partner will exit the landscape.

   57% of the landscapes and four lessons referred to the need for a well-planned handover.

8. **Commitment to FLR should be long term, but flexibility and adaptive management are necessary to incorporate changes over time -** By its very nature, FLR implementation requires long term thinking, planning and execution.

   57% of the landscapes and five lessons referred to the need for long-term commitment.

9 **Mechanisms that bring stakeholders together are essential -** Networks, partnerships, alliances and platforms promote collaboration and efficient implementation.

43% of the landscapes and five lessons referred to the need for partnerships and other related approaches.

10 **Public policies and instruments are needed to support FLR -** The role of policies, legislation and other public sector instruments can both help and harm FLR implementation. It is therefore important in any FLR intervention to track these and to promote supportive ones while lobbying to change or remove perverse ones.

43% of the landscapes and four lessons referred to the role of public policies and instruments.

11 **Long term financing tends to rely on public funding, but should be diversified -** So far, most of the funding for the seven FLR initiatives was from public sources.

43% of the landscapes and four lessons referred to the need for diversified funding.

12 **Monitoring is always weak but crucial to support FLR implementation and adaptive management -** The only way to assess success and to correct errors is through some form of systematic monitoring.

43% of the landscapes and three lessons referred to the need for monitoring.

13 **Scientific knowledge provides an important basis for FLR interventions -** Such knowledge is necessary to understand the social and ecological context and dynamics, and adapt FLR interventions accordingly.

43% of the landscapes and three lessons referred to the need to improve scientific knowledge.

14 **Engagement starts with awareness raising, capacity building and communications -** Frequently, the first components of an FLR project are not about planting trees but rather about raising awareness or capacity building in order to change attitudes, reduce drivers of forest loss and ensure that local partners can carry out key interventions.

29% of the landscapes and two lessons referred to the need to start with awareness raising, communications and capacity building.

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Practitioners and decision-makers embracing FLR and sharing experience in the field, here in the Danube region.

INTRODUCTION

As we are about to embark on the UN Decade on Ecosystem Restoration (2021-2030), it is timely to share and reflect on lessons from past restoration initiatives. Current knowledge and experiences on forest landscape restoration (FLR) gathered by scientists, implementers and organisations are of utmost importance to launch a successful Decade.

The world continues to lose 10 million ha of forests annually (FAO, 2020) and forest landscape restoration (FLR) is increasingly seen as a solution to reverse this trend. It is being promoted by major global processes such as the Bonn Challenge or the New York Declaration on Forests. A growing number of practitioners and decision-makers are embracing FLR but for many others, this approach still remains fuzzy and intangible. Furthermore, it faces diverse definitions and interpretations. In this context, it is important to base future interventions on solid experiences. Twenty years since the start of its work on FLR, WWF decided to take stock of some of its early FLR initiatives, to improve its own efficiency and to share these experiences more widely.

WWF has been working on FLR since 2000, (Box 1, Mansourian *et al.*, forthcoming) implementing pilot FLR initiatives to learn by doing. Since 2018, WWF has been actively collecting lessons which it is seeking to share widely through this "Experiences in Forest Landscape Restoration[1]" series. The purpose of this report is to synthesise the findings and lessons that have been collected through the seven reports in this series.

BOX 1. A community of practice on FLR in WWF: from 1999 to today

In 1999, WWF together with IUCN embarked on a project to restore forests. The next year, the organisations convened a workshop with over 30 experts from both natural and social sciences to pave the way for their future work on this topic. One outcome of that workshop was coining of the phrase "forest landscape restoration" which was defined as "a planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded landscapes" (WWF and IUCN, 2000). That same year, WWF's forest programme adopted a target to "By 2005, undertake at least twenty forest landscape restoration initiatives in the world's threatened, deforested or degraded forest regions to enhance ecological integrity and human well-being" and a milestone to lead on 10 such initiatives, with a view to learn from the process. Given the novelty of FLR, the intention through these projects was in large part to test the approach and to "learn by doing" (Mansourian *et al.*, forthcoming).

WWF's current global forest strategy includes as one of its global outcomes to contribute to the international ambition to restore "350 million hectares of forest landscapes" by 2030 (New York Declaration on Forests and Bonn Challenge on FLR). These global initiatives aim to reverse the trend of forest loss and degradation through several means notably, the restoration of degraded forest landscapes.

Today, WWF's global work on FLR is set up as an Area of Collective Action and Innovation (ACAI) with active chapters in Africa, Latin America, Asia-Pacific and Europe. About 200 staff contribute to the ACAI. WWF is an active member of the Global Partnership on Forest Landscape Restoration (GPFLR) and is a technical partner in the AFR 100 initiative and Initiative 20x20. WWF is also a Global Partner of the UN Decade on Ecosystem Restoration.

For further information: WWF's website about Forest Landscape Restoration[2].

[1, 2] https://forestsolutions.panda.org/approach/forest-landscape-restoration

A LESSON LEARNING FRAMEWORK

Environmental conservation more generally, including FLR, suffers from a lack of capacity to effectively learn and build on acquired knowledge to shape future interventions (Cooke *et al.*, 2018; Catalano *et al.*, 2019). This is a problem for many reasons, not least, a waste of resources and time. Increasingly, there is interest in the FLR community in monitoring (see Dudley *et al.*, 2018), case studies (Mansourian and Vallauri, 2014) and lesson learning (Mansourian and Vallauri, 2020). At the same time, there has been criticism of many FLR interventions and research outputs (e.g. Lewis *et al.*, 2019).

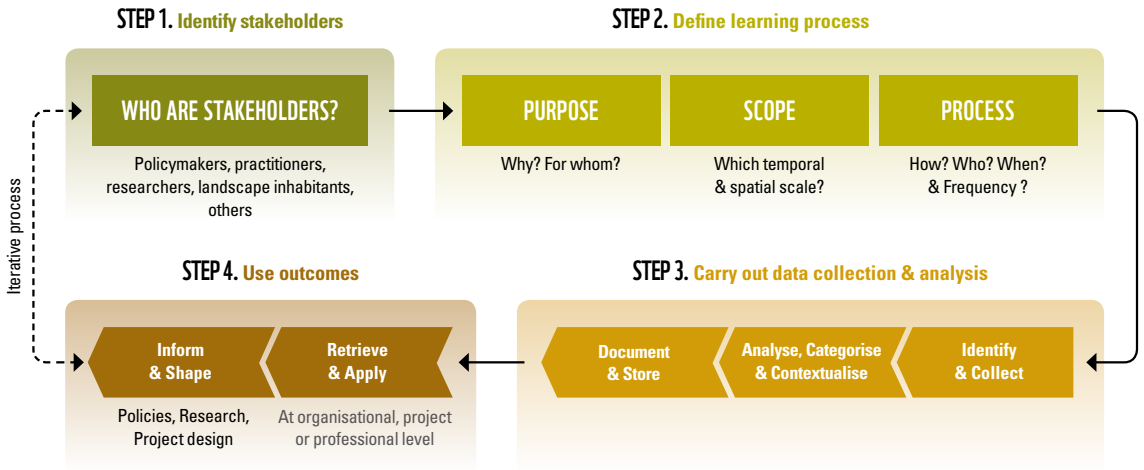
A lack of effective measures to demonstrate good practice, identify lessons (both positive and negative) and to build from those, has clearly hampered progress in FLR. Different interpretations of FLR have further confused and diluted the value of the approach. Improving both monitoring and lesson learning can help to change this and to ensure that FLR can effectively contribute to the UN Decade on Ecosystem Restoration.

There are many reasons to learn lessons: to inform, shape or correct actions; report to donors; test a hypothesis, or influence policies (Grantham *et al.*, 2010). The actual process of learning lessons is as important as the outcome (the lessons) and engaging a wide group of stakeholders ensures that they are active in the learning process. This is particularly relevant in long term initiatives such as the restoration of ecosystems like forests (Mansourian and Vallauri, 2020). Furthermore, at different stages in the learning process, different stakeholders may need to be involved. It is important to consider that while lesson learning may be part of monitoring, it is not the same. Indeed, the lesson learning process requires a series of steps that extend beyond monitoring (see Figure 1).

BOTH THE PROCESS AND THE OUTCOME OF LEARNING ARE IMPORTANT.

Key characteristics of FLR, including its spatial and temporal scales, signify that lesson learning needs to happen over the long term, and at different spatial scales, with a range of stakeholders from these different scales (Mansourian and Sgard, 2019). Both the process and the outcome of learning are important. Lesson learning helps to improve efficiency going forward. It can "*inform and transform science and practice, speed up progress, and shape policy design and application*" (Mansourian and Vallauri, 2020). Through the learning process, changes can be considered in implementation, improvements can be made, processes can be adapted and ultimately, human capital of an organisation is strengthened as those involved in the learning process can apply it to their future work.

A proposed framework for lesson learning (Mansourian and Vallauri, 2020), particularly in the context of FLR, is described below. Stakeholders are at the core of the learning process in this framework. They may be categorised as: policymakers, donors, practitioners, project managers, landscape inhabitants and researchers. "*Our framework starts from the premise that the process to learn lessons has been triggered by an expressed need or desire (by a donor, project manager, organization or other)*" (Mansourian and Vallauri, 2020).



STEP 1. Identify stakeholders

The first step begins with identifying and understanding the stakeholders potentially interested in the lessons. They may not necessarily be those targeted for the lesson learning process and outcomes, but this first step helps to take the decisions on who needs to be considered, when and for what reasons.

STEP 2. Define learning process

There are several reasons to learn lessons, and those need to be clearly defined in any given context. Similarly, the sub-set from step 1 which represents the target audience, needs to be confirmed. Both the temporal and spatial scales of the learning process need to be delineated. Defining the process also signifies identifying methods (e.g. document reviews, interviews, case studies, audits etc.) and those to involve.

STEP 3. Carry out data collection and analysis

Data collection and analysis requires a certain degree of contextualisation. In other words, a given lesson may apply in a given context but not in another. Lessons can be categorised in many different ways, including as being about process (project level), outcome (wider results) or transformation (impacting on future projects, policies or scientific advances).

STEP 4. Use outcomes

Lessons will need to be retrieved, applied and shared. The intention is to ensure that they can inform practice, research and policy.

Figure 1. A Framework for Lesson Learning in FLR (Source : Mansourian and Vallauri, 2020)

In the watersheds of Copalita-Zimatán-Huatulco (CZH), activities focused on improving agricultural practices, tree planting and participatory water management.

FIELD EXPERIENCES FROM SEVEN LANDSCAPES

In 2000 WWF adopted a target to carry out 20 FLR initiatives with its partners. It then set out to lead on 10 of those initiatives in priority ecoregions around the globe. These were intended to be pilot initiatives, each focusing on a different dimension. For example, connectivity was prioritised in the Atlantic Forest, while reconciling local livelihoods and forest restoration was prioritised in Madagascar.

Altogether WWF has reviewed seven long-term FLR field initiatives in Asia, Africa, Latin America and Europe (Figure 2, see respective reports). The seven landscapes represent different social and ecological contexts. Each landscape is briefly described below.

Figure 2. Map of the 7 initiatives analysed in this report

MADAGASCAR'S FANDRIANA-MAROLAMBO LANDSCAPE (FM)

See full report: Mansourian, S., Razafimahatratra, A. and Vallauri, D., 2018a. *Lessons Learnt from 13 Years of Restoration in a Moist Tropical Forest: The Fandriana-Marolambo Landscape in Madagascar.* Paris: WWF France, WWF report, Field series, Experiences in Forest Landscape Restoration, 36 pages.

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"While Madagascar was no stranger to tree planting, FLR provided new insights for all of us in the room."

Nanie Ratsifandrihamanana, CEO of WWF Madagascar, referring to the launch of the initiative in 2004

Madagascar's Fandriana-Marolambo (FM) landscape is situated in the south-central part of the island in the tropical moist forest, an ecoregion that exhibits exceptional rates of endemism. FM was prioritised for restoration because it has a large area of dense moist evergreen forest (95,063 ha) and because socio-economic factors suggested it would be a good pilot site for FLR. While a core area of dense forest remains, pressures on the remaining landscape have resulted in a mosaic of land uses, including subsistence agriculture, woodlots, savannah and degraded forests. Priority was given to working with local communities in order to expand their livelihood options (improved agriculture and innovations) while reducing pressures on forests and engaging in active and passive restoration. The initiative evolved over four successive phases (for a total of 13 years) and was modified in each phase to adapt to new donors' focal interests, but always maintained a strong focus on restoration, working with local communities and ensuring that their livelihood needs were prioritised.

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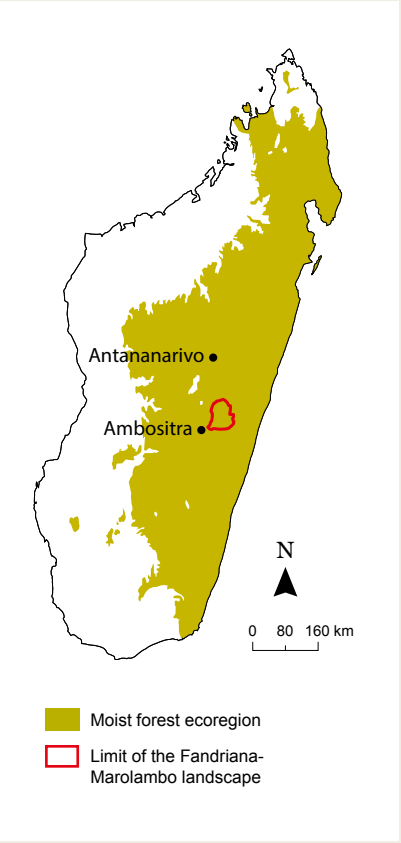
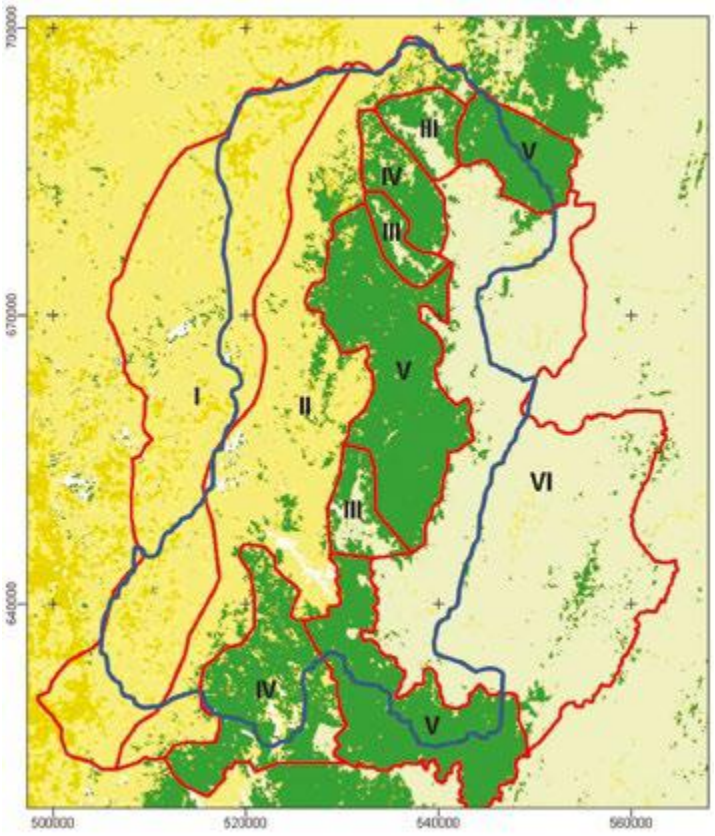


Location of the Fandriana Marolambo landscape



Type of vegetation in the large landscape (342,669 ha). The project focuses on the 45 "Fokontany" (first level of administrative organisation) which are the most important for forest conservation (203,080 ha).

NEW CALEDONIA DRY FOREST ECOREGION

(NC)

See full report: Mansourian, S., Géraux, H., do Khac, E. and Vallauri, D., 2018b. *Lessons Learnt from Seventeen Years of Restoration in New Caledonia's Dry Tropical Forest.* Paris: WWF France, WWF report, Field series, Experiences in Forest Landscape Restoration, 44 pages.

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"New Caledonia's dry forests represent a microcosm of the global challenge, yet the mobilisation of key partners in New Caledonia for the last 17 years demonstrates that solutions do exist, although they need to be up-scaled."

Pascal Canfin,
CEO of WWF France
until February 2019

New Caledonia's (NC) unique dry forest is situated along the western coast of this south Pacific island, part of the French territory. Over 60% of its plants are found nowhere else on earth and new species continue to be discovered, many with potentially important medicinal or other properties of value to people. Yet, only about 2% of the original forest cover remained at the turn of the century, and forest restoration rose high on the agenda. Research was carried out early on in the programme to better understand the ecosystem and its status in order to better prioritise actions. Fragmentation of the dry forest was a major challenge and initial mapping of the fragments across the entire ecoregion provided a baseline for future interventions. Priority restoration actions that were carried out were both passive (fencing to remove pressures) and active (planting trees). Also, it was important to focus on the removal of invasive exotic species. Together with WWF, nine other partners, both public and private, came together to protect and restore New Caledonia's unique and fragile dry forests. The partnership evolved over time to become a legal entity, the 'Conservatoire d'Espaces Naturels de Nouvelle-Calédonie' (CEN) which provides the actions undertaken with long term legitimacy and financing.

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Location of New Caledonia's dry tropical forest ecoregion

TANZANIA'S EAST USAMBARA LANDSCAPE (EU)

See full report: Mansourian, S., Sumbi, P., Bonifasi, E., Meshack, C., Malugu, I. and Vallauri, D. 2019a. *Lessons Learnt from 10 Years of Restoration of Coastal and Sub-montane Tropical Forests : The East Usambara Landscape (Tanzania).* Paris: WWF France, WWF report, field series, Experiences in Forest Landscape Restoration, 32 pages.

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"Ensuring that local districts took over the responsibility for continuing FLR work was a milestone towards sustainability of our work."

Dr. Amani Ngusaru,
Country Director of
WWF-Tanzania Country Office

The East Usambara landscape is one of the largest remaining forest massifs in north east Tanzania's Eastern Arc Mountains and East African Coastal Forests hotspot. Approximately 135,000 people live here in about 35 villages. They depend on the forests' natural resources; the ecosystem goods and services such as medicinal plants, food, construction material and importantly, regulation and protection of water sources. Starting in 2004 and for ten years, through three consecutive project phases, WWF together with its local partner, Tanzania Forest Conservation Group (TFCG), and with a unique funder, the Finnish Ministry of Foreign Affairs, implemented an FLR project "to prevent the loss of globally important biodiversity values, improve the livelihoods of the local population and restore and maintain the multiple functions of forests." The role of local villagers was essential in the initiative and the creation of village land forest reserves was a major tool to improve connectivity between existing protected areas. Several alternative income-generating activities were introduced to reduce pressures on the forest, such as beekeeping, butterfly farming and fish farming.

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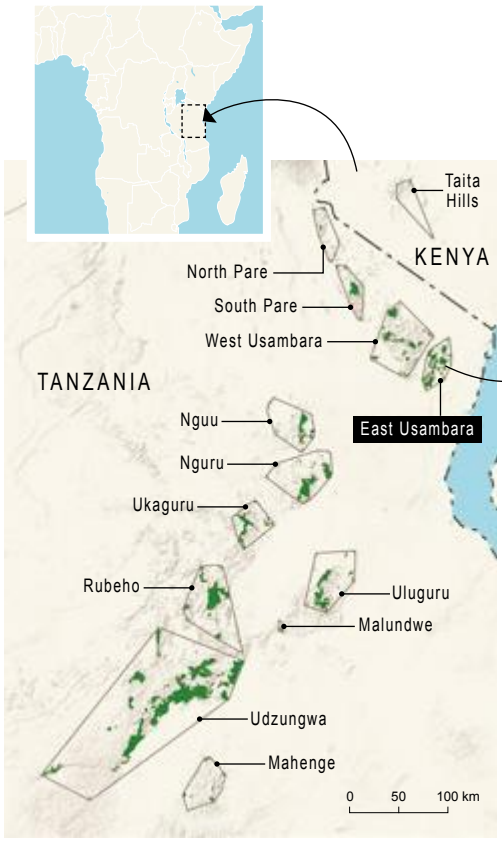


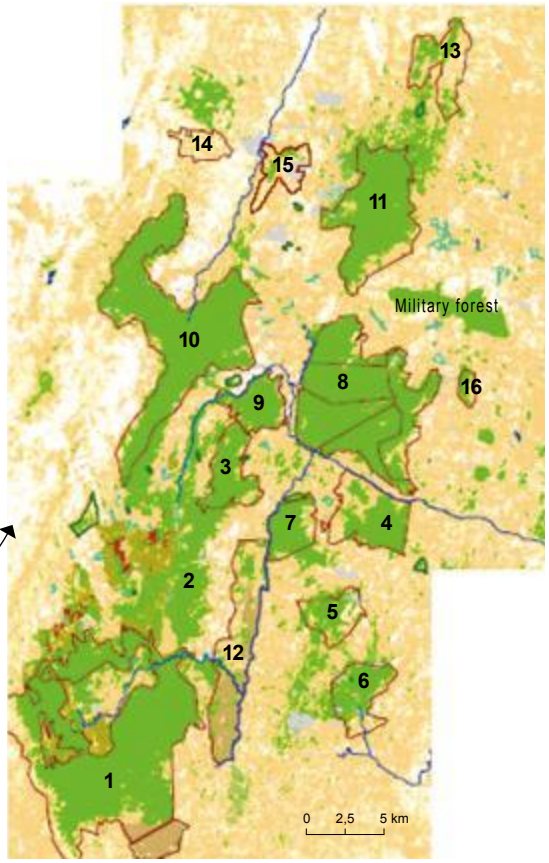
Legend

The 13 massifs of the Eastern Arc mountains

Natural forest cover

Sources: Newmark and Mc Neally (2018) modified

Location of the East Usambara landscape within the Eastern Arc mountains



Government Nature and Forest Reserves

1. Amani Nature Reserve
2. Derema Corridor
3. Kambai
4. Manga
5. Minga
6. Magoroto
7. Kwamarimba
8. Segoma Kwangumi Bamba
9. Semdoe
10. Nilo Nature Reserve
11. Mtai
12. Longuza
13. Mgambo
14. Bombo West
15. Bombo East
16. Mlingui

Key

Government Forest Reserves

Village Forest Reserves

Settlement

Bushes and scrub

Tea, Rubber

Teak

Water

Eucalyptus

Forest

Land-uses in the East Usambara landscape early in the project (2006)

LOWER DANUBE

(LD)

See full report: Mansourian, S., Doncheva, N., Valchev, K. and Vallauri, D., 2019b. *Lessons Learnt from 20 Years of Floodplain Forest Restoration: the Lower Danube Landscape*. Paris: WWF France, WWF report, Field series, Experiences in Forest Landscape Restoration, 40 pages.

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"We have used our excellent relations at the European Commission to increase compliance with EU nature and water legislation calling for ecosystem restoration."

Irene Lucius,
Regional Conservation Director,
WWF Central and Eastern Europe

The Lower Danube stretches for approximately 1,000 km primarily across Bulgaria and Romania, but also through Moldova and Ukraine. In contrast to the more Alpine Upper Danube, the floodplain is made up of diverse lakes, water courses, wetlands, gallery forests, levees and sand dunes. This region is home to about 30 million people who are heavily reliant on the ecosystem goods and services provided by the river. The Danube is also important for biodiversity with the Delta alone harbouring about 1,800 plant species and about 3,500 animal species. A first declaration on the importance of Danube wetlands and the need for their conservation, restoration and sustainable management was signed by over 130 environmental NGOs in 1998, generating the momentum for the creation of the 'Lower Danube Green Corridor' in 2000 signed by the Environment Ministers of Bulgaria, Moldova, Romania and Ukraine. This declaration committed the four countries to preserve a total of 935,000 ha, including restoring 223,000 ha of former wetlands. Numerous field-based interventions, such as site preparation, removal of invasive species and both passive and active restoration, have been carried out. Other key restoration activities have been active removal of dykes and sources of degradation, and trials on relatively small plots to determine best methods for the restoration of forest dynamics.

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Location of the Lower Danube river: a green infrastructure in Europe.

MEXICO'S COPALITA-ZIMATÁN-HUATULCO WATERSHEDS (CZH)

See full report: Mansourian, S., González Mora, I.D., Palmas Tenorio, M.A., Spota Diericx, G. and Vallauri, D., 2020a. *Lessons Learnt from 15 Years of Integrated Watershed Management and Forest Restoration: the Copalita-Zimatán-Huatulco Landscape in Mexico.* Paris: WWF France, WWF report, field series, Experiences in Forest Landscape Restoration, 44 pages.

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"We take an integrated approach linking the upper reaches of watersheds with the more populated and urbanised lower reaches."

Jorge Alejandro Rickards Guevara, CEO of WWF Mexico

In southern Mexico's Oaxaca state lie the watersheds of Copalita-Zimatán-Huatulco (CZH) covering an area of 268,023 ha. This unique landscape includes 26 of the country's 34 vegetation types and has an altitudinal range from sea level to 3,500 m. Different forest types can be found as a result, from dry forests, to cloud forests and mangroves. Yet pressures from the agriculture frontier, fire and deforestation are having a significant impact on the land, biodiversity, water quality and quantity, and local people. Communities in the landscape are dependent on ecosystem services and aware that this delicate balance is being altered. Water quality and quantity are a central priority in the landscape. Climate change is exacerbating local populations' vulnerability, notably by further limiting water availability. Working with local and indigenous communities, WWF has implemented various activities to reverse this trend and to ensure that the watersheds can be restored. Activities that were carried out focused on data collection, improving agricultural practices, nursery establishment, tree planting, participatory water management, participatory monitoring, awareness raising and reducing water pollution.

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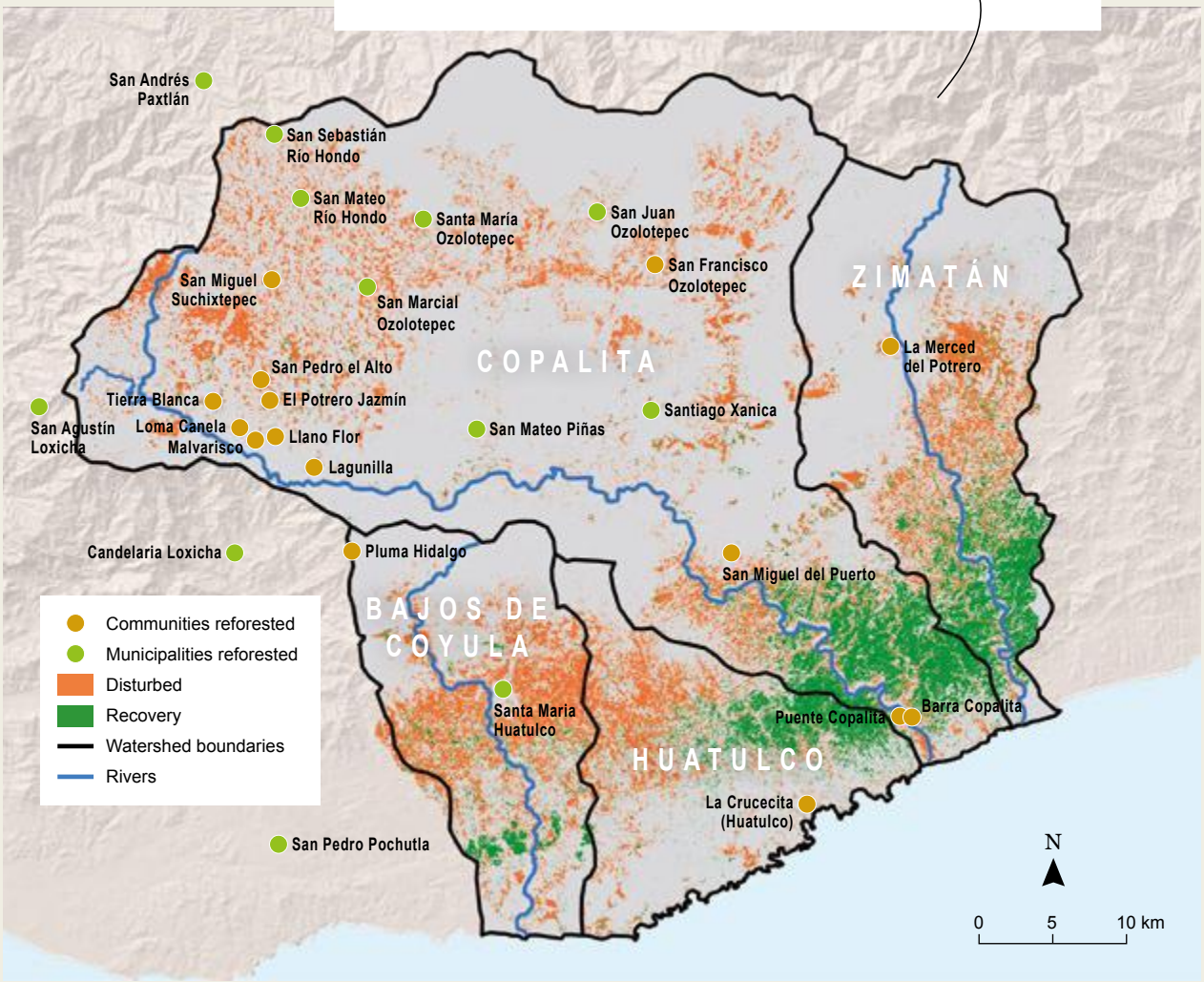
Location of the landscape in Oaxaca state.



The CZH watershed and soil degradation stages : disturbed (red), recovery (green), unchanged (grey).

SABAH'S ULU SEGAMA MALUA LANDSCAPE (USM)

See full report: Mansourian, S., Fung, M., Lobinsiu, F.P. and Vallauri, D. 2020b. *Lessons Learnt from 12 Years Restoring the Orangutan's Habitat: the Bukit Piton Forest Reserve in the Malaysian state of Sabah.* Paris: WWF France, WWF report, Field series, Experiences in Forest Landscape Restoration, 38 pages.

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"We have been seeking to demonstrate that restoration is an effective tool to return trees to the landscape for the purposes of recreating forest habitat and connectivity for populations of the critically endangered orangutan and associated species."

Sophia Lim,
CEO of WWF-Malaysia

The Ulu Segama Malua (USM) landscape is situated in the Malaysian state of Sabah on the island of Borneo. Here, lush forests - from lowland tropical rainforest to mangrove, montane forest and peat swamps – are under severe threat with industrial forest exploitation followed by oil palm plantations having significantly modified the landscape. The critically endangered Borneo orangutan (*Pongo pygmaeus*), has been a symbol of the plight of the forest. Restoring its habitat, food and shelter has been the driver of FLR in Sabah. In the USM landscape (approximately 240,000 ha) WWF's FLR programme has aimed to re-establish the structure, productivity and species diversity of the forest. Within USM, Bukit Piton was identified as one of the high conservation value areas because of its importance for orangutans. The main activities implemented include active restoration, maintenance and monitoring of both the restoration work and surveys of orangutans in the project area.

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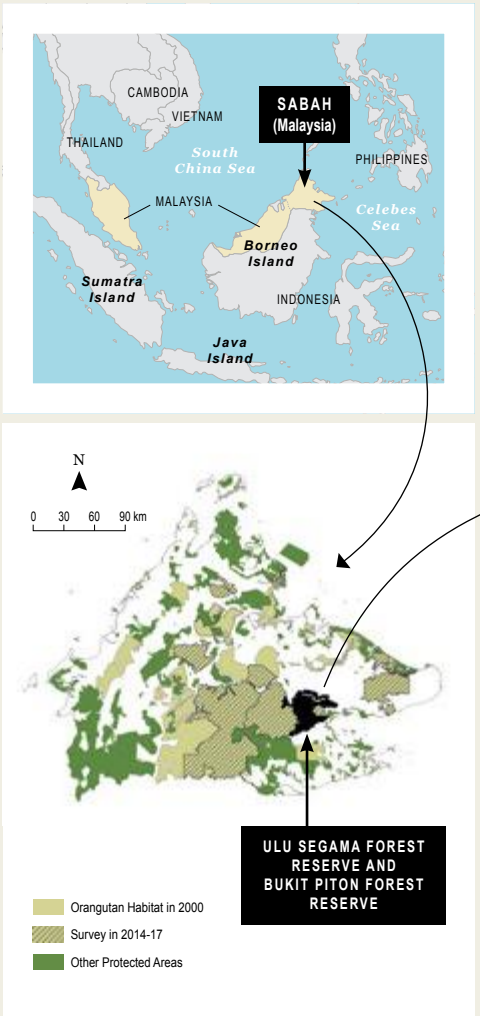
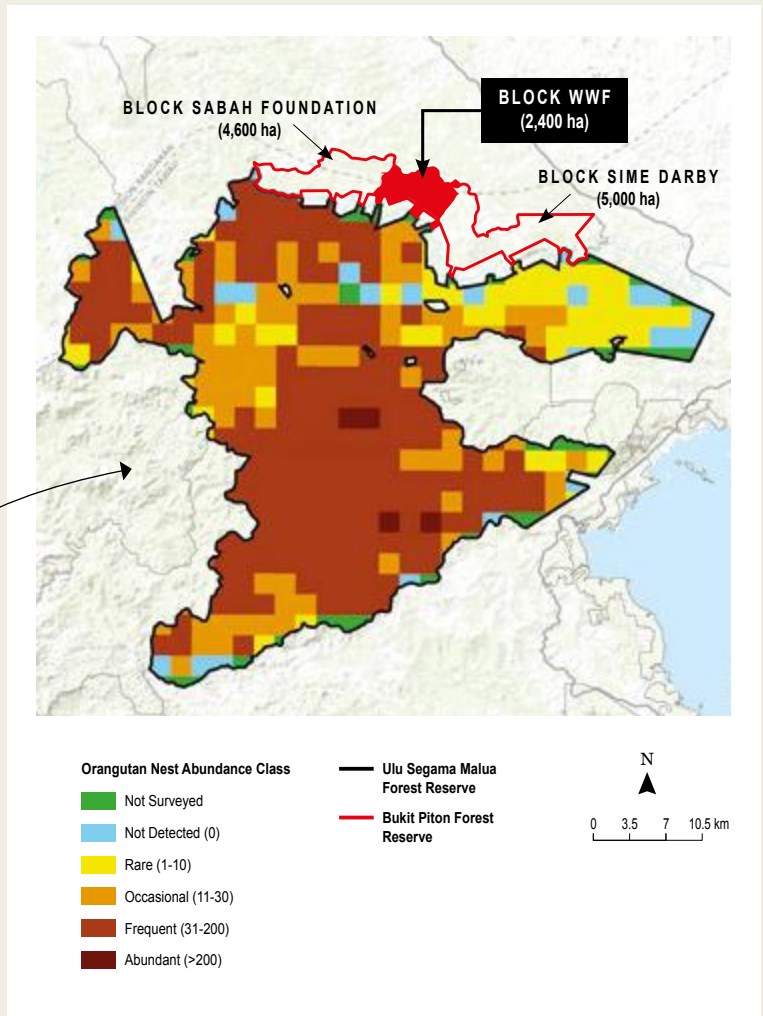
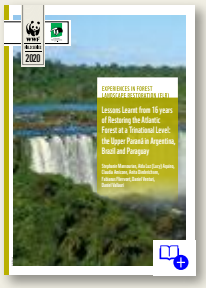


Location of the landscape



The landscape: Ulu Segama Malua Forest Reserve and Bukit Piton Forest Reserve

UPPER PARANÁ ATLANTIC FOREST ECOREGION (UPAF)



See full report: Mansourian, S., Aquino, A.L., Amicone, C., Diederichsen, A., Fliervoet, F., Venturi, D., Vallauri, D. 2020c. *Lessons Learnt from 16 years of Restoring the Atlantic Forest at a Trinational Level: the Upper Paraná in Argentina, Brazil and Paraguay.* Paris: WWF France, WWF Field series, Experiences in Forest Landscape Restoration, 56 pages.

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"With urgency comes a renewed sense of purpose, duty and partnership."

agree the leads of the three organisations (Mauricio Voivodic Chief Executive Officer WWF Brazil, Aída Luz (Lucy) Aquino, Country Office Director WWF Paraguay and Manuel Marcelo Jaramillo, Director General, Fundación Vida Silvestre Argentina).

The Upper Paraná Atlantic Forest (UPAF) lies at the area where Argentina, Brazil and Paraguay meet and is part of the wider Atlantic Forest Complex – a global biodiversity hotspot. Whereas forest cover of the UPAF once extended 39,442,271 ha across the three countries, today only about 5,607,900 ha remain (14%). The forest is extremely fragmented, with the majority (70%) of fragments under 100 ha in size. Main threats to the native Atlantic Forest here are conversion to agriculture and pasture land, ranching, infrastructure, illegal hunting and unsustainable exploitation. To tackle these threats, between 1998 and 2003, WWF Brazil, WWF Paraguay and Fundación Vida Silvestre Argentina brought together more than 70 institutions and experts to define an 'ecoregion vision' for the Upper Paraná Atlantic Forest, a planning process that still guides implementation today. Given the large areas under private ownership, much of the work carried out since 2003 in the UPAF has included working with landowners to change their attitudes towards the forest and to make restoration more economically viable for them (notably, through payments for ecosystem services schemes). Policy tools have also been an important mechanism used in the UPAF.

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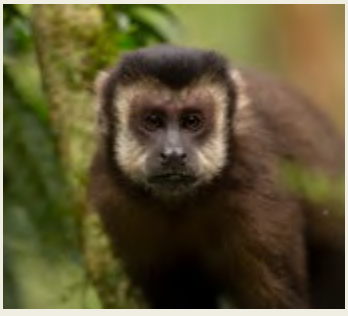

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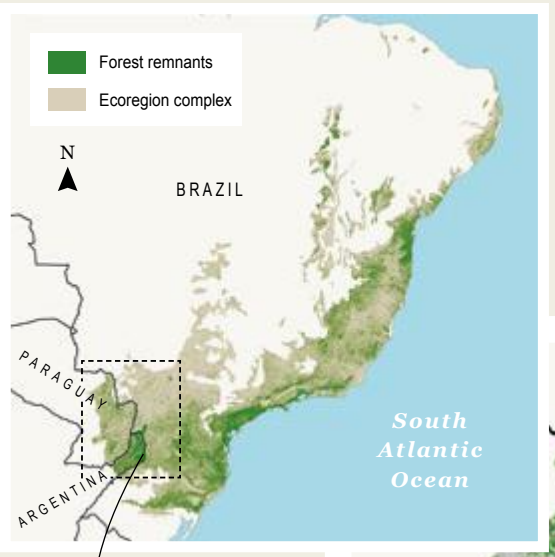

Location of the Atlantic Forest in Argentina, Brazil and Paraguay.

Detailed map of Upper Paraná

New Caledonia's (NC) unique dry forest is situated along the western coast of this south Pacific island.

THE LANDSCAPE DIMENSION

Forest landscape restoration takes place in a landscape. It evolved as a landscape approach within which restoration is a priority action. The projects outlined here have all been framed in the context of relatively large landscapes, although in most cases the boundaries have remained dynamic.

The challenge of defining what is a landscape

Delineating the landscape within which restoration takes place is not always straightforward. For a start, the term 'landscape' is interpreted in many different ways. Although the term was first defined in the early 1800s already (by the German geographer Alexander Von Humboldt), today it is seen by some as a spatial scale (e.g. Turner, 2005) and by others as a way of reconciling human and ecological dimensions (e.g. Sayer *et al.*, 2013). The discipline of landscape ecology has been seen as a way of unifying ecology and geography (Mansourian, 2021).

WWF has followed Chatterton *et al.* (2016), to define a landscape as "a socio-ecological system that consists of natural and/or human-modified ecosystems, and which is influenced by distinct ecological, historical, economic and socio-cultural processes and activities". In this interpretation, a landscape is seen as containing heterogeneous characteristics and land-uses. The main drivers influencing the landscape's overall functioning contribute to its practical delineation.

DELINEATING THE LANDSCAPE WITHIN WHICH RESTORATION TAKES PLACE IS ALWAYS A CHALLENGE.

The landscapes reviewed here (Table 1) were identified in some instances through a scientific ecologically-based exercise, such as the Upper Paraná Atlantic Forest, Tanzania's East Usambaras and New Caledonia's dry forests, all of which stemmed from an ecoregional process (Olson and Dinerstein, 1998). In the case of Borneo's USM, the landscape boundaries were set based on an important population of orangutans. In other cases, the landscape reflects a core "intact" forest area and the relevant administrative areas surrounding it (e.g. Madagascar's FM). Thus, in all cases while ecological priorities dominated, a practical political and administrative filter helped to define the wider boundaries within which to frame the landscape. Furthermore, in all cases, the specific areas to implement restoration actions are much smaller than the landscape as they represent the areas prioritised within that landscape.

Landscape characteristics

The seven landscapes considered for FLR are all situated in priority ecoregions and, except for the Danube, are all among the world's biodiversity hotspots. They vary in size from 17,500 ha to 935,000 ha. Nevertheless, in all cases, the boundaries were flexible and used essentially for planning purposes. Thus, for example, in the Lower Danube activities related to policy, strategy, awareness and communications focused on the landscape of the Lower Danube Green Corridor Declaration (covering an area of 935,000 ha) while field interventions were much more localised along the banks of the river and the floodplain forest on the islands. At the same time, the wider landscape extending further inland was considered particularly important for understanding historical changes and drivers of forest and wetland loss.

Of the seven landscapes explored, two are transboundary: 1. The Upper Paraná Atlantic Forest (UPAF) situated at the border between Argentina, Brazil and Paraguay; 2. The

Lower Danube which is primarily in Bulgaria and Romania but also runs through Moldova and Ukraine.

Altitudinal differences are important in three of the landscapes: CZH in Mexico where they range from sea level to 3,500 m; Madagascar's FM where the elevation range is from 800 to 1,800m and in Tanzania's East Usambaras, where the highest point – Mt Nilo – is at 1,506 m, and the lowest point at 150m.

THE MAIN DRIVER FOR RESTORATION WAS THE NEED TO RESTORE HABITAT FOR ENDANGERED, KEYSTONE AND ICONIC SPECIES.

Two landscapes, the Lower Danube and Mexico's CZH, are important watersheds and in that context FLR objectives and interventions focused on both forest and water resources. All other landscapes are predominantly forested landscapes.

Restoring forest habitats for biodiversity is an important target in all landscapes. In both Borneo and the Atlantic Forest the main driver for restoration was the need to restore habitat for endangered, keystone and iconic species (orangutan in Borneo; jaguar in the Atlantic Forest).

In many cases, protected areas form an important component of the landscape. In Madagascar's FM, central to the landscape, is the Marolambo National Park which was created in 2013 and covers approximately 95,000 ha. In Tanzania's East Usambaras, the Amani forest reserve (8,380 ha) was established in 1997 and the Nilo forest reserve (6,025 ha) was established in 2007; together they account for close to half of the landscape's forest area. The Lower Danube Declaration commits to maintaining 773,166 ha of existing protected areas, adding a further 160,626 ha of new protected areas, and 223,608 ha of proposed areas for restoration – making up a total of 1,157,400 ha. In the UPAF, lie the Iguazu Falls, a UNESCO World Heritage Site in both Argentina and Brazil. Adjacent to this park are Argentina's Urugua-í and Foerster Provincial Parks, making this a 335,000 ha core zone.

A view of the East Usambaras landscape

© N. Doggart

Table 1. Landscape characteristics

Characteristics		Landscape						
		FM	NC	EU	LD	CZH	USM	UPAF
Geographical	Region	Africa	Australasia	Africa	Europe	Latin America	South East Asia	South America
	Country/countries	Madagascar	New Caledonia	Tanzania	Bulgaria, Romania, Moldova & Ukraine	Mexico	Malaysia	Argentina, Brazil & Paraguay
	Delineation of the landscape	Socio-ecologically defined landscape	Dry forest ecoregion original area	Socio-ecologically defined landscape	Bankfull channel of the river	Watershed	Ecologically defined landscape	Ecoregion
	Landscape area (ha)	203,080	17,500	108,200	935,000	268,023	240,000	5,607,900
Social	No. of inhabitants	~150,000	~150,000	~135,000	~30 million	~76,000	0	~150 million
	Main forest ownership	State	Private/provincial	State/communities	State/private	Communities	State	State/private
Economic	Main economic sector	Subsistence farming	Mining Tourism Agriculture	Subsistence farming, tea plantations	Agriculture, forestry	Small scale agriculture (corn, coffee)	Forestry	Agriculture, forestry
	GDP/inhabitant (USD)	522	12,580	1,122	BG: 9,737 MO: 4,498 RO: 12,920 UR: 3,659	9,863	11,415	AR: 10,006 BR: 8,712 PA: 5,415
Environmental	Biodiversity and ecosystem service relevance	Hotspot	Hotspot	Hotspot	Green infrastructure of Europe	Hotspot	Hotspot	Hotspot
	Main ecosystem	Tropical moist forest	Tropical dry forest	Tropical submontane and coastal forest	Floodplain forest and wetlands	Subtropical, Tropical dry forests, cloud forests, mangrove	Tropical moist forest	Tropical and subtropical rainforest
	Main deforestation and degradation drivers	Shifting agriculture	Fires, grazing, invasive species	Agriculture, fuelwood	Dams, dykes, forestry, monoculture plantations	Shifting agriculture, unsustainable wood harvesting	Wood harvesting	Industrial plantations; commodities
	Forest cover (%)	~50%	~2%	~30%	–	>70%	~68%	~14%

The landscapes represent a range of forest types. Dry forests are found in both New Caledonia and Mexico. Riparian forests are represented in the Upper Paraná Atlantic Forest, Mexico's CZH and the Lower Danube. Montane forests are found in the East Usambaras and CZH. Lowland rainforests are characteristic of the USM in Malaysia and parts of the UPAF. A mosaic landscape characterises Fandriana-Marolambo in Madagascar, composed of agriculture, fallows, exotic plantations and fragments of degraded native forest.

New Caledonia's dry forests situated along the west coast of the island, exhibit high rates of endemism at 60.3% (Munzinger *et al.*, 2016) with numerous species listed as endangered or critically endangered on the IUCN Red List of Threatened Species.

Threats

FIRST, ANALYSE AND TACKLE MAIN THREATS.

The main threats to the landscapes reflect the challenges faced by forests in most parts of the globe:

- Large scale and/or unsustainable subsistence agriculture were a major cause of deforestation in the landscapes in the Upper Paraná Atlantic Forest, the Lower Danube, Madagascar's FM, Mexico's CZH, New Caledonia's dry forests and Tanzania's East Usambaras. For example, in the second half of the 20th century, close to 75% of the Lower Danube's floodplains were cut off from the main river by dykes and were transformed into agricultural areas;
- Non-native invasive species were a problem in the Lower Danube and New Caledonia;
- Tenure rights were a challenge in countries such as Madagascar whereby clearing forest was a way of "acquiring" land in a context of unclear or contested tenure and property rights;
- Exploitation of timber (legal and illegal) was identified as a threat in Borneo's USM, Tanzania's East Usambaras and the Upper Paraná Atlantic Forest;
- Fires were registered as a direct threat in most of the tropical landscapes;
- Climate change exacerbates the impacts of other threats, such as conversion of floodplain forests to agriculture and monoculture hybrid poplar plantations in the Lower Danube ;
- Additional threats identified included artisanal gold mining (Tanzania), infrastructure (Upper Paraná Atlantic Forest and New Caledonia) and eutrophication (Lower Danube).

People

All of the landscapes are inhabited, except for the priority restoration site in the USM landscape in Borneo which is essentially uninhabited and the Lower Danube islands which were prioritised for restoration, and which are also largely uninhabited.

The Upper Paraná Atlantic Forest is subject to significant anthropogenic pressure, with large populations living inside the ecoregion. Madagascar's Fandriana Marolambo landscape is home to about 150,000 people from three different ethnic groups: the Betsileo, Vakinankaratra and Betsimisaraka. Within the landscape an estimated 2,730 households live directly from the use of forest and natural resources (Roelens *et al.*, 2010). In Mexico, indigenous communities from the Zapotec and pre-Mayan Chontal civilizations (Danver, 2015) live in eight out of the 20 municipalities in the landscape.

Approximately 135,000 people live in Tanzania's East Usambaras, in about 35 villages. Here as well, indigenous communities can be found from the Wasambaa (or Sambaa or Shambaa), Bondei and Zigua tribes (Powell *et al.*, 2013).

In Madagascar, Mexico and Tanzania landscape populations are directly dependent on the forest ecosystems for their livelihoods. In the Lower Danube and the UPAF, the forest ecosystems provide indirect services such as water regulation and hydro-electricity to a large population. In New Caledonia, out of 59 priority sites identified, only one is exclusively on private or customary land, while 31 are on land that is mixed public/private and 27 are on public land. Kanak communities (the Indigenous people of New Caledonia) are an important stakeholder group in the restoration initiative.

Women are committed to testing agricultural innovations, like vanilla cultivation in CZH (Mexico).

In FM (Madagascar), transferring management for over 50,000 ha of forest to communities increases their rights and responsibility.

FLR ACTIVITIES

A range of activities could be seen in all cases, extending beyond strict tree planting measures. These can be organised according to the following overarching categories: planning, knowledge, field activities, governance, communications, finance and monitoring (see Table 2).

During the inception phase of FLR projects, awareness raising, sometimes research (e.g. in New-Caledonia) and policy work are needed. It was particularly important at the time the seven FLR initiatives were initiated, while today, the political momentum and agenda on FLR and awareness are higher.

At the start of most programmes, a series of planning activities took place, including meetings, assessments and mapping exercises. Creating a constituency for restoration and building partnerships was also a key component of this first phase. For example, in UPAF, the development of the ecoregion vision brought together over 70 sets of stakeholders from the three countries.

Specific research had to be carried out to expand knowledge, notably in the landscapes where there was limited information or in which scientists were central to the call for restoration, such as New Caledonia's dry forests. Here, plant inventories and an analysis of their ecology were central to any subsequent actions to restore the dry forests. Capacity building measures took place in all of the landscapes. A wide range of stakeholders were targeted for these activities, from villagers (e.g. in FM), to forest operators (e.g. in USM), or the forest service (e.g. in the Lower Danube).

© D. Vallauri

Producing seedlings of dry tropical forest tree species in a nursery in CZH (Mexico).

Field activities included forestry, agriculture and other measures related to alternative livelihood practices. Specific forestry activities included the development of nurseries and active planting (in all of the landscapes). In most cases, both active and passive restoration were prioritised. The removal of exotic species was a priority in New Caledonia and the Lower Danube. Fencing and protection were used to promote natural regeneration.

Other field activities included the development of agroforestry and the introduction of agricultural alternatives. Promoting the local economy was particularly important in inhabited landscapes where the communities depend on natural resources (such as in Madagascar and Tanzania). Measures included the introduction of alternative income-generating activities that place less pressure on forests, such as bee-keeping or butterfly farming in Tanzania's East Usambaras or improved rice cultivation in Madagascar's FM.

Activities associated with governance included targeting both formal governance tools such as policies (e.g. in Mexico's CZH), and informal governance such as working with traditional authorities (e.g. in FM). In most cases, setting up a project governance structure was also important to secure the long term success of the initiative. In New Caledonia for example, the creation of a legal entity (the CEN) to formalise the partnership to protect and restore the dry forest, was a significant

milestone. Thinking about a handover strategy beyond the project often involved the transfer to local communities (e.g. FM or EU).

Communications and awareness raising were important activities throughout many of the initiatives as a way of ensuring stakeholder buy in and changing attitudes towards the forests. For example, in New Caledonia, such measures included "tree planting days" that brought entire families out to engage in active restoration. Many landowners started planting native dry forest species on their own land, thanks to these measures, and also to the increased availability of dry forest species in garden centres and nurseries.

FIVE LANDSCAPES REPORTED THAT THEY DESIGNED A NEW MONITORING SCHEME.

Financial interventions have included a range of market measures such as microfinance schemes or certification. These have provided incentives for engaging in restoration and protecting existing forests. For example, in CZH agro-ecological shade grown coffee was being promoted, certified and sold at a premium.

Although monitoring was not sufficiently widespread and systematic, five of the seven landscapes reported that they designed a new monitoring scheme. The case of East Usambaras is unique: after the first phase of the project, the donor specifically asked to improve the monitoring system in the landscape. Consequently, a monitoring system and associated human resources were allocated during the last seven years of the initiative.

© TFCG

Butterfly farming in East Usambara landscape (Tanzania)

Table 2. Occurrence of main activities carried out in the seven landscapes. The order of the activities and categories in this table does not signify any order of importance.

Categories		Types	FM	NC	LD	EU	CZH	USM	UPAF	Occurrence
Planning		Mapping & zoning	✗	✗		✗	✗	✗	✗	86%
		Design management plans	✗	✗	✗		✗	✗	✗	86%
Knowledge	Research	Assess degradation		✗			✗	✗	✗	57%
		Studies on species/ecosystems	✗	✗			✗	✗		57%
	Capacity building	Awareness/training	✗	✗	✗	✗	✗	✗	✗	100%
		Develop training materials		✗		✗				29%
Field activities	Forestry	Design nurseries	✗	✗		✗	✗	✗	✗	86%
		Silvicultural practices	✗	✗	✗			✗	✗	71%
		Plantations	✗	✗	✗	✗	✗	✗	✗	100%
		Control exotic/invasive species		✗	✗			✗		43%
		Passive restoration	✗	✗	✗	✗		✗	✗	86%
	Agriculture	Agroforestry practices	✗			✗	✗		✗	57%
		Alternative agriculture	✗				✗		✗	43%
	Others	Alternative income-generation	✗			✗	✗			43%
Governance	Engaging	Engage partners/stakeholders	✗	✗		✗	✗		✗	71%
		Develop supportive governance structures	✗	✗	✗	✗	✗		✗	86%
		Consultations/ meetings	✗	✗	✗	✗	✗	✗	✗	100%
		Improve/strengthen local governance	✗	✗		✗	✗		✗	71%
	Policy	Strengthen local institutions	✗	✗	✗	✗	✗	✗	✗	100%
		Influence national/international policies			✗		✗		✗	43%
	Tenure	Improve/clarify tenure	✗							14%
	Beyond the project	Define a handover strategy	✗	✗		✗		✗		57%

Categories		Types	FM	NC	LD	EU	CZH	USM	UPAF	Occur-rence
Communications		Events/ meetings	✗	✗	✗	✗	✗	✗	✗	100%
		Communication materials	✗	✗	✗	✗	✗	✗	✗	100%
		Video materials					✗	✗		29%
Finance	Adminis-tration	Write proposals/fundraising	✗	✗	✗	✗	✗	✗	✗	100%
		Project administration	✗	✗	✗	✗	✗	✗	✗	100%
	Market measures	Value forests		✗					✗	29%
		Certification				✗	✗		✗	43%
		Microfinance schemes	✗			✗				29%
		Payments for ecosystem services			✗	✗		✗	✗	57%
Monitoring		Design monitoring system			✗	✗	✗	✗	✗	71%
		Collect systematic data	✗	✗		✗	✗	✗		71%

Planting campaign in UPAF (Paraguay)

RESULTS AND KEY PERFORMANCE INDICATORS FOR FLR

Several anecdotal results were reported in the seven landscapes. Quantifiable results were provided using a diversity of indicators which can be categorised as per Table 3. Results can be organised using the following categories: pressures, biodiversity, protection and management, planting, restoration of processes, alternative agriculture, livelihoods, awareness and capacity building, governance and empowerment, natural capital and finance.

Pressures on the landscape include those associated with forest loss, loss of ecosystem services, infrastructure, fire and exotic species. The removal of dykes and invasive alien species was an important activity in the Danube with 6km of dykes removed on Tataru island. Invasive alien species were also a major challenge in New Caledonia's dry forests and their removal prioritised for FLR.

For biodiversity, the state of wildlife and ecosystems was measured. In UPAF, survival and movement of the jaguar was an important indicator of progress, while in Borneo's USM, it was the orangutan that provided an important indicator of restoration progress. Between 2006 and 2018 the population of the jaguar in UPAF in Brazil and Argentina grew by 160%. In turn, in USM, the orangutan population was stabilised at 3,403 individuals. In Ukraine's Tataru island (Danube) the bird population increased by 68% between 1999 and 2018, while mammal species increased by 38% in the same period. The main ecosystem service measured is related to water (quantity and/or quality). In Mexico's CZH, water quality and availability were significant measures of progress. To a certain extent that was also the case in UPAF and the Lower Danube. No other ecosystem service was measured in the landscapes.

THE MAIN ECOSYSTEM SERVICE MEASURED IS RELATED TO WATER (QUANTITY AND/OR QUALITY).

Protection, improved management and certification were all important complementary measures in the landscapes. The area protected in Madagascar's FM landscape grew by 95,063 ha, while in New Caledonia's dry forest it grew by 127 ha. In Malaysia's USM, an area of 242,884 ha was certified to protect it from future disturbance.

Both active and passive restoration led to measurable areas of forests being restored. Results show that across the seven landscapes a total of 92,154 ha were planted (starting from the oldest project in 2000 to 2019, although in some cases this area restored occurred over a much shorter period). In some cases, for example, in UPAF, stabilising or reducing annual forest loss was an important measure. In Madagascar's FM the annual deforestation rate was reduced to below 1%. In Tanzania's East Usambaras, clearing of natural forests in the landscape was reduced by 88% between 2006 and 2012.

Five landscapes reported on the number of seeds, seedlings or saplings planted. A total of nearly 2.5 million plants were thus put in the ground by those projects over a period starting in 2000. Only two landscapes reported on survival rates: Fandriana-Marolambo and USM, with 75% and 88% reported respectively after two years. Nevertheless, in USM this figure dropped to between 10% and 38% after 7 years because of a lack of long-term maintenance.

In order to reduce pressure on forests while promoting livelihoods, a number of alternative farming techniques were promoted, such as improved rice cultivation in Madagascar's FM or butterfly farming in Tanzania's East Usambaras. At the level of local communities, changes in land use practices were important to reduce threats, such as those associated with water use, energy or agriculture. In Tanzania, between 2008 and 2013, 320 new households began using improved cookstoves.

Table 3. Indicators measured by the initiatives

Category		Project/landscape specific key performance indicator (KPI)	Occurrence
Pressures	**Forest loss**	Decrease in intensity of forest loss; reduction in annual forest loss; decline in deforestation rate; forest loss; percent reduction in clearing of natural forests in the landscape	43%
	Water use	Reduced water use in irrigation	14%
	Water availability	Metres of water distribution system developed; number of natural springs upgraded; proposal for an annual target volume of flowing water for nature and people (millions of m^3); ratio of flow for nature with respect to the average annual runoff	29%
	Fires	Decline in forest fires in village land forest reserves and community-based forest reserves	14%
	Infrastructure	Length of dykes removed	14%
	Exotic species	Area from which the invasive indigo bush was removed	14%
Biodiversity	**Populations of threatened species**	Increase in the jaguar population; % increase in number of mammal species; increase in number of bird species; stabilisation of orangutan population	43%
	Species distribution	Presence of orangutans outside 'refuge areas', especially restored areas	14%
	Known species	Percentage of dry forest whose avifauna was identified; number of dry forest species studied, mapped and submitted to IUCN Red List	14%
Protection & Management	**Area protected**	Increased protection status; area protected; area of legally protected dry forest (official protected area status) including a buffer zone	43%
	Improvement in PA management	Management effectiveness score in most reserves (using the METT tool)	14%
	Area certified	Area FSC certified (ha)	14%
Planting	**Area under restoration**	Area (ha) under restoration; area (ha) restored (both actively and passively; Area (ha) planted; Area of floodplain restored or undergoing restoration; Number of sites under restoration; area planted with native species	86%
	Trees planted	Number of saplings/seedlings/trees planted; number of saplings of indigenous species planted	57%
		Survival rate for indigenous tree species planted; survival rates of planted trees (after 2 years)	29%
	Origin of planted trees	Number of native species used for restoration; number of native species being reproduced; number of rare and threatened dry forest plant species reproduced in nurseries and planted	71%
	Nurseries	Number of locally-run nurseries; number of operational tree nurseries; number of seedlings produced by the nurseries; number of individuals of rare plant species reproduced in nurseries; number of seedlings produced in project nurseries	43%

Category		Project/landscape specific key performance indicator (KPI)	Occur-rence
Restoration of processes	**Natural regeneration**	Total area fenced or legally protected to allow natural regeneration; area under natural regeneration	29%
	Other natural processes	Area over which natural processes have taken over in two Romanian islands (flooding)	14%
Alternative agriculture	**Area under new agricultural techniques**	Coffee under shade; coffee under shade with organic certification; number of agricultural alternatives tested and introduced; number /surface of innovation parcels; area under new agroforestry systems	29%
	Production of new crops/ goods	Tonnes of tomatoes produced with organic methods per year; number of beehives supported by the project	29%
Livelihoods	**Beneficiary households/ individuals**	Number of household benefitting from alternative income-generating activities; number of project beneficiaries, direct / indirect	29%
	Individuals involved in alternative income generating activities	Number of individuals involved in beekeeping and aromatic camphor basil farming by project end; proportion of women	14%
	Energy production	Increase in number of households using improved stoves	14%
	Annual Income	Percent increase in annual income among targeted villagers thanks to activities supported by the project	14%
Awareness & Capacity building	**People trained**	Number of farmers trained in different agricultural techniques	14%
	Level of awareness	Number of views of You Tube channel; number of individuals who participated in educational activities in the dry forest; perceptions of watershed and social participation through the scoring proposed by SISMOC methodology (Mexico)	29%
Governance & Empowerment	**New supportive policies**	Supporting and lobbying for new legislation	14%
	Area under local management/co-management or new local governance arrangements	Number of hectares managed by community-based organisations; total area of new village land forest reserves	29%
	New local governance arrangements/ organisations	Number of community-based organisations; number of village land use plans	29%
Natural capital & Finance	**Value of restored ecosystem benefits**	Expected annual earnings through ecosystem benefits from restored floodplain	14%
	Individuals with access to new finance	Number of villages with newly introduced microfinance schemes; number of members in village savings and loans scheme	14%
	Women with access to new finance	Percent of women in village savings and loans scheme	14%

Some of the projects measured the number of beneficiaries. A common measure of improved livelihoods was income generation, as reported for example in Tanzania's East Usambaras which saw a 239% increase in income among project beneficiaries between 2004-2013.

Awareness and capacity building led to 554 farmers being trained in different agricultural techniques in Madagascar's FM landscape. New agricultural methods were introduced in CZH leading to 3 tonnes of tomatoes being produced with organic methods between 2009 and 2019, and 183 ha of coffee grown under shade. In Tanzania, 440 ha were brought under agroforestry. Outreach activities consisted in raising awareness and communications with for example, over 13,000 participants in different educational activities in New Caledonia's dry forest restoration programme.

In terms of governance, an improved role for local communities was central in Madagascar and Tanzania, with 51,743 ha of forest managed (or co-managed) by community-based organisations in Madagascar's FM landscape, while 18 village land use plans were developed in Tanzania's East Usambaras between 2004 and 2013 to take restoration into account. Changes in policies were also important, although only Mexico reported on a concrete change in policy, with the passing of a Mexican standard on defining environmentally-friendly flows in watersheds in 2012.

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Second meeting of the programme "Women working for forest conservation" in 2019 in Argentina.

Local communities were provided with increased access to finance, including through micro-finance schemes. In Tanzania's East Usambaras a total of 2,090 inhabitants were enrolled in such schemes in 2013, of whom 63% were women. Direct and indirect beneficiaries were measured in Mexico, and reported to be 6,433 and 22,196 respectively.

In general, aggregating results across the initiatives proved difficult because of the different types of measures applied across these projects. Although overarching categories of measures were to some extent similar, specific indicators differed. The only common measure remains the number of hectares and/or trees planted. This was the measure most used (five landscapes, as shown in Table 3). A number of potential indicators, were not monitored, even though they seemed useful in the context of the projects. Such potential indicators include for example: carbon sequestered, value of NTFP production, number of unsupportive policies or incentives removed, among others. Thus, although in total over 30 indicators were measured across the initiatives, only a handful were measured systematically, and several potentially useful ones, were omitted. Furthermore, although we quantify in Table 3 the number of landscapes (last column) that used the given indicators, that is not to say that some of the other landscapes were not engaging in similar activities (e.g. removal of exotic species in New Caledonia) however, they were not measuring these indicators systematically.

Producing seedlings in a village nursery in FM (Madagascar). Note the use of pots made of natural resource (raffia palm) to avoid plastic bags.

GOVERNANCE CHALLENGES

Governance issues associated with the FLR projects concerned: 1. tenure; 2. the governance framework: policies, laws and incentives; 3. stakeholder engagement; 4. multi-scale governance; 5. project governance arrangements or structure.

Tenure

Security of tenure rights - on land, forests, individual trees or even the products from the trees - can be an incentive for FLR. In contrast, insecurity or conflict over tenure rights can be a hurdle for FLR. In most landscapes surveyed, forests officially belonged to the State. However, contested tenure between traditional and formal rights exists for example in places like Madagascar, New Caledonia and Tanzania.

The potential for conflicts over land rights when scaling up can be an obstacle to further expansion of restoration efforts. In Mexico, indigenous communities have 'primordial titles' to the land, but these are not always honoured by the government and as a result, conflicts arise. In the CZH watershed, already in the 1960s (and again more recently) the community had to take up legal recourse to ward off forestry concessions in the upper watershed. More generally the lack of official titles can be a challenge for small rural rightsholders, as seen in Tanzania.

Where land is in private hands, it may also be difficult to convince landowners to engage in FLR. Large private landowners are often engaged in intensive land use practices and see little incentive to restore forests. In the wider region of UPAF, concentration of land (particularly more productive land) in the hands of a few powerful private owners is the rule, with for example, 93% of producers in Misiones (Argentina) possessing estates under 100 ha, within just 1/3 of the productive land (Colcombet and Noseda, 2000). Brazil and Paraguay also reflect this trend. While smallholders may be more open to restoration, the areas in question are often very small and fragmented.

LARGE PRIVATE LANDOWNERS ARE OFTEN ENGAGED IN INTENSIVE LAND USE PRACTICES AND SEE LITTLE INCENTIVE TO RESTORE FORESTS.

In the Lower Danube, the islands in Bulgaria which were a priority for restoration are largely under state ownership (and uninhabited). In contrast, the situation is different along the main riverbanks with a patchwork of ownership which has resulted in significant conversion to agriculture.

Tree species are an important component of FLR, and yet there is often a perverse incentive to use exotic species since native species are often considered property of the state, as is the case in Madagascar for example. In contrast, planting exotic species is seen as a productive use of the land and entitles those planting them to their benefits (Mansourian *et al.*, 2016). Similarly, leaving land fallow in between rotation cycles can be perceived as land that is available, thus, disincentivising sustainable practices.

Governance frameworks: Policies, laws and incentives

Policies and legislation provide an important context for FLR. They can serve to incentivise restoration for example by setting minimum forest cover areas as is the case in the Atlantic Forest in Brazil (20% plus riparian areas) or in Sabah (50%). In Paraguay, declaration of a moratorium on forest conversion in 2004 was an important legal instrument promoted by WWF Paraguay. Other laws protecting or zoning certain areas

can also provide the context for FLR. For example, in Argentina the Green Corridor Law in Misiones adopted in 2000 created an area of 1,200,000 ha within the province of Misiones to connect existing core forest areas. Other policies that have supported FLR in UPAF are those requiring a protective strip of forest cover along water courses. Connectivity more generally is also included in Sabah's new forest policy (2018).

Payments of different sorts are important incentives for FLR. They can be payments for the service of restoring forests (e.g. in UPAF) or they can be payments for products coming from restored areas (or areas under restoration, e.g. in CZH). Financial benefits can also occur because of new activities such as ecotourism (e.g. the East Usambaras). Payments from private enterprises for tree planting occurred for example in USM in Borneo, with companies such as Marks and Spencer's from the UK or Itochu Corporation from Japan supporting the project. In this case the service that these companies funded was restoring forest habitat for the orangutans.

DISSONANCE IN LEGISLATION ACROSS SECTORS BUT ALSO ACROSS PROVINCES CAN BE A CHALLENGE FOR FLR.

Dissonance in legislation across sectors but also across provinces can be a challenge for FLR, as seen in New Caledonia where the dry forests straddle two provinces with different legislation concerning their conservation.

Commitments under the global multilateral environmental agreements can also support FLR implementation as is the case for example with Tanzania's national biodiversity strategy and action plan (NBSAP) under the CBD which includes a target (target 14) to restore ecosystems by 2020.

When straddling countries, as is the case with the Lower Danube, more formal frameworks can support the engagement of different governments in the same direction. The Danube River Protection Convention, signed in 1994, sets the regional framework for collaboration. Starting in 2000, the Lower Danube Green Corridor declaration has provided a solid political framework across the four countries to engage in restoration of their common resource.

Stakeholder engagement

FLR requires mobilising stakeholders at different spatial scales and engaging them in relevant aspects of FLR decision-making (a key step in the landscape approach). This may happen through informal platforms, partnerships or alliances. For example, in 2013, WWF-Brazil gathered a group of organisations under the banner of the Forest Code Watch project to oppose implementation of new legislation perceived to weaken forest protection. Similarly, in Paraguay, WWF organised and facilitated a stakeholder coalition project, called the 'Social Pact for the Conservation of the Atlantic Forest' to bring multiple parties together to identify a viable means of ensuring the survival of the Upper Paraná Atlantic Forest. This pact ultimately led to the 'Conformance with Forest Law (CFL) programme' which aligns with the Paraguayan Forest Code of 1973 (Law N°422). In CZH, the Alianza Suchixtepec, which brings together several community groups, was formed for the 'defence and sustainable use of the Copalita river', giving community members an opportunity to play an active role in the formal political processes related to their watersheds.

Stakeholders may also be engaged during the initial consultation phase, as was the case in Madagascar's FM when a first workshop (2003) brought together different national-level stakeholders. Contractual arrangements, such as through co-management agreements signed with local community groups (e.g. FM), helps to improve the role of communities in decision-making and empower them.

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Restoration field visit - Iguaçu National Park in Foz de Iguaçu (Brazil) – during a trinational workshop in October 2019.

Multi-scale governance

While FLR focuses on landscapes, it inevitably is influenced by other administrative scales such as the national scale or on the contrary more local scales. The interaction between actors and policies at these different scales can be complex. Furthermore, informal institutions may also come into play as has been the case in CZH where community members established their own agro-ecological movement with the aim to influence public policies in support of sustainable agriculture. In Brazil's Atlantic Forest the "Mata Atlantica Pacto" launched in 2009 also brings together over 300 entities to safeguard and restore the forest and presents a strong voice in the country. It is coordinated by a governing board made up of 20 members and has six working groups on specific issues (e.g. a technical and scientific group or a policy group) (Brancalion *et al.*, 2013).

IN BRAZIL'S ATLANTIC FOREST THE "MATA ATLANTICA PACTO" LAUNCHED IN 2009 BRINGS TOGETHER OVER 300 ENTITIES.

At the international level, commitments under the Bonn Challenge or other such voluntary mechanisms, as well as commitments under legally-binding conventions, also provide a higher level governance framework that needs to be translated to the more local level.

Project governance arrangements or structure

The governance structure of FLR projects can itself be complex given the multiple levels and stakeholders frequently involved. In New Caledonia for example, what started as a loose partnership of 10 public and private sector entities became a formal body in 2011 (the Conservatoire d'Espaces Naturels – CEN) with its own legal structure and board. These governance arrangements provide a way of bringing in different concerns, acknowledging the diversity of stakeholders in a landscape and integrating both public and private interests. In Tanzania's East Usambaras, a project steering committee was established with representatives from the district level, the regional level, the forest service, protected area representatives, private sector and NGO representatives. The committee's role was to advise and supervise. In Madagascar's FM,

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Planting with volunteers in New Caledonia to catalyse citizen engagement.

the role of local communities through local associations, grew over the course of the project. Community organisations (COBAs) were set up specifically for restoration and contracts signed with the communities to engage them in forest management and restoration.

Towards sustainability and successful handover

Project funding has its limitations, both in terms of duration and amount. Equally, the involvement of an external agency, such as WWF, in most landscapes should be time-bound and replaced by local ownership. A successful and sustainable FLR project should become integrated into landscape activities, priorities and plans, as was the case in New Caledonia. Local actors should be in a position to incorporate FLR and FLR plans into their development plans, as was the case in Madagascar's FM. At the same time, an untimely exit from the landscape can be detrimental to the consolidation of FLR, which is why all seven FLR initiatives carried on for at least 10 years.

FLR FUNDING

FLR projects usually require significant funding, especially in the start-up phase. WWF, as lead entity in all seven landscapes, carried out most of the fundraising, often with many network partners involved.

Funding characteristics

Funding varied from EUR 135,490 per year to over 3.5 times that amount, at EUR 491,573 per year (see Table 4). Costs per hectare, varied from EUR 8 in Madagascar to EUR 450 in Borneo although the costs estimated include very different components in each landscape.

Sources of funding were diverse including governmental aid agencies, private corporations, foundations and NGOs (including several WWF offices).

Table 4. Funds invested in the seven FLR initiatives for the period analysed (some are still ongoing)

FLR initiative	Period Analysed	Number of years	EUR*	avg. EUR/ yr	Main funding sources
FM	2005-2017	12	1,625,881	135,490	Public funding, corporations, foundation, WWF-FR, WWF-CH, WWF-Int
NC	2001-2017	16	6,745,981	421,624	Public funding, WWF-FR, WWF-Int
LD	2000-2020	20	NA	NA	WWF Int; Public funding, EU
EU	2004-2013	9	1,951,519	216,835	Public funding, WWF-Fi, WW-Int
CZH	2004-2020	16	2,323,736	145,233	Foundation, corporations
USM	2008-2019	11	5,407,302	491,573	Corporations, WWF-NL,WW-UK, WWF-DE, WWF-US, WWF-Japan, WWF-SG, WWF-Malaysia
UPAF	2003-2019	16	5,759,330	359,958	Public funding, corporations, foundations, WWF-NL, WWF-CH, WWF-US, WWF-Int

* Where funding was reported in USD, the rate of 0.8545 was used to calculate the EUR amount.

The challenge of long term funding

Project duration overall (including several phases) was between 10 and 20 years. No single project was funded for the entire period, but rather several 3-4 year long projects were designed. In most cases, initiatives were funded by multiple donors. Tanzania was an exception in this regard, with three successive phases of the initiative receiving 84% of its funding from the same donor, the Finnish government (and WWF funded the remaining 16% and the inception phase). All initiatives required at least three different phases, including a 1-2 year inception phase. Different activities typically took place in different phases, with for example awareness raising, research and engagement being more prominent in earlier phases. In light of this, it is important to identify a committed lead organisation that takes the long term responsibility for 10 years or more; in the case of the seven landscapes reviewed here, it was WWF.

Value of restored ecosystem, costs and benefits of restoration

In some cases an estimate of the costs and benefits was carried out. For example, in Paraguay (UPAF), a study found that the natural capital value of 1,396 ha of restored native forest within Itaipu's buffer area was USD 4 million because of its carbon, or approximately USD 2,865 per ha (without counting additional benefits such as soil and water conservation).

In the Lower Danube, studies have also looked at the costs and benefits of restoration. One study by WWF Romania suggested that in a 100,000 ha area, dyke removal to allow restoration of the water regime would amount to EUR 50,000-200,000 per km or a total of EUR 20 million, but would generate ecosystem services valued at EUR 50 million per year (Schwarz *et al.*, 2006). Another estimate suggested that the total cost of floodplain restoration along the Lower Danube Green Corridor would total EUR 183 million but generate annual benefits of EUR 111.8 million (Faivre *et al.*, 2018).

COSTS COVERED FAR MORE THAN THE TECHNICAL COST OF PRODUCING SEEDLINGS IN NURSERIES AND PLANTING THEM.

Costs of some activities

In all seven initiatives, costs covered far more than the technical cost of producing seedlings in nurseries and planting them. For example, in most cases the project costs included capacity building, training and agricultural activities.

In Malaysia an analysis by WWF suggested that the real cost of restoration (including site preparation, maintenance, staff costs etc.) per ha amounted to EUR 1,450 per year. Similarly, in New Caledonia an analysis suggested that the average cost for protection and active restoration of one hectare of dry forest, was EUR 27,000 (Oréade-Brèche and Botanic, 2012). The approach to restoration applied in New Caledonia is expensive due to local costs and the fact that planted species are all endangered and require special propagation techniques. In Argentina (UPAF), in 2010 the cost of planting trees was estimated at USD 4,270 per hectare, although more recent estimates place this amount at USD 1,500-2,400 per ha. In Brazil (UPAF), Brancalion *et al.* (2012) estimated the restoration cost per ha to be closer to USD 5,000.

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Monitoring is always weak but crucial to support FLR implementation and adaptive management. It should not be limited to measuring planted trees.

OVERARCHING LESSONS LEARNT

The analysis of the seven initiatives produced between 9 and 17 lessons per project, and 81 lessons altogether. An analysis across the seven landscapes leads to 14 meta-lessons. All of these lessons emerged from at least two landscapes (see Table 5). They are ranked below by frequency of occurrence.

86%
of the landscapes and ten lessons referred to the importance of different spatial scales.

1 FLR takes place at a landscape scale but multiple spatial scales must be considered, from sites to ecoregions, as well as the ways in which they inter-relate.

Although the landscape is the key area of focus, it is influenced by actions both above (e.g. at the ecoregional or international level) and below (e.g. at the village or site level).

A distinction is to be made between planning which is often at the larger scale and implementation which tends to be at the more local level. For example, in the UPAF, improvements in policies and legislation were made at the national level, planning was done at the ecoregional level, while on the ground implementation took place with small landowners and communities. In a transboundary context, such as the UPAF or the Lower Danube, planning may also take place across countries, but implementation is defined at the national and local levels. Ultimately, the landscape is a social construct, with multiple interpretations, which can make implementation challenging. This provides an additional argument for engaging in site-based interventions within the wider 'landscape space' as these interventions can also serve to influence wider processes, as was the case in the Lower Danube, New Caledonia or in Fandriana-Marolambo. Site-based interventions can be better executed where there are several smaller landowners, as seen in New Caledonia or parts of UPAF. There is a critical role for site based interventions in the wider landscape, particularly in terms of connectivity. This is especially important when seeking to restore habitat for wide-ranging species, as was the case in USM for the orangutan or in UPAF for the jaguar. Watersheds provide a useful framing for a landscape, as seen in CZH. Here, the altitudinal range and the diverse forest types present in each, provided a convenient framing for a variety of actions to be carried out with the different stakeholders present at each altitude (upper, middle and lower watershed). Furthermore, with the pressing challenges brought by climate change, linkages in the landscape take all the more importance. For example, in the fragile context of New Caledonia's dry forests, linkages with the moist tropical forests of the centre and east coast have been prioritised to provide corridors for species' migration.

86%
of the landscapes and ten lessons referred to the diversity of actions for FLR.

2 Several actions in a landscape contribute to a strategic approach to FLR.

In the context of a given landscape, a series of actions contribute to its restoration. Many of these activities relate directly to forests (e.g. active and passive restoration), but many do not (e.g. capacity building or improved agriculture techniques).

Improved agricultural techniques, alternative income-generating activities that are more sustainable, wildlife conservation measures, support to landowners, etc. are all required. A multi-pronged approach, bringing in these diverse measures ensures that they can work in tandem and complement each other. For example, in CZH, the

package of measures centred on the provision of alternative livelihood options, improved agriculture, policy changes, and silviculture interventions. Ultimately, the reality of most landscapes is such that a strategic approach to FLR requires compromises and a series of measures that respond to multiple interests in a landscape. In UPAF, for example, forests are under pressure by strong commercial interests, and FLR implementation is predicated on reducing these pressures by collaborating with diverse public and private stakeholders to reach acceptable trade-offs. At the same time, and in order to ensure adaptive management, it is important to be in a position to monitor the impacts of these different measures. In the Lower Danube for example, monitoring was particularly important given the complex feedback loops within and across ecosystems.

71%
of the landscapes and twelve lessons referred to the need for equitable and inclusive FLR implementation.

3 Equitable implementation must be inclusive and build on social realities.

The local social context has to be an integral part of any FLR intervention. Often, FLR takes place in landscapes where local rural populations face numerous challenges. While FLR may prove to be a solution to some of these challenges, it must incorporate their local realities and needs if it is to achieve lasting change in the landscape.

Trust needs to be established and a common vision shared, as was the case in the co-designing of interventions by WWF, Fundación Vida Silvestre Argentina and local stakeholders in the UPAF. One important dimension to this is the development of alternative activities for local communities so that they may be in a position to reduce pressure on the forests, if relevant, and to benefit from FLR interventions in the landscape. For example, in the East Usambaras several income-generating activities such as bee-keeping and butterfly farming were introduced to provide an incentive for communities to engage in restoration and reduce degradation. In CZH, local communities adopted new agroforestry practices (e.g. undercover coffee plantation, vanilla) which have had a profound impact on their landscape. One important dimension of social sustainability is also the engagement of women and youth as seen in CZH. More broadly, the engagement of ordinary citizens in tree planting campaigns was an important cornerstone of the FLR strategy in New Caledonia, in an effort to raise awareness, improve understanding and change practices at all levels.

71%
of the landscapes and nine lessons referred to the different pathways for FLR.

4 Forest restoration can take several pathways.

Both active and passive restoration are viable approaches to restoring forest landscapes, depending on local conditions.

When pressures are removed, natural regeneration can be a low cost option, as seen in the Lower Danube. The use of both slow and fast growing species, or native and exotic species, may be appropriate in certain contexts, to meet different objectives. For example, in Madagascar's FM, fast growing exotic species were used to meet the immediate needs of local populations (fuelwood), but slower growing native species were used to improve ecological integrity of the landscape. The choice of species to use for restoration may also be determined by an endangered faunal species, as was the case in USM where the needs of the orangutan dictated the selection of species to plant. Small scale pilot tests can also be an important first step to determine the right species mix and most locally suitable approaches as was the case in the Lower Danube and the UPAF, and to engage stakeholders, as was the case in New Caledonia. Urgent measures, such as fencing to protect remaining fragments (e.g. in New Caledonia), may need to occur rapidly whilst broader measures are being prepared. Planting may use

different approaches, such as enrichment and undercover planting, reintroduction of endangered species, choosing pioneer species and 'stepping stones' in the landscape. Agroforestry is also an important intervention that can contribute to FLR, particularly where poverty levels are high as was the case in the East Usambaras.

71%
of the landscapes and six lessons referred to the need for local level governance.

5 Inclusive, local level governance facilitates long-term FLR efforts.

The role of local civil society organisations is critical in FLR implementation as they take ownership of the approach.

In landscapes as diverse as UPAF, Fandriana-Marolambo, the East Usambaras or CZH, local community organisations played a major role in FLR implementation. Frequently, however, their capacity may need to be strengthened, as seen in the UPAF in Argentina and Paraguay. A number of local level associations were established or strengthened in CZH in support of FLR interventions. Equally, in the East Usambaras, a strong collaboration with the local NGO, Tanzania Forest Conservation Group (TFCG), contributed to the success of the project.

57%
of the landscapes and four lessons referred to the need to address drivers of forest loss and degradation.

6 Addressing the drivers of forest loss and degradation is a key first step in FLR.

Unless drivers are understood and addressed, FLR efforts will be in vain. Thus, addressing these drivers has to be a central component of any FLR strategy and theory of change.

The underlying causes of forest loss and degradation may occur directly within the landscape; for example, dykes in the Lower Danube leading to changes in natural flows and processes. Often, however, they may occur at a more distant location, as is the case with demand for products such as soya and beef from the Atlantic Forest. In these cases, an altogether different strategy is required to change consumer behaviour and promote market-based approaches such as the promotion of sustainable commodity production for example through the Roundtable on Sustainable Soya. An additional challenge when dealing with transboundary landscapes such as the Lower Danube or the Upper Paraná Atlantic Forest is that each country may face different underlying causes of forest loss and degradation. Seeking to collaborate on the common ones (for example agricultural crops in the UPAF) whilst at the same time tackling individual drivers, is a delicate but necessary balance in carrying out FLR within such landscapes.

57%
of the landscapes and four lessons referred to the need for a well-planned handover.

7 The organisation leading implementation must plan for a careful handover strategy to ensure local ownership and continuity.

When FLR is promoted by a partner external to the landscape, a careful handover strategy needs to be designed for when the external partner will exit the landscape.

It is unsustainable for such a partner to remain in the landscape beyond a given period, yet it is also irresponsible to exit too quickly. Therefore, a clear handover strategy should be designed with sufficient notice so that the necessary capacities and other local foundations can be in place before the organisation's departure. In Fandriana-Marolambo, WWF considered that after 13 years of active presence

in the landscape, it had built sufficient local capacity among local groups for them to continue the FLR efforts in the landscape. In New Caledonia, the creation of a new governance structure, the CEN, allowed WWF to reduce its involvement in the dry forest programme after having led it successfully for several years. In the East Usambaras, an important component of the final phase was the collection of lessons learnt so that both those in the landscape, and beyond, could build on these important lessons.

57%
of the landscapes and five lessons referred to the need for long-term commitment.

8 Commitment to FLR should be long term, but flexibility and adaptive management are necessary to incorporate changes over time.

By its very nature, FLR implementation requires long term thinking, planning and execution.

All landscapes reflected the need for long term interventions (ten to over twenty years). Since most donors provide only short-term funding, in all cases, projects had to be renewed in order to continue FLR actions in the landscape. Over the course of such long term interventions, unexpected challenges may arise and further delay or change the achievement of objectives. In USM for example, unexpected lack of labour and climate extremes meant that windows of opportunities for the planting season were missed, causing delays. The ecoregional plan developed for the UPAF in 2003 served as a long term roadmap that continues to be used to this day, but within that roadmap, several shorter term projects and interventions reflected ongoing changes and present reality in the landscape. The duration of FLR initiatives covered in this series varied in total from 10 to 20 years (and in the case of the Lower Danube, USM and CZH are still ongoing, led by WWF). This has implications for the leaders of FLR initiatives, but also for donors, implementers and decision-makers at all levels who need to understand that FLR cannot be achieved in a typical project cycle of 3-5 years. In one case only, the East Usambaras, the donor renewed funding for three phases (for a total of 10 years), while in all other cases new funding had to be sought from different donors.

43%
of the landscapes and five lessons referred to the need for partnerships and other related approaches.

9 Mechanisms that bring stakeholders together are essential.

Networks, partnerships, alliances and platforms promote collaboration and efficient implementation.

On the one hand they harness different expertise and on the other, they help to secure long term engagement. In the UPAF for example, the ecoregional process provided a useful participatory mechanism to engage a wide range of stakeholders in the planning and designing phases of the ecoregional plan towards a shared vision. In Fandriana-Marolambo, a wide range of partners from the private sector, the national and local government, local associations and communities etc. were engaged at different stages in the process. In New Caledonia, a partnership of 10 actors eventually developed into a formal entity, the Conservatoire d'Espaces Naturels, to take the conservation and restoration of the dry forest forward. The role of the private sector is increasingly important, notably in securing the long term funding and commitment in a landscape, particularly as companies often rely directly on ecosystem services. For example, in UPAF, the Itaipu (Brazil and Paraguay) hydropower companies have recognised the role of maintaining and increasing forest cover to extend the life of their dams.

43%
of the landscapes and four lessons referred to the role of public policies and instruments.

10 Public policies and instruments are needed to support FLR.

The role of policies, legislation and other public sector instruments can both help and harm FLR implementation. It is therefore important in any FLR intervention to track these and to promote supportive ones while lobbying to change or remove perverse ones.

In UPAF, Brazil's 2012 Forest Code has provided an incentive for large scale forest restoration. Conflicting sectoral policies may generate additional difficulties when implementing FLR, as seen in the Lower Danube where water and forest policies are not always aligned. In the East Usambaras, three national level policies - the forest policy, the land law and the forest act - provided a good framing to carry out FLR activities such as for example, by promoting the creation of village forest reserves.

43%
of the landscapes and four lessons referred to the need for diversified funding.

11 Long term financing tends to rely on public funding, but should be diversified.

So far, most of the funding for the seven FLR initiatives was from public sources.

In some cases, such as in UPAF, USM and CZH, some payments were made by companies for water or biodiversity conservation. Philanthropic funding was the main contributor to CZH. In all cases, however, the need to diversify funding was evident, and the tendency for short-term funding was a challenge. Mis-conceptions by donors that they may see rapid results in the context of long-term processes such as FLR need to be corrected. Tree planting may be the first short-term result, but it is only the first step in restoring and growing a forest.

43%
of the landscapes and three lessons referred to the need for monitoring.

12 Monitoring is always weak but crucial to support FLR implementation and adaptive management.

The only way to assess success and to correct errors is through some form of systematic monitoring.

Although monitoring is essential, it is often perceived as superfluous, complicated or expensive and therefore, neglected. In Fandriana-Marolambo, monitoring has been limited to site-based actions, rather than landscape scale impact. Yet monitoring can and should be systematic but pragmatic and locally-grounded. It should start the first day of any FLR project. New tools are supporting monitoring of FLR, as is the case in the UPAF, where Brazil has launched the MapBiomas project which uses Google's Earth Engine platform and available Landsat datasets to reconstruct historical land cover and land use maps. In the East Usambaras, a comprehensive monitoring scheme was developed after the end of the first phase when it was clear that it was difficult to report on progress in an effective way because such a system was lacking.

43%
of the landscapes and three lessons referred to the need to improve scientific knowledge.

13 Scientific knowledge provides an important basis for FLR interventions.

Such knowledge is necessary to understand the social and ecological context and dynamics, and adapt FLR interventions accordingly.

Often, we lack sufficient data to ensure effective FLR interventions and so a first step will be the collection of key data and the creation of systems that can assess this data

over the long term. For example, in Fandriana-Marolambo WWF carried out research to better understand techniques for native tree species propagation and also to understand drivers of governance failures in the landscape. In New Caledonia, researchers initially carried out several surveys to better understand the unique ecosystem of the dry forest, in order to better conserve and restore it.

29%
of the landscapes and two lessons referred to the need to start with awareness raising, communications and capacity building.

14 Engagement starts with awareness raising, capacity building and communications.

Frequently, the first components of an FLR project are not about planting trees but rather about raising awareness or capacity building in order to change attitudes, reduce drivers of forest loss and ensure that local partners can carry out key interventions.

In Fandriana-Marolambo, many initial activities related to awareness raising, engagement of communities and capacity building. Equally, in the East Usambaras a comprehensive communication strategy was designed to change behaviours in the landscape.

Meta-lessons related to FLR principles

These 14 meta-lessons can be mapped against the six FLR principles agreed by the Global Partnership on FLR in 2018 (Besseau *et al.*, 2018) (Table 5). Twelve of these meta-lessons map on at least one principle. Only two meta-lessons do not appear explicitly in the principles. Four meta-lessons cover at least three principles. Meta lesson 3 – "equitable implementation must be inclusive and build on social realities" – overlaps with four FLR principles. The overlap between these lessons and the FLR principles confirms the relevance of these meta-lessons to the global FLR agenda. Indeed, the issues brought out through these lessons which stem from the detailed analysis of seven large-scale and long-term FLR initiatives, confirm the validity of the FLR principles. The two meta-lessons that are not covered by the FLR principles - "scientific knowledge provides an important basis for FLR interventions" and "public policies and instruments are needed to support FLR" – are important in 43% of the landscapes and may need to be considered in a revision of the FLR principles.

Table 5. Meta-lessons and their occurrence in the seven landscapes mapped against the FLR principles

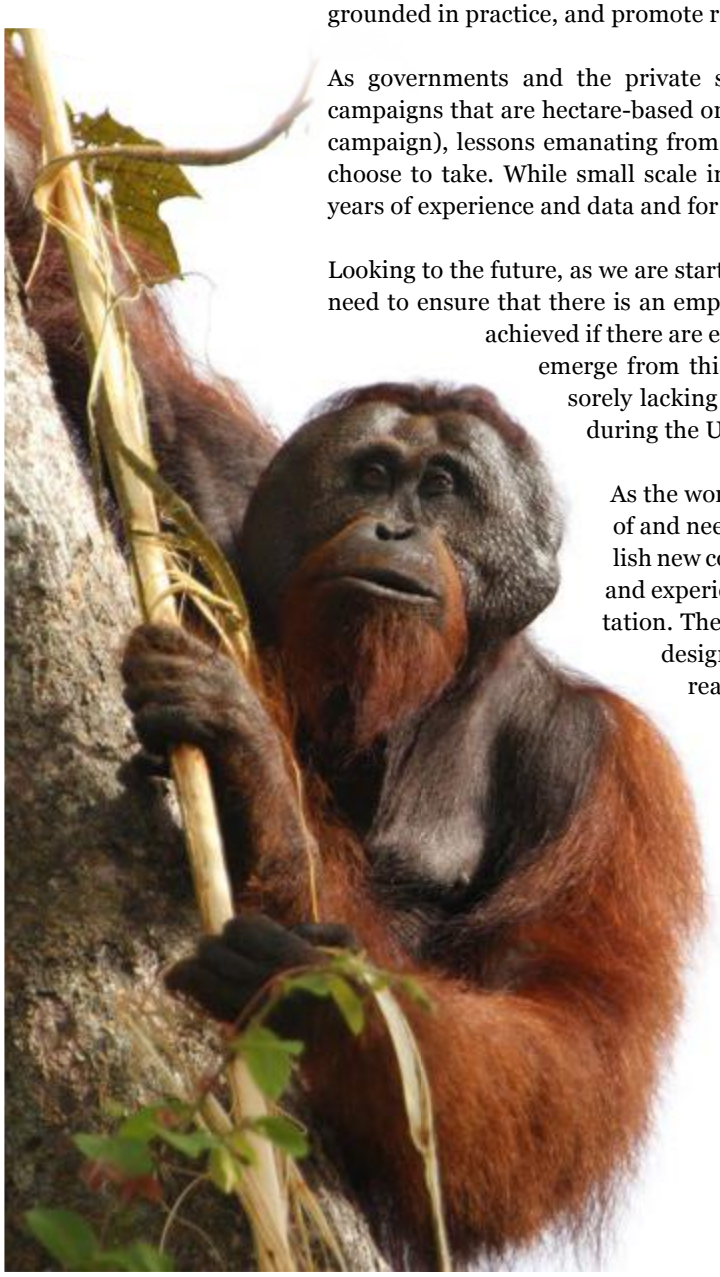
Meta-lessons		Data		Link to GPFLR principles (Besseau *et al.*, 2018)					
Theme	Wording	Frequency among landscapes	Total number of lessons*	Focus on landscape	Engage stakeholders and support participatory governance	Restore multiple functions for multiple benefits	Maintain and enhance natural ecosystems within landscapes	Tailor to the local context using a variety of approaches	Manage adaptively for long-term resilience
1. Spatial scale	FLR takes place at a landscape scale but multiple spatial scales must be considered, from sites to ecoregions as well as the ways in which they inter-relate	86%	10	✗					
2. Multiple measures	Several actions in a landscape contribute to a strategic approach to FLR	86%	10	✗		✗		✗	
3. Inclusiveness	Equitable implementation must be inclusive and build on social realities	71%	12		✗	✗		✗	✗
4. Pathways	Forest restoration can take several pathways	71%	9			✗	✗	✗	
5. Governance	Inclusive, local level governance facilitates long-term FLR efforts	71%	6		✗			✗	
6. Degradation	Addressing the drivers of forest loss and degradation is a key first step in FLR	57%	4				✗	✗	
7. Planning	The organisation leading implementation must plan for a careful handover strategy to ensure local ownership and continuity	57%	4						✗
8. Temporal scale	Commitment to FLR should be long term, but flexibility and adaptive management are necessary to incorporate changes over time	43%	5			✗			✗
9. Stakeholders	Mechanisms that bring stakeholders together are essential	43%	5		✗				
10. Policies	Public policies and instruments are needed to support FLR	43%	4						
11. Funding	Long term financing tends to rely on public funding, but should be diversified	43%	4						✗
12. Monitoring	Monitoring is always weak but crucial to support FLR implementation and adaptive management	43%	3						✗
13. Science	Scientific knowledge provides an important basis for FLR interventions	43%	3						
14. Engagement	Engagement starts with awareness raising, capacity building and communications	29%	2		✗			✗	✗

* Represents the number of lessons out of 81 from the seven landscapes.

CONCLUSION AND WAY FORWARD

The analysis carried out over the period 2018-2020 of seven FLR initiatives around the globe led by WWF and partners provides essential data, experiences, meta-lessons and other information that help expand our understanding of FLR practice. As far as we are aware this is the first such analysis, and should be seen as a valuable input into future FLR initiatives.

Lesson learning processes are much needed to inform practice and enable adaptive management in environmental projects more generally. Because FLR is a long term process, it is all the more important to ensure that the capacity and tools are in place to collect data in a systematic way, to measure change and to identify cause and effect for different actions. Valuing experience and lessons, recording these and disseminating them are all going to be essential if we want to improve FLR knowledge that is grounded in practice, and promote replication and upscaling.



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As governments and the private sector are embarking on massive tree planting campaigns that are hectare-based or tree-based (e.g. the Bonn Challenge or the 1t.org campaign), lessons emanating from the field can help to inform the approaches they choose to take. While small scale in comparison, these pilot initiatives benefit from years of experience and data and for these reasons alone should not be discarded.

Looking to the future, as we are starting the UN Decade on Ecosystem Restoration, we need to ensure that there is an emphasis on learning from practice. This can only be achieved if there are effective ways to collect the lessons and results that emerge from this practice. Capacity and tools to do this are still sorely lacking around the globe and this is an area to prioritise during the UN Decade.

As the world's decision-makers are realising the importance of and need for restoration, there is an opportunity to establish new collaborations, bringing together different expertise and experiences which can help to accelerate FLR implementation. The results of this analysis can help to guide how the design of future FLR projects develops, grounded in the reality and experience of long-term initiatives.

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IN BRIEF

7

The number of FLR initiatives reviewed.

20

The number of years since WWF co-defined FLR with IUCN and started testing its field implementation.

14

The number of meta-lessons gathered from over 80 individual lessons learnt.

>25

The number of generic key performance indicators collected.

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