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FIELD SERIES

2020

EXPERIENCES IN FOREST LANDSCAPE RESTORATION (FLR)

Lessons Learnt from 15 Years of Integrated Watershed Management and Forest Restoration: the Copalita-Zimatán-Huatulco Landscape in Mexico

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Acknowledgements:

We would like to thank Blanca Sánchez Reyes (Mbis Bin Semilla para la Siembra), Marinhe Rosas Rodríguez (Los Macuiles Copalita), Romeo Salinas Ramírez (Alternativa Agrícola Suchixtepec) and Eugenio Barrios (WWF) for providing valuable insights for the production of this report. We would also like to thank Anuar Martínez, for the maps and some of the data and Hanna Besirevic, Mario Contini and Santiago Azuela for donating to WWF-Mexico professional photos covering the project.

Published in 2020 by WWF-France.

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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

If diversity of life forms and human cultures were given a price tag, Mexico would be among the wealthiest nations on the planet. We know of over 20,000 vascular plant species – and many more to be discovered. We are home to the splendid monarch butterfly, known for its long migration from Canada and the US down to our warmer climes in winter. Vaquita, jaguar and howler monkey are just a few of the rare and wonderful mammals that call Mexico home. Also in our nation, a total of 143 languages are spoken, reflecting the multiple indigenous cultures that co-exist here.



With its tremendous biodiversity and rich cultural heritage, our nation – situated at the junction between the Nearctic and Neotropical bioregions – has much knowledge to offer related to our environment. Yet both nature and culture are facing the tragedy of extinction.

Today this delicate balance between our natural and cultural heritage is threatened by many pressures, including – but not only – global ones related to markets, urbanisation and climate change. Restoring this balance is an urgent matter. Our government has chosen to join the Bonn Challenge and Initiative 20x20, and committed to restoring over 8 million ha of forest landscapes. But forests, water and people are closely intertwined. We cannot tackle one without the other.

WWF in Mexico has been contributing to restoring watersheds since the start of this century. We take an integrated approach linking the upper reaches of watersheds with the more populated and urbanised lower reaches. Since 2004 with funding from Fundación Gonzalo Río Arronte (FGRA) and later from Caudalie, we have taken a comprehensive approach to restoring the Copalita-Zimatán-Huatulco (CZH) watersheds in Oaxaca State.

Our experience in CZH is exemplary and through this publication we seek to share 15 years of effort to improve water, livelihoods and forest in these watersheds.

Jorge Alejandro Rickards Guevara,
CEO
WWF Mexico

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EXECUTIVE SUMMARY

Lessons Learnt from 15 Years of Integrated Watershed Management and Forest Restoration: the Copalita-Zimatán-Huatulco Landscape in Mexico



The watersheds of Copalita-Zimatán-Huatulco (CZH) can be found in the south of Mexico's state of Oaxaca, in the Sierra Madre del Sur. They cover an area of 268,023 ha and include 26 of the country's 34 vegetation types. With an altitudinal range from sea level to 3,500 m, the landscape is home to numerous faunal and floral species. Yet, forest loss has had an impact on the land, biodiversity, water quality and quantity, and local people.

Threats to the landscape include deforestation, fire, advancement of the agricultural frontier, slash and burn on steep slopes for maize cultivation, reduction in water availability, sedimentation of coastal zones, unplanned tourism activities and water contamination from domestic, urban, industrial and agricultural sources.

Starting in 2004, with funding from Fundación Gonzalo Río Arronte (FGRA), WWF began work in these watersheds. Three phases can be identified: the first phase (2004-2011) focused on data collection – both biological and socio-economic. The second phase (2012-2016) sought to consolidate and replicate achievements from the first phase. The third and current phase (2016-2020) aims to consolidate work to date, and to continue addressing threats and enhance restoration work for the benefit of people and nature, in order to achieve water security and biodiversity conservation.

Activities that were carried out focused on data collection, improving agricultural practices, nursery establishment and reforestation, participatory water management, participatory monitoring, awareness raising and reducing water pollution. The project benefited a total of 6,433 people directly and 22,196 people indirectly. Significant results were achieved with enhanced water quality, better agricultural practices that have led to improved yields, at lower costs and with higher market value, a total of 2,625 ha reforested across all three levels of the watersheds (upper, middle and lower). Importantly, communities – including women and youth – have been empowered to take decisions related to land use and natural resources.

Several partners have collaborated with WWF over the years from public authorities, to local community organisations, research bodies and other NGOs. Both formal and informal institutions co-exist in this part of Mexico, with the indigenous Zapotec communities for example, having 'primordial titles' to the land. At the legislative level, the decree on water reserves established in 2018, based on the Mexican Environmental Flow Standard, has been an important tool nationwide to secure improvements in protection and management of critical river basins. Although CZH has still not benefitted from this declaration, all technical studies for supporting the decree have been completed.

Over the entire 15 years of the project – which represents a whole generation - many practices promoted by the project (such as agroecological activities, tree nursery techniques and improved water usage) have been integrated into the communities.

The project has benefitted from long term financial support by one donor FGRA and additional funding by Caudalie. It continues to this day. A handover strategy has not yet been defined, as more work remains to be done in the landscape.

Key lessons learnt over the course of this project are:

- 1 **A watershed perspective makes sense to engage stakeholders** - Because of linkages between the upper, middle and lower parts of a watershed, it makes sense to engage stakeholders and develop activities at all levels, recognising the linkages but also the differences between each area. Water provides a guiding thread between the upper and lower reaches of the watershed.
- 2 **Starting with broader actions can support a more focused tree planting intervention several years later** - Laying the ground work through research, engagement, policies and demonstration sites can be an effective way of starting an FLR intervention.
- 3 **Integrated approaches to restoration provide better results than reforestation alone** - Addressing underlying causes of forest degradation and approaching the restoration process in a comprehensive and integrated manner provides faster and more durable results.
- 4 **Integrated approaches across actors and stakeholders, from federal to community level, are important for large-scale achievements** - Bringing in political players, social actors, across federal and local scales, creates the enabling conditions for long-term success.
- 5 **Providing alternatives for management and production in the landscape ensures better engagement of communities** - Providing several different and innovative water, agriculture and forestry management alternatives, leads to better engagement by communities who feel empowered to take decisions related to their land, livelihoods and future. In turn, this leads to more sustainable results and changes in lifestyle.
- 6 **Making explicit the link between forests and water to the overall development model of the landscape via a watershed approach leads to better results** - This link is not obvious for communities and policy makers. Linking upper and lower watershed communities and related land use and management leads to positive impacts on water, forests and development.
- 7 **Engaging women and youth in decision-making at local level increases social sustainability** - Women and youth have a vested interest in land management and innovation in rural areas but are often not targeted as key participants and decision-makers.
- 8 **Champions help to disseminate project results** - Enlisting key “champions”, leaders, or change-makers, at different geographical levels, can help to promote the project, maintain its momentum beyond its lifetime and disseminate its approach.
- 9 **Long term funding for water and people is an opportunity** - Enabling the continuity of funding over the necessary 10 to 20 years essential to achieving sustainable results is always a struggle. Bridging water and development policies with forest issues helps to secure success in FLR.

RESUMEN EJECUTIVO

Lecciones aprendidas en 15 años de manejo integrado de cuenca y restauración de bosques en: el paisaje Copalita-Zimatán-Huatulco, en México



Las cuencas Copalita-Zimatán-Huatulco (CZH) se encuentran en la Sierra Madre del Sur, en el estado de Oaxaca, México. Éstas, cubren un área de 268,023 hectáreas e incluyen 26 de los 34 tipos de vegetación del país. Con una altitud de 3,500 metros sobre el nivel de mar, este paisaje es el hogar de numerosas especies de flora y fauna. Sin embargo, la pérdida de bosque ha tenido un impacto en el suelo, la biodiversidad, la calidad y cantidad de agua así como en las personas locales.

Las amenazas sobre el paisaje incluyen la deforestación, los incendios, el avance de la frontera agrícola, la tala y quema de laderas para el cultivo de maíz, la reducción de la disponibilidad de agua, la sedimentación de zonas costeras, las actividades turísticas no planeadas, y la contaminación de agua de fuentes domésticas, industriales y agrícolas.

A principios de 2004, con financiamiento de la Fundación Gonzalo Río Arronte (FGRA), WWF México empezó a trabajar en estas cuencas. Se pueden identificar tres fases: la primera fase (2004-2011) se enfocó en recolección de datos— tanto biológicos como socio-económicos. La segunda fase (2012-2016), buscó consolidar y replicar los logros de la primera fase y en los primeros proyectos socioambientales de manejo del agua. La tercera y actual fase (2016-2019), consolida el trabajo a la fecha para hacer frente a las amenazas y promover la labor restaurativa en beneficio de las personas y la naturaleza, con el fin de lograr seguridad hídrica y la conservación de la biodiversidad.

Las actividades llevadas a cabo se enfocaron en la recolección de datos, mejora de prácticas agrícolas, establecimiento de viveros forestales y reforestación, gestión participativa del agua, monitoreo participativo, creación de conciencia y reducción de la contaminación del agua. Se logró apoyar y favorecer a un total de 6,433 beneficiarios directos y 22,196 indirectos. También se alcanzaron resultados significativos con las mejoras en la calidad de agua y en las prácticas agrícolas que a su vez incrementaron los rendimientos a un costo menor de producción y con un mayor valor de mercado. Un total de 2,625 hectáreas se reforestaron en los tres niveles de las cuencas (parte alta, media y baja), y algo muy importante, comunidades—que incluyen a mujeres y jóvenes—se empoderaron para integrarlas en los procesos de toma de decisiones acerca del uso del territorio y sus recursos naturales.

Varios aliados colaboraron con WWF a lo largo de los años, desde autoridades públicas hasta comunidades y organizaciones locales, centros de investigación y otras ONG. En esta parte de México, en donde comunidades indígenas Zapotecas retienen derechos “primordiales a la tierra,” coexisten instituciones formales e informales. A nivel legislativo, el decreto sobre reservas de agua establecido en 2018, que se basa en la norma mexicana de caudal ecológico, ha sido una herramienta nacional importante para asegurar la protección y manejo sustentable del agua de las cuencas. Aunque CZH todavía no se beneficia de este decreto, cuenta con todos los estudios técnicos para sustentar

que se incorpore a las cuencas nacionales que constituyen el programa nacional de reservas de agua para la protección ecológica.

Quince años, la duración del Proyecto, representan a toda una generación de personas y muchas de las prácticas que se han promovido -tales como las actividades agroecológicas, las técnicas para el manejo de viveros forestales y la producción de planta, así como las de mejora en el uso sustentable de agua- han sido integradas dentro de las comunidades. Diversas actividades de comunicación para crear conciencia también se han llevado a cabo, incluyendo talleres, videos, conversaciones en radio y exposiciones.

El Proyecto se ha beneficiado de financiamiento a largo plazo gracias al donante FGRA y a financiamiento adicional proveniente de la empresa Caudalie. El trabajo de WWF México continúa y hasta este momento no ha definido una estrategia de salida debido a que todavía queda mucho por hacer en este paisaje.

Las principales lecciones aprendidas en el curso del proyecto son:

- 1 **La perspectiva de manejo de cuenca hace sentido para involucrar a los interesados en la conservación y restauración de paisajes** - Debido a los vínculos entre la parte alta, media y baja de la cuenca, tiene sentido involucrar a los diferentes actores interesados y desarrollar actividades en los tres niveles, reconociendo estos vínculos y al mismo tiempo las diferencias entre cada área. El agua se presenta como un lazo conductor entre la parte alta y baja de la cuenca.
- 2 **Empezar con acciones más amplias y complementarias puede ayudar a establecer una base para la plantación de árboles más enfocada en los años siguientes** - Sentar las bases para el trabajo en campo desde la investigación, vinculación, desarrollo de políticas y establecimiento de sitios demostrativos puede ser un camino efectivo para empezar el trabajo de conservación y restauración de paisajes.
- 3 **Una aproximación integrada para restaurar consigue mejores resultados que la reforestación por sí sola** - Atendiendo las causas que subyacen la degradación de bosques y aproximándose a los procesos de restauración desde una perspectiva comprehensiva e integrada permite resultados más rápidos y durables.
- 4 **Una perspectiva integral entre los diferentes actores interesados de la cuenca, desde los niveles federales hasta los comunitarios, son importantes para conseguir resultados de gran escala** - Atraer actores tanto políticos como sociales, en los niveles federales y a escala local, crea las condiciones necesarias para alcanzar resultados exitosos de largo plazo.
- 5 **Proveer alternativas para el manejo y la producción en los paisajes mismos asegura una mejor vinculación de las comunidades** - Proveer diferentes alternativas innovadoras basadas en las condiciones locales para el manejo de agua, agrícola y de bosques, permite una mejor vinculación de las comunidades quienes se sienten empoderadas para tomar decisiones relativas a sus tierras, su nivel de vida y su futuro. Esto a su vez permite resultados más sustentables y cambios en los estilos de vida.
- 6 **Hacer explícito el vínculo entre bosques y agua, a través de un enfoque de manejo de cuenca, permite mejores resultados en el desarrollo integral del modelo de conservación de paisaje** - Este vínculo no es obvio para las comunidades ni para las personas que hacen política pública. Vincular a las comunidades de los tres niveles de la cuenca, y con ello el manejo y uso del territorio, conduce a impactos positivos en el agua, en los bosques y en el desarrollo.

- 7 Involucrar a las mujeres y jóvenes en los procesos de toma de decisiones a nivel local incrementa la sustentabilidad social** - Las mujeres y los jóvenes tienen intereses establecidos en el manejo del territorio y la innovación en áreas rurales y sin embargo no es común que se planteen como participantes clave y tomadores de decisiones.
- 8 Campeones ayudan a diseminar los resultados del Proyecto** - Reclutar campeones clave, líderes, o personas capaces de lograr cambios, en los diferentes niveles geográficos, puede ayudar a promover el proyecto, mantener *momentum* más allá de su vida, y diseminarlo.
- 9 Financiamiento a largo plazo para el agua y las personas es una oportunidad para la conservación y restauración de paisajes** - Facilitar la continuidad de financiamiento para los 10 o 20 años necesarios para lograr resultados sustentables de conservación y restauración de paisajes siempre es difícil. Crear puentes entre la conservación del agua y políticas de desarrollo con temas forestales ayuda.



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INTRODUCTION

**MEXICO IS A
MEGADIVERSE
COUNTRY, BASED
ON KNOWN SPECIES
RICHNESS BUT
ALSO CULTURAL
DIVERSITY.**

With more than 10% of the world's biodiversity, Mexico is rated as one of the planet's most megadiverse countries, based on known species richness (CONABIO, 2016). Situated at the intersection of two continents, Mexico presents significant genetic and cultural diversity. A total of six terrestrial habitat types can be found: tropical rain-forest, tropical dry forest, cloud forest, temperate pine-oak forest, deserts and grasslands (Robson, 2007). Mexico is home to over 20,000 vascular plants, 564 mammal species, close to 1,150 bird species, 864 reptile species and 376 amphibian species (website of the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad).

The southern state of Oaxaca, situated on the Pacific coast, is home to about one third of the country's biodiversity, covering a wide diversity of habitats from temperate, mesophyllous to dry tropical forests. A total of 8,903 vascular plants have been identified for the state of Oaxaca (Mendoza and Meave, 2011), although much remains to be discovered. The state is also important for its genetic diversity, notably for its agrobiodiversity including maize, coffee and beans.

The role of communities in managing forests in Mexico is high with an estimated 56–62% of forests under common property regimes (Figel *et al.*, 2011). In the state of Oaxaca, an estimated 80% of forests are under the management and control of approximately 1,400 indigenous communities (Robson, 2007). A total of 18 ethnic groups live here, making it particularly rich from a socio-cultural perspective as well.

WWF Mexico has been working for 15 years in three river basins across the country: Cuenca alta del río Conchos (in Chihuahua state in the north), Copalita-Zimatán-Huatulco (in Oaxaca State in the south west) and San Pedro Mezquital (in Durango and Nayarit on the west coast). In these three 'model' basins, WWF, together with numerous public and non-state local actors, has been working on developing practical experiences and demonstration projects to improve water use and develop a nation-wide network of water reserves for both nature and people based on sound scientific, technical, social and economic foundations.



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Forest loss in Oaxaca has had an impact not only on the land, fauna and flora, but also on water quality and quantity. As such, WWF has emphasised an integrated approach to water management, and one of the important tools in this approach is restoration of forest cover. Forest landscape restoration (FLR) is a means of reconciling ecological and social objectives focusing on recovery of the role of forests in the wider landscape.

Since 1997, and more intensely in 2004, thanks to funding from the Fundación Gonzalo Río Arronte (FGRA), WWF Mexico has prioritised the southwest of Oaxaca region focusing on the watersheds of Copalita-Zimatán-Huatulco (CZH). The emphasis has been on the links between water and forests, across the full altitudinal range of the watersheds.

FLR in WWF's Global Forest Programme

WWF's 'Forests for Life' programme during the period 2001-2006 centred around three global targets: protected areas, sustainable forest management and FLR. The FLR target was "to undertake at least twenty FLR initiatives in the world's threatened, deforested or degraded forest regions to enhance ecological integrity and human well-being by 2005". WWF contributed specific steps along the way to this global target, including leading the implementation of 10 long-term FLR initiatives.

Outside the WWF network, much has been achieved at an international level to raise the political profile of FLR and to advance technical understanding through implementation in key landscapes (Mansourian and Vallauri, 2014). In March 2019, the UN General Assembly (UNGA) proclaimed 2021-2030 UN Decade on Ecosystem Restoration.

Today, WWF's global forest strategy includes as one of its ambitions to contribute to the international effort to restore '350 million hectares of forest landscapes' by 2030 (New York Declaration on Forests and Bonn Challenge on FLR). These global efforts aim to reverse the trend of forest loss and degradation by putting an emphasis on restoring the ecological functions of degraded forest landscapes.

WWF 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 staffs contribute to it. WWF is an active member of Global Partnership on Forest Landscape Restoration and is participating to the Initiative 20x20.

PRESENTATION OF THE LANDSCAPE

In the south of the state of Oaxaca, in the Sierra Madre del Sur, lies the landscape encompassing the watersheds of Copalita-Zimatán-Huatulco and Coyula (hereafter referred to interchangeably as ‘the landscape’ or as the ‘CZH watersheds’). It covers an area of 268,023 ha within 20 municipalities, with 854 villages, and boasts high rates of endemism (WWF, 2009, Figures 1, 2, 3)). Of the 34 vegetation types country-wide, 26 are present in this landscape (WWF, 2009). The area’s exceptional altitudinal range – from sea

level to 3,500 m – contributes to it being considered a unique centre of endemism with dry forest habitats, but also cloud forest and mangroves all being found in this ecoregion. Inland, the high peaks of the NW Sierra Madre represent a mix of pine-oak forest, dominated by Mexican weeping pine (*Pinus patula*), Oaxacan pine (*P. oaxacana*), Mexican yellow pine (*P. oocarpa*), Pringle’s pine (*P. pringlei*), smooth-bark Mexican pine (*P. pseudostrobus*), teocote (*P. teocote*), sycamore (*Platanus spp.*), Oaxacan Douglas fir (*Pseudotsuga mensie-zii var. oaxacana*) among others. The dry forests are important for several endangered and endemic species, such as the Sinaloa Wren (*Thryothorus sinaloa*), the Golden-cheeked Woodpecker (*Melanerpes chrysogenys*) and the West Mexican Chacalaca (*Ortalis poliocephala*), as well as numerous marine mammals that transit the coastline, such as the Pygmy and False Killer Whales (*Feresa attenuata* and *Pseudorca crassidens*) and the Long-finned Pilot Whale (*Globicephala macrorhynchus*) (Ramsar website). The vulnerable leatherback turtle (*Dermochelys coriacea*) can also be found here. Ocelot (*Leopardus pardalis*), margay (*Leopardus wiedii*), bobcat (*Lynx rufus*) and jaguar (*Panthera onca*) are among the many mammals sharing this territory.

In the year 2000, WWF Mexico conducted an ecoregional assessment of the coastal mountains of Oaxaca which led to the prioritisation of the CZH watersheds. This landscape straddles two ecoregions: ‘Mexican Dry Forests’ and ‘Mesoamerican Pine–Oak Forest’, defined by WWF’s Global 200, an attempt to identify a set of ecoregions whose conservation would achieve the goal of saving a broad diversity of the Earth’s ecosystems (Olson and Dinerstein, 2002).

The unique biological diversity present in this landscape is matched by a unique cultural diversity, with indigenous communities from the Zapotec and pre-Mayan Chontal civilisations living here and human presence traced back 15,000 years (Danver, 2015). They live in eight out of the 20 municipalities in the landscape and have their own customs related to land use and a century-long relationship to nature. Their main economic activities are collection of seashells, agriculture and tourism. In the upstream portion of the landscape where more forests are present, the main activity is timber production and carpentry specifically in the municipality of San Miguel Suchixtepec.

Threats to the landscape include deforestation, fire, advance of the agricultural frontier, slash and burn on steep slopes for maize cultivation, reduction in water availability, sedimentation of coastal zones, unplanned tourism activities and water contamination from domestic, urban, industrial and agricultural sources. Water quality and quantity are significant challenges, but so is its equitable distribution.

Climate change is exacerbating local populations’ vulnerability notably by further limiting water availability. Pine and mesophyll forests in the upper and middle watershed have been the most affected with a 3.9% loss between 2000 and 2005, followed by tropical dry forests (a loss of 2.5% in the same period) and mangroves at 1.8% loss (Martínez-Pacheco, 2010). The lower watershed is more urbanised than the upper stretches, and has been heavily modified by tourism development at Bahías de Huatulco which receives about 300,000 visitors per year.

THE COPALITA-
ZIMATÁN-HUATULCO
WATERSHEDS
COVER AN AREA OF
268,023 HA WITHIN
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RATES OF ENDEMISM.

**EMBEDDED IN
WWF'S FRESHWATER
PROGRAMME, THE CZH
PILOT PROJECT AIMS
TO DEMONSTRATE
THAT IT IS POSSIBLE TO
BALANCE WATER USE
AND CONSERVATION.**

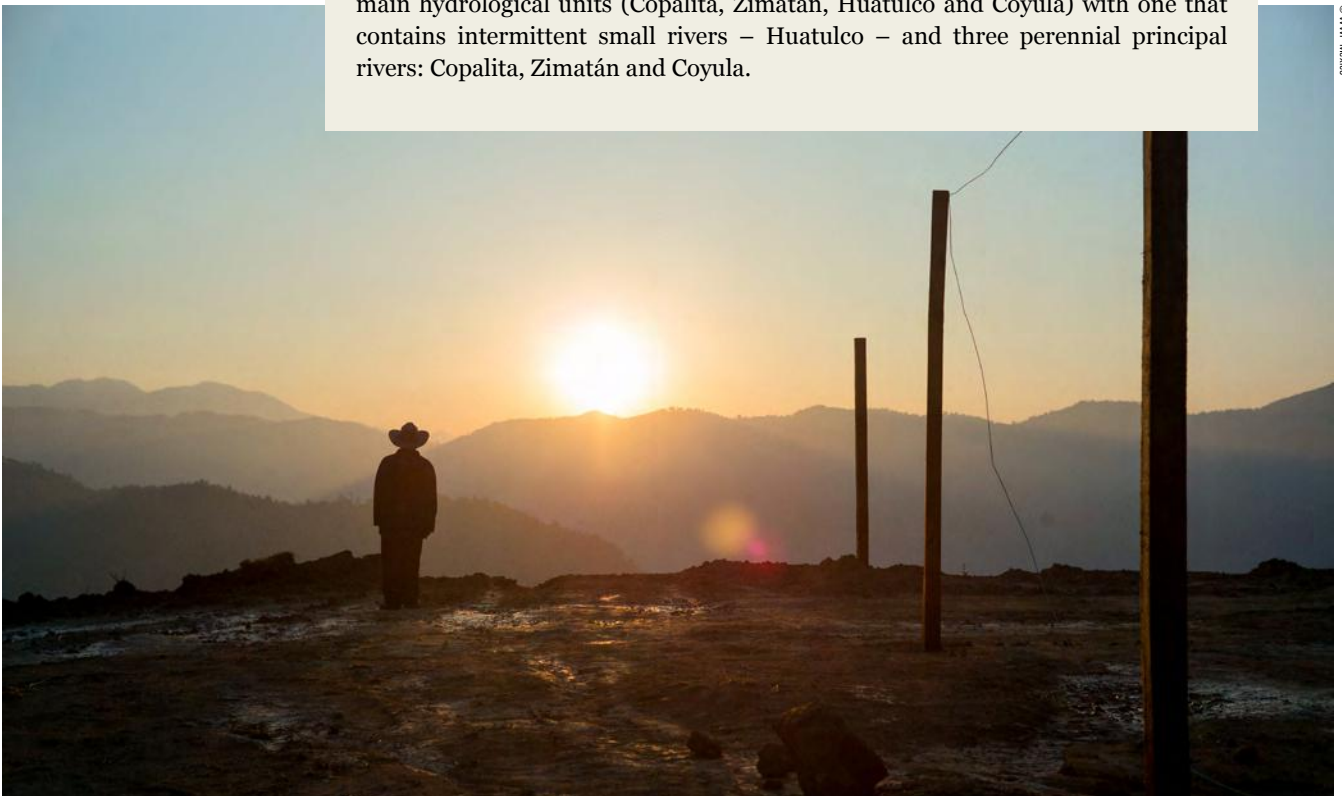
Embedded in WWF's Freshwater Programme, the CZH landscape is part of a wider programme covering three basins that aims to demonstrate that it is possible to strike a balance between water use and conservation. The effort in these watersheds builds on WWF Mexico's initial work in the Río Conchos basin in Chihuahua State. The lessons learned and successful results from CZH watersheds were also transferred to San Pedro Mezquital. The knowledge and experience achieved in these 'model' basins were the cornerstones of both the Mexican Environmental Flow Standard and the Programa Nacional de Reservas de Agua (National Water Reserve Programme).

Interpreting the landscape and watershed

Watersheds are "areas of land that drain all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel" (USGS website). A watershed often presents with similar features as a landscape and thus, frequently, the two can be equated. Various altitudinal gradients can typically be found in a watershed with activities upstream having significant impact downstream.

The term landscape may not necessarily be defined by its size, as it has ecological, political and socio-cultural dimensions. Thus, a landscape can be defined 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" (Chatterton *et al.*, 2016). Thus, a landscape contains heterogeneous characteristics and land-uses but the main drivers influencing its overall functioning contribute to its practical delineation.

In the context of this report, the 'landscape' encompasses the watersheds of four main hydrological units (Copalita, Zimatán, Huatulco and Coyula) with one that contains intermittent small rivers – Huatulco – and three perennial principal rivers: Copalita, Zimatán and Coyula.



The landscape

Figure 1.
Location of the landscape
in Oaxaca state.

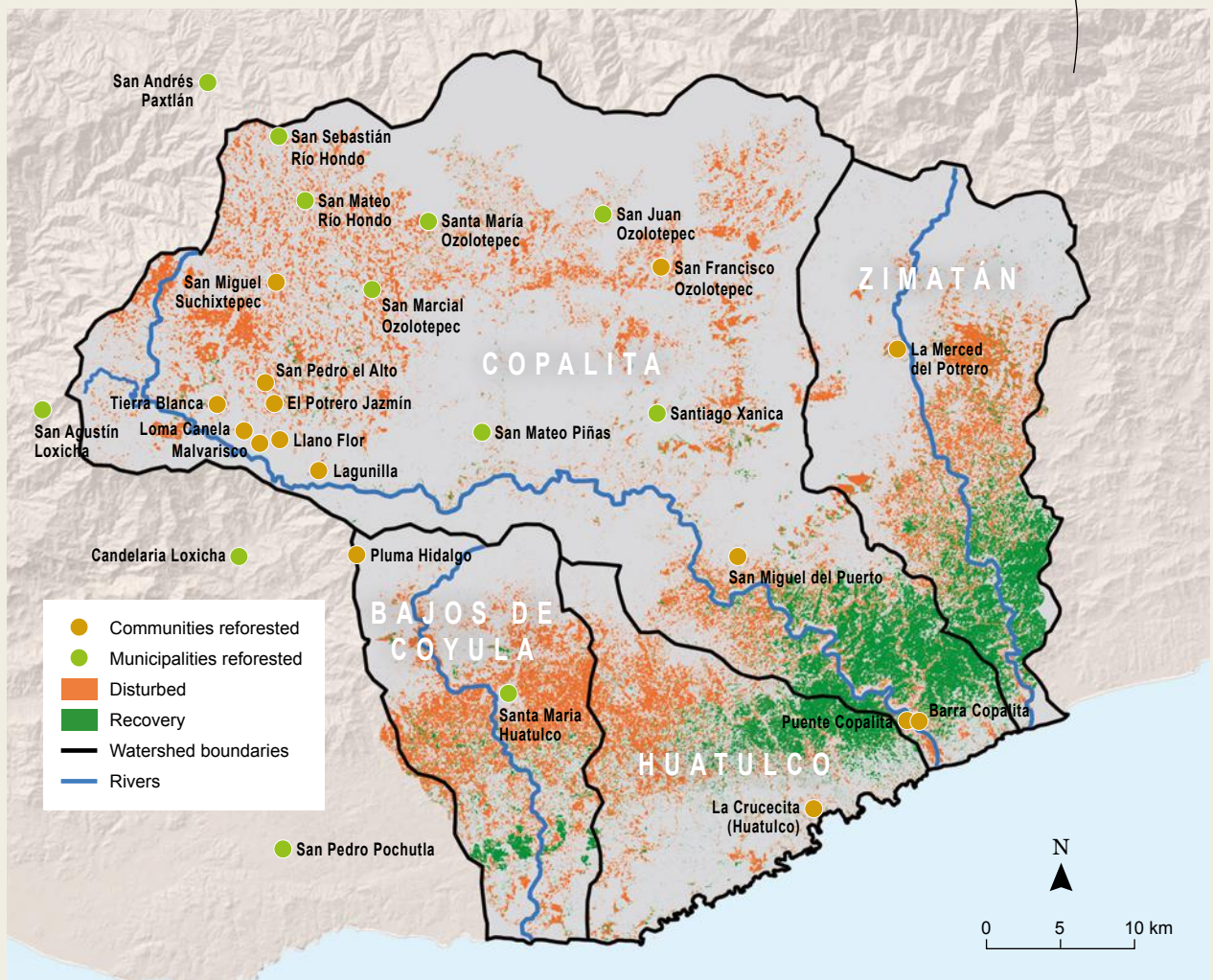


Figure 2. The CZH watershed and soil degradation stages : disturbed (red), recovery (green), unchanged (grey).

↓ Upper



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↓ Middle



© D. Vallauri

↓ Lower



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Figure 3. The Copalita-Zimatán-Huatulco watershed in a few images.

PROJECT PHASES

WWF began work in these watersheds already in 1997 when it undertook a dry forest conservation project. In 2004, a seven-year project was approved with the Fundación Gonzalo Río Arronte (FGRA) which has since continued to this day. A total of three phases can be identified, with the French cosmetics company, Caudalie, also supporting the third phase (see Table 1).

Facing a complete dearth of up-to-date information on the CZH watersheds, the first phase of WWF's intervention was to collect data – both biological and socio-economic. This provided a solid foundation for future work in the next phases of the programme. The main objective under this first phase was to ensure that Mexican society could support the wise use of water through an integrated river basin approach that meets the needs of vulnerable people, while restoring and conserving water resources. Key activities included: research on environmental flows (González-Mora *et al.*, 2009) and better understanding the socio-economic context. At this stage, participatory monitoring systems were also designed. Relationships with several partners – public and private – were established. For example, in order to develop a management plan for the watershed, a partnership was initiated with three levels of government, from communities, up to the federal level. Pilot projects were started in the upper watershed, and later with more experience and community consensus, in the lower altitudes. Awareness raising campaigns were begun.

The second phase was to consolidate and replicate achievements from the first phase. This phase emphasised: 1. determining sustainable water balance, taking into account the environmental flows for each watershed; 2. strengthening water governance through active participation of different stakeholders in the watershed committee; 3. improving the recognition of forest and river environmental services by beneficiaries and producers; 4. securing water for rural communities, through its sustainable management and implementation of eco-technologies; and 5. communications.

A milestone in this phase was the approval by the Ramsar Convention's 12th COP of Resolution XII.12 proposed by Mexico calling on "action to ensure and protect the water requirements of wetlands for the present and the future". That initiative was created and promoted by CONAGUA, CONANP and the Alliance WWF-FGRA based on the 'Programa Nacional de Reservas de Agua'.

The third and current phase was intended on the one hand to consolidate work to date, and on the other to continue addressing threats and enhance restoration work for the benefit of people and nature, in order to achieve water security and biodiversity conservation. Specific objectives for this 2016-2020 phase are to: 1. recover soil, forest cover and water infiltration to maintain the ecosystem services by producing 335,000 plants (of native species) per year; 2. reduce the impact of the main threats to the forest: conventional agricultural and livestock activities within the watershed; 3. strengthen three community-based companies that produces native plants for each types of forest in the watershed; and 4. improve ten rural communities' production practices for their social and economic benefit. Agroecological practices have been promoted in this phase as a sustainable solution to the twin goals of biodiversity conservation and food production.

A TOTAL OF THREE PHASES CAN BE IDENTIFIED, STARTING IN 2004, WITH THE SUPPORT OF THE FUNDACIÓN GONZALO RÍO ARRONTE.

Table 1. Programme phases.

Phases	Objectives	Related event
<p>Phase I 2004-2011</p> <p>Development of new models to manage water basins</p>	<p>The Alliance WWF-FGRA was established. It aimed to bring local communities into an integrated watershed management model, using three basins – one of which is CZH (funded by Fundación Gonzalo Río Arronte, I.A.P. (FGRA)).</p> <p>The overall objective was to “Ensure that citizens support the rational use of water through a comprehensive watershed management that incorporates and satisfies the needs of the least favoured – while restoring and conserving natural sources of water.” Five priority strategies were: 1. Recognition of the environment in the administration of water and territory, 2. Water governance in the basin, 3. Environmental services assessment, 4. Strengthening of rural communities and 5. Recognition of belonging to the basin and the importance of its conservation.</p>	<p>2011. Bonn Challenge on FLR</p>
<p>Phase II 2012-2016</p> <p>Consolidation and replication</p>	<p>This consolidation phase was also funded by FGRA. The overall objective was to “Consolidate water management based on sustainable extraction that considers the necessary reserves for ecosystems, efficient use based on demand management and equitable access to the resource with informed participation and support from society, and public investment that ensures its continuity and sustainability”. Five strategies in this phase were: 1. Sustainable hydrological balance; 2. Water governance; 3. Environmental services assessment; 4. Water for rural communities; and 5. Communication.</p>	<p>2014. New York Declaration on Forests</p> <p>2014. Mexico commits to restore 8.47 million hectares by 2020 under the Bonn Challenge and the Initiative 20x20</p> <p>2015. Ramsar Convention, 12th COP – Resolution XII.12 “Call to action to ensure and protect the water requirements of wetlands for the present and the future”.</p>
<p>Phase III Mid 2016-2020</p> <p>Water, reforestation and innovative agriculture</p>	<p>In the current phase, the intention is to improve water security in Mexico through a national strategy and a network of 300 water reserves for environment (funded by FGRA). The strategies are: 1. Implementation of the National Water Reserves Programme, 2. Consolidation of the Alliance model (3 model basins) and 3. Appropriation of water reserves for the environment by society. At the same time, a related project (funded by Caudalie) aims to reforest pine and mesophyll forest, riparian forest and dry forest (over 1 million trees planted), while improving agricultural and livestock practices enhancing the local capacities of rural communities to recover the ecosystem services that the forest provides for people and biodiversity in the CZH watersheds.</p>	<p>2017. Updating water reserves proposal for Copalita, Zimatán and Coyula rivers, in order to meet the Ramsar Convention’s Resolution XII.12.</p>

IMPLEMENTATION: ACTIVITIES & RESULTS

Activities in the landscape were designed to achieve wider landscape scale results, and in particular to connect key forest areas across the landscape and reduce erosion and sedimentation.

Activities (Table 2)

Data collection

In the first phase, several surveys were carried out to collect baseline data and better understand the challenges faced by the watershed and its people. Twenty categories of land uses were thus defined, including dry forest, coffee growing regions and deforested zones. Through this exercise, six priority municipalities were identified based on both environmental and socio-economic criteria: San Miguel Suchixtepec, San Pedro el Alto, San Marcial Ozolotepec, San Pedro Pochutla, Santa María Huatulco and San Miguel del Puerto. In the upland municipality of San Miguel Suchixtepec – an 8,450 ha area inhabited by 2,694 people – participatory zoning and land use planning was undertaken using GIS mapping. As a result, 25 landscape units were identified and for each, five parameters were monitored: hydrological affinity index, slope, anthropic activity, environmental impact and vegetation cover. A first ecological study of freshwater biodiversity was undertaken in order to have sufficient information and eco-hydrological understanding to determine environmental flows. Furthermore, policies affecting land use were identified and analysed in this first data collection phase.

Agriculture

Organic production was promoted through the project, in particular the use of composting, bio-fertilisation and eco-silvopastoral practices. Local communities were trained and began to practice agro-ecological methods for the production of maize under milpa, fruits, tomatoes and coffee. Alternative agricultural practices have been promoted, including for shade grown coffee (*Coffea arabica*), avocado (*Persea americana*) and vanilla (*Vanilla planifolia*). The coffee plant has been grown in the middle part of the watershed for over 60 years. Agricultural improvements centred on biological fertilisation. Technological innovations related to agro-ecology started already in 2014, but it is not until the third phase that they were properly tested in the field and systematised. For example, in the middle watershed bio-fertilisation and mycorrhizal application have been promoted. Local communities have been trained in these practices in the middle and upper reaches of the watershed.



Shade grown coffee

Reforestation

Reforestation was a priority at two levels: in the higher grounds to reduce erosion and also along the banks of the rivers to protect more directly the watercourse. Nurseries were established, notably by the Río Molino group in 2004 in the upper watershed. Production of saplings in the nursery Río Molino was increased substantially at the start of the project. The group evolved and decided to legally establish itself as 'Alternativa Agrícola Suchixtepec'. Seeds were collected from local native trees and germinated in the nursery. Saplings that reached 20 cm were then used for reforestation. Active reforestation activities were undertaken in Zemialtepec and Suchixtepec. For example, in 2011, 8,000 trees were planted along the Copalita river to protect river banks. With additional fund-



**DRY FOREST TREES
ARE MORE DIFFICULT
TO PROPAGATE, BUT
IMPROVEMENTS IN THE
NURSERY ALLOWED
THE POTENTIAL
PRODUCTION OF
150,000 SAPLINGS
PER YEAR.**

ing from Caudalie as of 2016, the nursery run by the Alternativa Agrícola Suchixtepec was expanded and production of saplings intensified, with 240,000 pines and oaks produced each year. By 2018, four municipalities in the upper watershed were engaged in tree planting: San Mateo Río Hondo (25,100 plants), San Sebastián Río Hondo (125,000 plants), San Miguel Suchixtepec (39,900 plants) and San Pedro el Alto (50,000 plants). In this phase, human urine from the dry ecological bathrooms was used as foliar fertiliser for its contents of 3 g of nitrogen, 2 g of potassium, 1.5 g of sodium and 0.82 g of phosphorus per litre. The dose used was 3 litres of fresh urine per 15 litres of water. Pest and disease control were carried out manually. To control the fungus attack (*Fusarium sp.*) the humidity of the nursery was lowered by reducing the irrigation and managing solar radiation using shade mesh.

In the middle part of the watersheds, the organisation 'Unión San Pedro para la Agricultura Sostenible 100 Sombras (USP)' established eight nurseries in three communities (Tierra Blanca, Malvarisco and Lagunilla) to produce 60,000 plants per year, of both coffee and shade tree plants, which are resilient to climatic variation. Control of fungi was done using organic means with Bordelés Broth and Sulfocalcium Broth. Bio-fertilisers enriched with mineral salts or ground rock meal were also used.

Dry forest plants are more difficult to produce, but improvements in the nursery have signified that as of 2016, 75,000 saplings of diverse dry forest species are being produced organically and with the potential for cultivation twice a year, by Los Macuiles Copalita. A nursery was established in that year, and the development of the plants was carried out in recycled and biodegradable plastic bags. The plants were cultivated without agrochemicals, using soil from the forest and natural fertiliser. A communal seed collection campaign was carried out, called 'Semillatón', in which schools, government agencies and hotels participated. In order to have the necessary materials, a massive collection of plastic was proposed to later be recycled and converted into biodegradable nursery bags.

The municipality authorities, associations, committees, social and private owners, students and the general public received the plants as a donation from WWF and Caudalie, and they pledged to reforest the plots without financial remuneration. They prepared the soil and sites to reforest the land.

Producing dry tropical forest species seedlings in a brand new nursery maintained by Los Macuiles Copalita



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Participatory management

Several spaces under the federal legal framework, have been created to encourage and promote participatory management (see section on governance below). In the coffee zone in the municipalities of San Pedro el Alto and Santiago Xanica, a first inventory identified 60 springs, of which 23 were characterised in more detail using GIS mapping and two communities signed an agreement to co-manage the water spring. In San Miguel Suchixtepec, the Centre to Sustainably Manage Water ('Centro de Manejo Sustentable del Agua' (CMSA)) was established in 2012 by young professionals, who later combined forces to form the association 'Mbis Bin Semilla para la Siembra', in order to ensure better water management for rural communities. These successful participatory experiences in CZH have since been shared with other watersheds.

Participatory monitoring

The international programme 'Global Water Watch' – a network that aims to foster watershed stewardship through the development of citizen volunteer monitoring of surface waters to improve both water quality and public health – provided training to WWF technicians as well as community leaders. This was later extended to youth groups who were directly involved in monitoring of physical, chemical and bacteriological data.

Awareness raising

Several awareness raising and engagement activities have taken place. For example, in 2009, 272 community members were trained in the wise use of water under the MUSA process (models of sustainable water use) developed by WWF. It included improving waste management and agricultural production. In the lowlands this focused on the communities of Bajos del Arenal, Barrio La Guadalupe, Bajos de Coyula and Bahía de San Agustín, while in the highlands, in the community of San Miguel Suchixtepec. Awareness raising efforts were undertaken with the coffee producing communities in the middle watershed, notably through the cooperative 'Los Productores de Café La Trinidad S.S.S.' present in the seven communities of Los Naranjos Esquipulas, Loma Canela, Llano Flor, Malvarisco, Tierra Blanca and Lagunilla from the municipality of San Pedro el Alto and Santiago Xanica. In 2013, La Trinidad evolved into a new and proactive organisation: USP, but only with San Pedro el Alto communities. As a result, a growing amount of the coffee production here is cultivated under shade with agroecological practices, certified as organic and sold at a premium in more discerning markets.

Meeting and training with local people



© Mbis Bin

Reducing water pollution

To improve water quality under the MUSA, water filters were installed at the level of households. Dry toilets were also installed and are rapidly being adopted. The local development of water filters has also served to generate jobs. Regular clearing activities around water springs and wells have been undertaken to reduce sediments and debris entering the water.

Table 2. Key activities by phases.

Dates	Key activities
<p>Phase I 2004-2011</p> <p>Development of new models to manage watersheds</p>	<ul style="list-style-type: none"> • Land use change analysis (2000-2005 data) – later updated in 2010 • A workshop held with 18 watershed experts to do a rapid analysis of the situation • A nursery was established in the upper watershed, conducted by the Río Molino organisation that later became Alternativa Agrícola Suchixtepec • Criteria were developed to define and implement demonstration water projects for rural communities • Reforestation efforts were started with native plants, especially in the upper part of the basin • A first evaluation of base flows was undertaken in 19 sites • A working group was set up with the Universidad Nacional Autónoma de México (UNAM)'s Institute of Biology to monitor biodiversity and watersheds health. • Analysis of water management and treatment for rural communities • Establishment of the models of sustainable water use (MUSA) including water treatment facilities in houses and in schools • A monitoring system (SISMOC C-Z-H) was set up on the perceptions and participation of communities. • Five rural communities, living both along the coast and in the mountains, were approached to engage in the project
<p>Phase II 2012-2016</p> <p>Consolidation and replication</p>	<ul style="list-style-type: none"> • Securing legal changes to provide for recognition of water reserves and contributing to the establishment of a Mexican Environmental Flow Standard • Proposal to create water reserves in five hydrological basins in CZH watersheds (based on flows required by both species and people) • Strengthening of watershed committees • Consolidation of MUSA in houses and schools and launching of MUSA in agricultural projects • Strengthening of Alternativa Agrícola Suchixtepec as an organic farm and pine nursery • Programa Arbolotón was created to support and spur reforestation effort along the watersheds • Tree planting was mainly done in the upper watershed and along the Copalita river banks • Creation of Mercado Orgánico Huatulco (organic market for agricultural products from the landscape)
<p>Phase III 2016-2020</p> <p>Water, reforestation and innovative agriculture</p>	<ul style="list-style-type: none"> • Consolidation of tree nurseries and reproduction techniques at all three levels (upper, middle and lower) of the watershed by local and indigenous community companies • Expansion of tree planting to the upper, middle and lower watersheds (including riparian forest), with organically produced native species • Technical evaluation on reforestation (plant survival and growth) • Capacity building in agroecological practices focused on local and indigenous farmers • Implementation of agroecological innovation projects strengthening MUSA • Development of agricultural alternatives (coffee, vanilla, avocado, citrus...) • Strengthening collaboration with 11 municipalities • Involvement of stakeholders in participatory management in forest restoration and conservation of biodiversity in the landscape • Updating the water reserves for environment and people

Results (Table 6)

Water

Water quality has improved as measured in several sites along the three watersheds. During first phase of the project, two volunteer teams were established to monitor water quality in 15 sites, using the Global Water Watch system. The results show a higher oxygen concentration in upper watershed sites (7.3 mg/L) than the lower ones (6.7 mg/L). The turbidity shows the opposite trend: less turbidity (12.2 JTU) in upper sites than the lower ones (14.0 JTU). In the case of *Escherichia coli*, the coliform bacteria, the mean for the upper sites was 1.2 MPN/100 mL in contrast to 691.1 MPN/100 mL for the lower sites. The general trend is what is expected in these kinds of landscapes since the upper watershed has less pressure than the lower zone due to the intensity of human activities. However, bacterial contamination indicates a large difference, of three orders of magnitude, which denotes rivers more contaminated by wastewater drainage without treatment in the lower part of the basin.

Over the course of the project, demand for dry toilets has expanded. It has led to reduced water pollution mainly in the upper part of landscape with rural communities and resulted in increased employment opportunities as well. During the entire project 280 dry toilets and 204 biofilters for grey waters were built in houses and schools, which effectively diminished pollution.

Seven municipalities with 29 communities are implementing MUSA activities, thanks to which, each year water consumption is reduced by 76,000 m³, 8,600 m³ of water are treated through biofilters, 6,200 m³ of water are re-used and 700 m³ are stored.

**BALANCING HUMAN
WATER UPTAKE,
REDUCTION OF RIVER
POLLUTION AND
WATER PROVISION
FOR SPECIES HELPS
TO MAINTAIN BOTH
PEOPLE'S WELL-BEING
AND ECOSYSTEMS.**

The Copalita river at the bottom of the watershed.



© WWF Mexico

THE PROPOSED ANNUAL ALLOCATION OF 880 MILLION CUBIC METRES FOR THE INTEGRITY OF THE ECOSYSTEMS AND WATER SECURITY FOR PEOPLE IS PENDING FEDERAL ENDORSEMENT.

The holistic approach for determination of environmentally friendly flows resulted in the proposed annual allocation of 875 million cubic metres (62% of mean annual runoff) for 'water for nature' (González-Mora, 2013) – i.e. water reserves for the function and integrity of the ecosystems of CZH landscape. Further to a review carried out in 2017 as part of the work of the Alliance WWF-FGRA in the Consejo de Cuenca de la Costa de Oaxaca, an annual volume of 5 million cubic metres was added for guaranteeing the population's human right to water until 2070. These proposals were ratified by the Consejo de Cuenca and are awaiting CONAGUA's endorsement (and a final federal decree).

With the knowledge obtained in CZH and the other 'model' basins, the Mexican Environmental Flow Standard was approved in 2012. This was a significant step in ensuring the protection of water courses throughout the country. The three basins that the Alliance WWF-FGRA focused on served as a practical demonstration of the significance of securing environmental water flows but also of the feasibility of engaging communities in ensuring sustainable water flows.

In 2017, the environmentally friendly flows studies were updated and a corresponding proposal for water reserves was added with the annual volumes to guarantee the human right to water. Also, the proposal included another two watersheds in the Coast of Oaxaca.

Agricultural practices

Agricultural practices have improved with more integrated approaches and agroecological practices being applied in the landscape, in specific demonstration sites, in order to reduce threats on forests. In total, 13 innovation plots have implemented Models of Agroecological Innovation (MIA, in Spanish): four MIA plots of maize and four of avocado were established in San Miguel Suchixtepec, while the rest were implemented in coffee agroecosystems in San Pedro el Alto. An area of 134 ha produces certified coffee. Unión San Pedro has secured that 74% of its coffee production plots are organically certified. The total area for MIA and certified plots is 151 ha. MIA plots include efficient use of water through drip systems, recycling water, application of soil microorganisms and organic fertilisers. A notable example is the organisation Alternativa Agrícola Suchixtepec which was set up to promote sustainable and integrated agricultural practices. Originally a nursery, today it is a comprehensive organic farm as well as a tree nursery. Through improved land, forest and water management systems, this organisation, Mbis Bin Semilla para la Siembra and other farmers of Guitani have demonstrated tangible results such as the use of rain water to reduce water extraction from the watershed and improved agricultural practices reducing water consumption by 64%, mainly in avocado crop. The MIA has also demonstrated that economic benefits can be achieved by farmers through agroecological practices. The cost of conventional corn production is 12,900 pesos per hectare, 500 kilogrammes of fertiliser are used and the yield is 600 kg. In the production system with agroecological practices and fractional fertilisation, the production cost is 8,600 pesos per hectare, with a saving of 33%, reducing fertilisers by 70% and with a harvest of 800 kg of corn (33% increase in the production). In conventional avocado cultivation, production cost is 231 pesos per plant in the first three years while with agroecological management, production cost is 94.8 pesos; the savings correspond to 59%. In one of the MIA plots of the USP organisation, a micro-batch of coffee evaluated as high quality in the cup was obtained and 368 kg of coffee were sold at a price of 68 pesos, 41% more than the price of conventional coffee. Also, 10 tonnes of coffee were sold to a Canadian purchaser at 55 pesos per kg, while the price of conventional coffee was set at 40 pesos per kg. Thus, a 27% gain was obtained thanks to the agroecological management.

Experimental farm to test agricultural alternatives



© WWF Mexico

Reforestation

In CZH watersheds, forest restoration work started with the Alliance WWF-FGRA in 2005. In the period between 2005 and 2015 (phases I and II) the efforts were focused in the upper part of the watersheds with nursery Río Molino (later Alternativa Agrícola Suchixtepec) reforesting only temperate forest with three pine species *Pinus patula*, *P. pseudostrobus* and *P. ayacahuite*. During this period 1,527,100 pines were produced and 1,400 ha were planted across seven municipalities (see Table 1).

During phase III (period 2016- 2020), reforestation activities funded by Caudalie enabled 10 plant nurseries to be operational: one with Alternativa Agrícola Suchixtepec, eight with USP and one with Los Macuiles Copalita. Overall, they have a capacity of 500,000 seedlings. Overall, the partners produced 1,107, 971 plants for reforestation of 1,225 ha across all three watershed levels during these four years.

In total, during the three phases, the reforestation covered 2,625 ha across 18 of CZH's 20 municipalities. In the historical series, 2017 and 2018 were the most active years with 385,310 and 365,000 plants produced, respectively (Figure 4, 5 and Table 3). A total of 27 different tree species were planted (Table 4). These were all produced organically, without contaminating the soil and water, and without jeopardising the health of the farmers.

A total of 998 community members from 14 different municipalities (representing upper, middle and lower parts of the watershed) were actively engaged in tree planting by 2018. The reforestation in the CZH landscape has achieved the highest coverage in the upper part and the lowest one in the lower part of the landscape. Detailed monitoring enabled measurements of survival rates for restored saplings (see Table 5). In San Miguel Suchixtepec for example, reforestation of 187 ha has secured 14 water sources which are vital to 2,500 people. Practices have been improved and there is a recognition and pride in the importance of using native species.

In phase III, survival studies were conducted for the reforested plants within the three levels of the watershed. The survival of pine *P. patula* was evaluated in the upper watershed's temperate forest; while in the middle watershed, survival of *Coffea arabica* in coffee agroecosystems was assessed and in the lower watershed's dry tropical forest, survival of *B. alicastrum* was assessed (see Table 5).

27 DIFFERENT TREE SPECIES WERE PLANTED, ALL PRODUCED ORGANICALLY TO CONSERVE WATER QUALITY.

Table 3. Total number of plants produced and reforested area in hectares (2005-2019).

Who and where ?		Watershed level	Total number	
			Number of plants	Area reforested (ha)
Who is producing seedlings?	Río Molino/Alternativa Agrícola Suchixtepec	Upper	2,227,100	
	Unión San Pedro	Middle	192,380	
	Los Macuiles Copalita	Lower	215,591	
Where are trees planted?	San Miguel Suchixtepec	Upper		883.1
	San Agustín Loxicha			427.0
	San Mateo Río Hondo			221.5
	San Pedro el Alto			118.4
	San Juan Mixtepec			4.0
	San Juan Ozolotepec			47.6
	San Marcial Ozolotepec			92.0
	San Andrés Paxtlán			12.7
	Santa María Ozolotepec			73.5
	San Francisco Ozolotepec			73.3
	San Sebastián Río Hondo			132.5
	Santiago Xanica			3.5
	San Pedro Pochutla (Los Naranjos Esquipulas)			7.5
	San Pedro el Alto		Middle	
	Pluma Hidalgo	Middle /Lower		111.4
	San Mateo Piñas			4.9
	San Miguel del Puerto	Lower		124.9
	Candelaria Loxicha			6.7
San Pedro Pochutla			41.8	
Santa María Huatulco			46.5	
Total			2,635,071	2,625.3

Figure 4. Number of seedlings produced in CZH per year for the period 2005-2019.

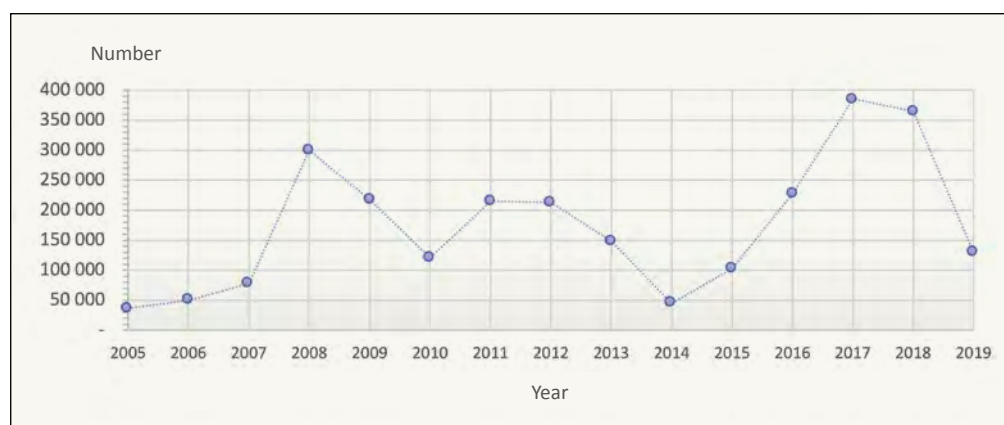


Table 4. Species diversity used in tree plantings. Overall 27 different species were grown in nurseries and planted.

Species	Local common name	Vegetation Type	Watershed level
<i>Pinus patula</i>	Pino patula	Pine oak forest	Upper
<i>Pinus pseudostrobus</i>	Chamite		
<i>Quercus rugosa</i>	Encino negro		
<i>Quercus laurina</i>	Encino blanco		
<i>Senna pallida</i>	Cuachepil		
<i>Alnus acuminata</i>	Palo de águila		
<i>Inga paterno</i>	Cuil de machete	Mesophyll forest	Middle
<i>Inga jinicuil</i>	Cuil		
<i>Bursera simaruba</i>	Palo mulato		
<i>Enterolobium cyclocarpum</i>	Guanacastle		
<i>Leucaena esculenta</i>	Guaje rojo		
<i>Nectandra sp</i>	Aguacatillo		
<i>Matayba scrobiculata</i>	Huanchal		
<i>Cecropia peltata</i>	Guarumbo		
<i>Coffea arabica</i>	Café		
<i>Cedrela odorata</i>	Cedro		
<i>Swietenia macrophylla</i>	Caobilla		
<i>Swietenia humilis</i>	Caoba		
<i>Ceiba pentandra</i>	Ceiba		
<i>Caesalpinia ébano</i>	Ébano		
<i>Gliricidia sepium</i>	Cacahuananche		
<i>Caesalpinia platylobatodo</i>	Cuapinol		
<i>Tabebuia chrysantha</i>	Guayacán		
<i>Cordia elaeagnoides</i>	Cordia, ocotillo		
<i>Brosimum alicastrum</i>	Ramón		
<i>Tabebuia impetiginosa</i>	Macuil serrano		
<i>Salix humboldtiana</i>	Sauce	Riparian forest	

Table 5. Survival rate (%) in upper, middle and lower reaches of CZH watersheds.

Watershed	Species	Survival rate after one year (%)	
		Mean	Standard deviation
Upper	<i>Pinus patula</i>	91.3	0.02
Middle	<i>Coffea arabica</i>	94.5	3.05
Lower	<i>Brosimum alicastrum</i>	91.2	1.19

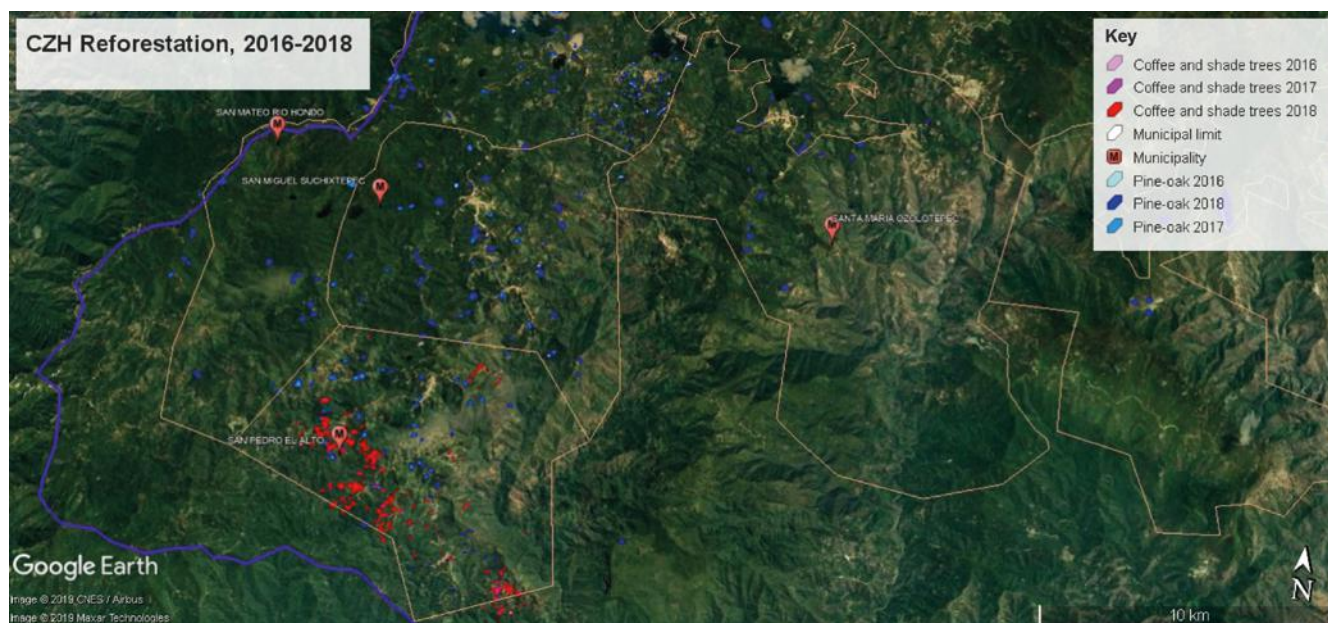


Figure 5. Monitoring reforestation in CZH landscape in 2016-2018. Upper and middle watersheds. Each polygon is a single, documented plantation (number of plants, species planted, growth). Information visualised on Google Earth.

Livelihoods

The entire project has reached 6,433 direct and 22,196 indirect beneficiaries. In the third phase alone 3,700 direct beneficiaries and 7,200 indirect beneficiaries were reached, with their wellbeing improved as measured according to the five fundamental capitals according to the sustainable livelihoods framework: social, human, natural, financial and physical capital.

In the first two phases of the project, 29 communities were incorporated into the conservation and management of water and forests in the CZH landscape. In these phases, collaboration centred on three producer organisations and Mbis Bin was created as an organisation for technical assistance.

In the third phase, work focused on 10 communities that were trained in agroecological practices and better use of water for production. The communities improved their human, social, natural, physical and financial capitals. In this phase, four organisations and three groups of producers were established, Mbis Bin was strengthened and Los Macuiles was created for the production of native plants in the lower part of the watershed and also to provide technical assistance. In addition, these organisations, especially Mbis Bin, Alternativa Agrícola Suchixtepec and Los Macuiles Copalita participated in the Comité de Cuencas de los ríos Copalita-Tonameca (Watershed Committee of Copalita-Tonameca), the governance group for CZH landscape.

A total of 280 dry toilets and 204 biofilters were built, with great impact on the lives of the inhabitants of the CZH watersheds, especially in schools. Mbis Bin managed to build its office, with workspace, a boardroom, agricultural supplies store, demonstration space for MUSA and an organic orchard. The infrastructure of the partner organisations in the CZH watersheds has been improved thanks to their efforts with federal and state government institutions, through projects, or by the investments of the members who have used their profits to improve the infrastructure.

TRAINING COMMUNITY MEMBERS TO IMPROVE LIVELIHOODS WAS INCORPORATED IN THE PROGRAMME FROM THE START.

The 29 communities in the CZH watersheds have been empowered to take decisions. The project provided demonstration and pilot sites presenting new and improved practices but enabled and empowered communities to adapt and adopt those practices at their own pace and according to their own needs. Thus, five new cooperatives were established, notably by women, using their own initiative, but based in these new approaches that they integrated into their livelihood practices.

Table 6. Key results.

Type	Key performance indicators	Results
Forests	Total area planted (2004-2019)	2,625 ha
	Number of operational tree nurseries (in 2019)	10
	Number of seedlings produced by the nurseries (2005-2019)	2,635,071
	Number of native species being reproduced in 2010 / 2016 / 2019	3 (pine species) / 16 / 27
Water for nature and people	Proposal for an annual target volume of flowing water for nature plus people (millions of m ³)	880
	Ratio of flow for nature with respect to the average annual runoff	62%
	Perceptions of watershed and social participation in San Miguel Suchixtepec, San Pedro el Alto, San Miguel del Puerto and Santiago Xanica through the scoring proposed by SISMOC methodology	From 5.8 to 8.3 (out of 10)
	Reduced water use in irrigation at San Miguel Suchixtepec	By 64% (from 1,296,000 to 835,200 m ³ per year)
Management and governance	Supporting and lobbying for new legislation	In 2012 the passing of a Mexican standard on defining environmentally friendly flows in watersheds
Income generating activities	Tons of tomatoes produced with organic methods (2009-2019) per year	3
	Coffee under shade (ha)	183
	Coffee under shade with organic certification (ha)	135
	Number of agricultural alternatives tested and introduced (innovation)	13
	Number /surface of innovation parcels	26 / 17 ha
	Number of beneficiaries, direct / indirect	6,433 / 22,196

PARTNERS AND MAIN ACTORS

Several partners have collaborated with WWF over the years from public authorities, to local community organisations, research bodies and other NGOs.

One strength of the programme has been to facilitate the emergence of new local organisations led by a generation of young professionals that are well trained and dedicated.

Federal and state actors

CONAGUA – ‘Comisión Nacional del Agua’ (National Water Commission). An MoU was signed to formalise collaboration nationwide. Their ‘Organismo de Cuenca Pacífico Sur’ (Pacific office) is involved in measuring water quality and quantity (flows). CONAGUA is the federal institution that serves as the technical secretary of the Watershed Committee.

CONANP – ‘Comisión Nacional de Áreas Naturales Protegidas’ (National Commission on Protected Areas). The CONANP manages and protects the Ramsar site 1321 and the Huatulco National Park (natural protected area). It finances conservation projects for people in the CZH landscape and has invested in the Alternativa Agrícola Suchixtepec, Unión San Pedro and Los Macuiles Copalita.

CONABIO – ‘Comisión Nacional para el Conocimiento y Uso de la Biodiversidad’ (National Commission on Knowledge and Use of Biodiversity). It is the federal authority concerning use and knowledge of biodiversity, and holds records and databases of Mexican flora and fauna. Their role has been to provide and disseminate relevant information.

FONATUR – ‘Fondo Nacional de Fomento al Turismo’ (the National Fund for the Development of Tourism). It is the federal institution in charge of developing sites for tourism. Its Centre in Bahías de Huatulco is the largest town in the CZH watersheds and is therefore the largest consumer of water. FONATUR has promoted and invested funds to reforest the upper part of the landscape, recognising that the tourist centre benefits from the environmental services provided by the watershed.

Oaxaca state and municipal authorities. The project has been collaborating with the three state institutions responsible for the environment, water and tourism. It has had working relationships with municipal authorities in 17 out of the 20 municipalities in the CZH landscape during the entire project.

Engaged communities and partners

The project has involved 17 municipalities with a total population of 76,000 inhabitants. Several existing local entities were supported and a number of new ones created. For example the local partner: ‘Organización Comunitas A.C’ contributed to the project through an agreement on management of the basin and local capacity building.

The coffee producers, La Trinidad, and the ‘Unión de Trabajadores Agrícolas de Oaxaca (UNTA)’ have contributed to the working group on environmental flows and have undertaken the study on social values of rivers.

Mbis Bin Semilla para la Siembra (set up in 2013 by local youths) has provided support to communities in the upper and middle watersheds. They have carried out activities to

THE PROGRAMME
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estimate plant survival and growth as well as monitored the organic production of coffee plants, disease control, bio-fertilisation and mycorrhizal application.

In phase III, other social and producer organisations were consolidated. In the upper part of the landscape, a new group of organisations under coordination of Mbis Bin Semilla para la Siembra and called Alianza Suchixtepec includes:

- Guitani S.P.R. de R.I.;
- Alternativa Agrícola Suchixtepec S.P.R. de R.I.;
- Yii Mbey “Cerro de Hongos”;
- Yu Naban “Tierra Viva”
- Nayé “Verde”.

Other main partners are:

- Unión San Pedro para la Agricultura Sustentable 100 Sombras S.C. de R.L. de C.V. (the middle watershed)
- Los Macuiles Copalita SPR de RI (Lower watershed)
- Comité de Cuencas de los ríos Copalita-Tonameca A.C. (Lower watershed)
- Comité de Playas Limpias de Santa María Huatulco A.C. (Lower watershed)
- Comité de Playas Limpias de San Pedro Pochutla (Lower watershed)

Unión San Pedro para la Agricultura Sustentable

Unión San Pedro para la Agricultura Sostenible 100 Sombras, was created in 2013 and consists of six rural communities: Tierra Blanca, Malvarisco, Lagunilla, San Pedro el Alto, Loma Canela and Llano Flor in the municipality of San Pedro el Alto; later El Potrero Jazmín also joined. This organisation has been an important reforestation partner for WWF and has also introduced agroecological innovations to diversify crops and create sustainable economic models that have benefitted these communities. Coffee production involves the work of both men and women who increasingly play an important role in the economic models of their communities. Shade coffee is planted at an altitude of between 991 and 2,200 metres above sea level. In addition to coffee production, women’s cooperatives have been created to incorporate other high value crops such as vanilla that also involve reforestation.



Other partners

Other partners involved notably in awareness raising and education have included GAIA, Agroder and Methodus, Instituto Tecnológico del Valle de Oaxaca (ITVO) and Sarar Transformación. The latter for example, have been involved in the School Water, Sanitation and Hygiene (SWASH) project which undertook a first review in 14 schools in the upper watershed to increase awareness among this target group about the importance of integrated water management.

The lower part of the watersheds is influenced by the Bahías de Huatulco tourism development, the fifth largest in Mexico. The inhabitants of the city of Huatulco participate in the conservation of biodiversity and ecosystem services of the CZH watersheds through the 'Programa Arbolotón'.

Success is led by individuals!

Blanca, Romeo, Marhine and Claudio are part of a new generation that have helped to create the social enterprises and organisations that implement the water management model in the region.



Blanca Sánchez Reyes (Mbis Bin Semilla para la Siembra)

Blanca is currently the President of the local NGO, Mbis Bin Semilla para la Siembra. She is young zapotec woman born and raised in rural San Miguel Suchixtepec. In 2010 she began her training in WWF on water management and pursued a degree in rural development. In 2012 together with Romeo Salinas and other young professionals, she founded the NGO to drive and promote sustainable development alternatives in the CZH watersheds.



Claudio Salinas and Romeo Salinas Ramirez (Alternativa Agrícola Suchixtepec)

Claudio is of zapotecan origin. He initiated reforestation efforts in the region back in the early 2000s. For over 15 years he has collaborated with WWF and founded Alternativa Agrícola Suchixtepec in 2009. His son Romeo Salinas initiated his training in agroecology and collaborated in the implementation of WWF's water management project. As of 2017 father and son run the Alternativa Agrícola Suchixtepec which has become a centre for agroecological innovation under a circular economy model with zero waste, based on plant production (including, pine, oaks and other local species), reforestation, crop diversification, sustainable farming, and the development of agroecological techniques to support organic fertilisers and other agro-ecological innovations. Alternativa Agrícola Suchixtepec is playing a decisive role in setting demonstration plots and models to be scaled-up and replicated in the region.



Marinhe Concepción Rosas Rodríguez (Macuiles Copalita)

Marinhe is a biologist who graduated from the University of Veracruz with a master degree in science and technology from the Universidad Iberoamericana (Mexico City). She is specialised in tropical dry forest ecology, agroecology, water and community management. She has collaborated with WWF in Mexico for over 11 years and is the founder of Los Macuiles Copalita, a community enterprise that supports native plant production, including tropical dry forest species as well as reforestation, training and conservation activities to preserve the biodiversity of CZH in the lower part of the basin.



GOVERNANCE

In remote and decentralised communities, local governance structures play a paramount role in decision-making concerning natural resources. Many such structures in the project zone are rooted in traditional uses, traditions and customs that impact on natural resource management.

One example of such a locally run initiative is the tree nursery Río Molino (later Alternativa Agrícola Suchixtepec) which was developed in the Zapotec community of San Miguel Suchixtepec.

Tenure

As in many countries around the world, de facto (informal or traditional) and de jure (formal or legal) tenure systems clash in Mexico. Indigenous communities such as the Zapotec present in the watershed, have 'primordial titles' to the land, which the government does not always honour. Conflicts over tenure have taken place in the upper watershed in San Miguel Suchixtepec, firstly in the 1960s, again in the early 2000s and more recently in 2016 over logging concessions. Indeed, while the communities hold primordial title (since 1584) to the forest, external interests have sought to log these areas. To this date, the issue remains with the courts, highlighting the fragility of the watershed.

Informal governance

Local informal governance arrangements through the project have brought in a number of players, including for example, Alianza Suchixtepec, which was formed to strengthen agroecological practices, make group purchases of supplies and to establish a group of custodians of water reserves. This Alliance which re-groups a number of community groups was established for the 'defence and sustainable use of the Copalita river'. Communities participate actively in this alliance, which provides them with a voice and an opportunity to play an active role in the formal political processes related to their watersheds. The Alliance has joined Los Macuiles Copalita and other organisations of producers, from other regions of the State, to form the Movimiento Agroecológico de Oaxaca, with the aim to influence public policy towards a sustainable agriculture, that is environmentally friendly and without risks of contamination or diseases for farmers.

Formal governance

At the formal governance level, efforts have been put in place to collaborate with the State Committee for the Development of Oaxaca ('Comité Estatal de Planeación para el Desarrollo de Oaxaca (COPLADE)'), to better integrate the project dimensions into formal governance structures.

There are various committees established under the federal 'National Water Law' (Ley de Aguas Nacionales) such as the watershed committee ('Comités de Cuenca'), and the committee for clean beaches ('Comité de Playas Limpias'). Community empowerment is apparent with the establishment of all these groups. Also, there are two committees for natural resources ('Comités de Recursos Naturales') existing in the CZH landscape formed by agrarian communities and ejidos (communal property).

The government of Mexico committed to restoring 8.47 million ha under the Bonn Challenge and 20x20 initiative. Its proposed strategy to achieve this includes recovery of ecosystem services, increasing productivity, and mitigation of climate change.

**VARIOUS
COMMITTEES HAVE
BEEN ESTABLISHED
UNDER THE FEDERAL
'NATIONAL WATER
LAW', INCREASING
COMMUNITY POWER
ON NATURAL RESOURCE
MANAGEMENT.**



Field visit of the project

At the legislative level, the decree on water reserves established in 2018, based on environmental flow standards, has been an important tool nationwide to secure improvements in protection and management of critical river basins. To date, CZH has still not benefitted from this declaration, but work is underway to ensure that it can join the network of Mexican water reserves. The technical studies for supporting the decree have been completed.

At the local level, engagement with municipalities has been less successful, although more remains to be done.

Private sector

Private sector pressures and activities in the watershed play a substantial role in the governance of the watershed. Financial mechanisms put in place include payments for ecosystem services. In one instance, earlier attempts at payments for ecosystem services in the watershed failed due to the lack of clarity on whom should be the beneficiaries of such payments. Also, in the lower watershed, tourism development by FONATUR has put pressure on coastal zones, although it remains contained to a certain extent. Conflict with timber interests exist over the forests of San Miguel de Suchixtepec (as discussed above).

In phases II and III, the private sector made up of hoteliers, developers and other tourism companies have joined efforts to reforest the CZH landscape through the Semillatón and Arbolotón programmes, referred to above. In these programmes, civil society is also invited to participate in collective activities for the recovery of seeds and reforestation, all of which are carried out with sensitisation and training sessions by Los Macuiles Copalita and the watershed and clean beach committees.

Project governance

At the project level, a working group was created that includes Alianza Suchixtepec, Unión San Pedro and Los Macuiles Copalita and meets regularly and discusses new projects that expand the benefits achieved with phase III of the WWF project.

Working together



In addition, these stakeholders participate in the watershed and clean beach committees as members of civil society or the agricultural sector. In these spaces, they have disseminated the achievements and advances of the project, which has positioned them as relevant actors at regional and state level.

CAPACITY BUILDING

Capacity building has been a major element of this project. Over the 15 years of the whole project, an entire generation has been adopting the project approaches thus securing its continuity (see page 30). Demonstration sites were set up as a way of promoting new practices. Rather than a rigid top-down approach with the widescale imple-

mentation of external solutions, the project opted to start with small pilot projects to provide alternatives that communities could then adopt and adapt to their particular needs and circumstances. Significant resources were spent providing capacity for such changes at the local level, while being responsive and sensitive to local needs and responses to these approaches.

Agroecological practices for example were widely embraced by local communities who could see the multiple benefits in terms of their food, nutrition, crop yields, soil impacts, water impacts and more general environmental improvements. In phases I and II, 4,083 individuals were trained via 245 workshops to acquire different skills and in phase III an additional 698 individuals received training.

Testing agricultural alternatives. Here, the introduction of vanilla cultivation in Tierra Blanca.



The project has been credited with leading to a widespread change in lifestyle within the target communities. Furthermore, the practices were replicated across communities outside of the project (in regions like Valles Centrales and Sierra Norte in the state of Oaxaca) through exchange visits and local champions and leaders.

Nursery practices were also widely shared across communities. The Río Molino Suchixtepec nursery (later Alternativa Agrícola Suchixtepec) shared its experience raising native species through the formal 'Red Nacional de Desarrollo Rural Sustentable (Rendrus) de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y

Alimentación (SAGARPA)'. This not only provided them with an opportunity to share their knowhow but also raised their profile substantially and gave them visibility.

Formal workshops on watershed management were led by the 'Instituto Estatal de Educación Pública de Oaxaca (IEEPO)' with the Educational Council 'Consejo Nacional de Fomento Educativo (CONAFE)'. Agreements with schools were formalised to change water usage, including for sanitation.

Importantly, the project has focused on providing tools to local communities, to empower them and give them a voice in the management of the watershed. Thus, for example, while in many parts of Mexico the presence of a tourism resort has significantly impacted on the landscape, in the case of CZH, the Huatulco tourist resort has to contend with the other needs of the landscape's inhabitants who are active participants in shaping the landscape, rather than passive recipients of externally-driven changes.

**EMPOWERING WOMEN
AND TRAINING THEM
WAS DECISIVE FOR
THE INTRODUCTION
OF AGRICULTURAL
INNOVATIONS.**

COMMUNICATION

Reflecting its bottom-up approach, the project has emphasised awareness raising activities focusing on sustainable management of water.

A guide for land owners was developed, that contains notably a chapter on “protection, conservation and restoration”. It was intended also to raise awareness among landowners about specific and relevant legislation.



A weekly radio show entitled ‘Tribuna Verde’ (Green Tribune) has been promoting profound changes to support integrated watershed management. A TV show was also produced highlighting the problems of water, forests, coffee production and climate change. A video was produced on activities in the Río Molino nursery which was launched on CNN in Spanish. In phase I, a total of 18 short educational films were prepared by WWF for children and youth on the relationship between forests and water. These were also presented at the ‘Festival Música del Mar’ (Festival of Sea Music) attended by 260 students. In 2019, two different videos were produced:

- One to present the results of the last phase of the project, especially the reforestation work funded by Caudalie (7’, http://www.wwf.org.mx/que_hacemos/agua_dulce/reforestando_la_cuenca_copalita_zimatan_huatulco)
- One on people, water and reforestation (2’, http://www.wwf.org.mx/que_hacemos/agua_dulce/reforestando_la_cuenca_copalita_zimatan_huatulco).

Visual exhibits have also been designed. For example, forest day was celebrated through a competition for the best mural. In the three zones of San Miguel del Puerto, Santa María Xadani y Zimatán, a roll up (poster) highlights the message ‘Water for life, water for all’. A regional exhibition on the furniture industry provided a platform for the project to present some of its achievement, under the theme ‘forest-wood-furniture’.

Activities targeting children included talks and videos about rational water use and climate change. A total of 385 young pupils attended workshops in which they designed their own exhibit about forests, water, climate change and waste during phases I and II.

SUSTAINABILITY AND HANDOVER STRATEGY

The programme has relied on national and international philanthropy through different projects which, in the long term, is not a financially viable model. Having said that, several factors may be said to contribute to the programme's sustainability. Three aspects of sustainability are explored here: 1. Financial sustainability; 2. Institutionalisation; 3. WWF's position toward a handover strategy.

Financial sustainability



The project has benefitted from a 15 year-long support by the FGRA which has enabled it to maintain and build on the momentum started in phase I (Table 7). It has also enabled the project to have a strong and stable core team, represented by the same project leader since 2005 – Ignacio Daniel González Mora. Furthermore, it has provided the basis for and facilitated the obtention of additional co-funding. The approach taken by the project has been to ensure that local communities are able to produce from the land, and not just to conserve it, so that they can earn a living. This is an important component of any large-scale conservation or restoration effort and should be central to FLR. Without direct benefits to communities, the sustainability of FLR projects can be seriously compromised. Nevertheless, at this stage, in the medium to long-term, the project remains dependent on external funding.

Table 7. Overall budget.

	Fundación Gonzalo Río Arronte (USD)	Caudalie (USD)
Inception phase	-	-
Phase I – 2004-2011	1,100,000	-
Phase II – 2012-2016	615,000	-
Phase III – 2016-2020	500,000	519,410
Total	2,200,000	519,410

Institutional sustainability

Emphasis has been given to bringing in key formal institutions, such as CONAFOR (forestry), CONABIO (biodiversity) and CONAGUA (water) with a view to demonstrating linkages between their priorities and the project objectives. Successful changes achieved in water policy reflect the potential influence of the project on government decisions and subsequent application of improved approaches.

Several local level platforms and associations were established through the project. These in turn spawned new ones, notably new women's and youth groups. This important social and institutional base in the watershed contributes to re-vitalising local communities and making them more attractive for youths to remain or return to them. This is probably the most striking result of the project, based on individual commitments of mainly young and well trained people (see page 30) that manage to turn their effort into local reliable organisations. Thus, local level solutions aligned with the project are being generated and serve to maintain the project's momentum. Furthermore, these are expected to remain beyond the lifetime of the project as a multiplier of the project's approach and achievements.

**FORMAL INSTITUTIONS,
LOCAL PLATFORMS
AND ASSOCIATIONS
HAVE BEEN CREATED
AND WILL REMAIN
BEYOND THE LIFETIME
OF THE PROJECT.**

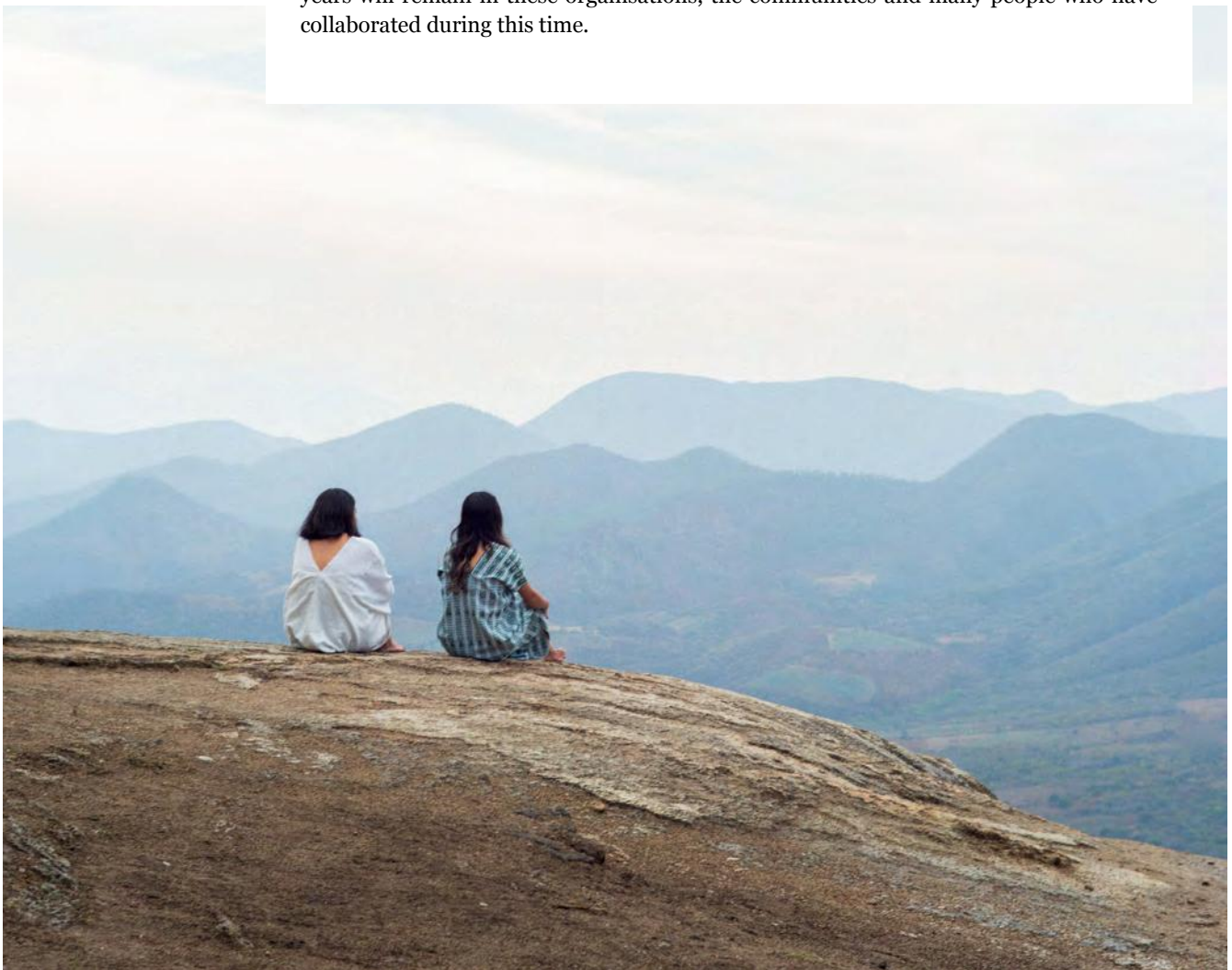
The integrated approach promoted by the project, focusing on water, forests, food, agriculture, and capacities, has secured stronger local engagement and ownership of the project and its activities.

Handover strategy

At this stage, a handover strategy is not yet planned by WWF and additional funding is being sought for a fourth phase. Nevertheless, as in other long term FLR projects and programmes, the institutional foundations and local knowledge and capacities are being developed with a view to the eventual departure of WWF from the landscape.

The most important achievement of WWF has been the strengthening of local capacities, their legal establishment as organisations and their technical and social consolidation. The Alianza Suchixtepec, Unión San Pedro and Los Macuiles Copalita are recognised within the CZH watersheds, in the state of Oaxaca and by federal institutions, as responsible organisations that offer satisfactory results with a high commitment to biodiversity conservation and proper management of water, soil and forest. The first step in the handover strategy is based on this. WWF has full confidence that when it exits from the CZH landscape, the activities will continue with excellent outcomes and the legacy of these 15 years will remain in these organisations, the communities and many people who have collaborated during this time.

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OVERARCHING LESSONS LEARNT

Over the years, several lessons for FLR practitioners have been documented from the CZH watershed. Today, they are important for the country itself, but reflecting on the most significant lessons learnt is also crucial for FLR success in other degraded landscapes worldwide. It is the purpose of this chapter. It focuses on lessons that are of value to other projects worldwide. An emphasis on water-soil-forest linkages, with a watershed approach, is what has characterised conservation and restoration work in this landscape. Key lessons for FLR emerging from this project are:

1 A watershed perspective makes sense to engage stakeholders

Because of linkages between the upper, middle and lower parts of a watershed, it makes sense to engage stakeholders and develop activities at all levels, recognising the linkages but also the differences between each area. Water provides a guiding thread between the upper and lower reaches of the watershed.

In the CZH landscape, WWF targeted different community groups at each level and encouraged them to collaborate across spatial scales in recognition of their interdependence and joint responsibility in the watershed. In the first years, and in agreement with the communities, the planning and execution of actions began considering the temperate forests and the springs of the upper watershed down through to the lower part. This tactics yields better social and environmental results.

2 Starting with broader actions can support a more focused tree planting intervention several years later

Laying the ground work through research, engagement, policies and demonstration sites can be an effective way of starting an FLR intervention.

In the CZH landscape, these activities provided the solid foundations for a more targeted set of active restorative activities 10 years later, such as tree planting in phase III of the project.

3 Integrated approaches to restoration provide better results than reforestation alone

Addressing underlying causes of forest degradation and approaching the restoration process in a comprehensive and integrated manner provides faster and more durable results.

In the CZH landscape, interventions were multi-faceted, including at the level of governance, agriculture as well as direct forest interventions. Forest activities could be broadened and would benefit from promoting silvicultural alternatives beyond only planting trees, especially in the upper part of the watershed.

4 Integrated approaches across actors and stakeholders, from federal to community level, are important for large-scale achievements

Bringing in political players, social actors, across federal and local scales, creates the enabling conditions for long-term success.

In the CZH landscape, WWF has worked at the political level for policy changes and political support, while working at the local level, with coffee growers and other community groups, to ensure a change in livelihood practices for the benefit of people and nature.

5 Providing alternatives for management and production in the landscape ensures better engagement of communities

Providing several different and innovative water, agriculture and forest management alternatives, leads to better engagement by communities who feel empowered to take decisions related to their land, livelihoods and future. In turn, this leads to more sustainable results and changes in lifestyle.

In CZH landscape, communities adopted new practices related to agroforestry, agroecological interventions, improved agriculture which have a profound impact on their landscape.

6 Making explicit the link between forests and water to the overall development model of the landscape via a watershed approach leads to better results

This link is not obvious for communities and policy makers. Linking upper and lower watershed communities and related land use and management leads to positive impacts on water, forests and development.

In CZH landscape, where tourism in the lower part of the watershed requires a lot of water, linking upper and lower communities makes sense today, after years of advocacy, and will be even more crucial tomorrow with climate change.

7 Engaging women and youth in decision-making at local level increases social sustainability

Women and youth have a vested interest in land management and innovation in rural areas but are often not targeted as key participants and decision-makers.

Experience in the CZH landscape demonstrated the importance of bringing these groups on board notably, because of their ability to innovate and mobilise further their villages.

8 Champions help to disseminate project results

Enlisting key “champions”, leaders, or change-makers, at different geographical levels, can help to promote the project, maintain its momentum beyond its lifetime and disseminate its approach.

In the CZH landscape, champions were identified within the communities (young well-trained professionals or women in each community) as important local multipliers. Investing in people was beneficial to keep in the landscape a new eco-friendly generation of dedicated leaders.

9 Long term funding for water and people is an opportunity

Enabling the continuity of funding over the necessary 10 to 20 years essential to achieving sustainable results is always a struggle. Bridging water and development policies with forest issues helps to secure success in FLR.

In the CZH landscape, the main source of funding for water and watershed work was a Mexican foundation supporting programmes for the environment and people, then new private foreign donors were brought in for specific activities such as tree planting.





CONCLUSION AND FUTURE PROSPECTS

The wealth and diversity of this landscape – both ecologically and socially – are truly unique. Today, progress on the ground is clearly visible and securing it for the long term becomes essential.

Much has been achieved in fifteen years. WWF has been working at a very local level with indigenous communities to improve their agricultural practices and water use.

It has also worked with the national and state governments to enhance water legislation and watershed management practices. Results can be seen on the ground. First, from better water quality, enhanced forested areas and improved community knowledge that will reduce pressures on forests and water in the future. Second, from the now apparent inter-connections of the upper reaches of the watersheds down to sea level. Such approach that considers so many different angles and integrate them at watershed scale is crucial. It helps covering such distinct altitudinal scales, each with their own challenges. But it requires time.

**ACHIEVEMENTS
ARE NOW COMING
TOGETHER RAISING
NEW CHALLENGES AND
OPPORTUNITIES.**

Throughout the three phases many people have changed, some young people who started as promoters are now professionals who manage projects. The farmers talk about conservation, ecosystem services and environmental flow. The organisations, which were first beneficiaries and are now true partners, have established strong social ties that have resisted the passage of time and the intermittence of projects. The experience showed us that the landscape was more than its biophysical components, presenting its social and cultural complexity. Practice has taught us all a lot; the challenge between theory and practice is the only constant in our activities. We have all learned to listen and exchange ideas and knowledge with respect but with constructive criticism.

Achievements at all levels are now coming together raising new challenges and opportunities for all concerned. Although many foundations have been laid, WWF expects to continue supporting this landscape for at least another five years. It will need to prepare a handover strategy to ensure that communities can continue the good work that they have developed in these watersheds and can act as replicators for other watersheds across the state of Oaxaca and beyond.

REFERENCES

Chatterton, P., Ledecq, T., and Dudley, N. 2016. Landscape Elements. Steps to achieving Integrated Landscape Management. WWF, 11 pages.

CONABIO, 2016. *Estrategia Nacional sobre Biodiversidad de Mexico y Plan de Accion - 2016-2020*. Mexico: Gobierno de la Republica de Mexico, 388 pages.

Danver, S., 2015. *Native Peoples of the World: An Encyclopedia of Groups Cultures and Contemporary Issues*. Oxon and New York: Routledge, 1030 pages.

Figel, J.J., Durán, E. and Bray, D.B., 2011. Conservation of the jaguar *Panthera onca* in a community-dominated landscape in montane forests in Oaxaca, Mexico. *Oryx*, 45(4), pp.554-560.

González-Mora, I. D., G. de la Lanza-Espino y R. Sánchez-Navarro. 2009. *Memoria del Taller: propuesta de caudal ecológico en la cuenca Copalita-Zimatán-Huatulco. Manejo del agua en cuencas hidrográficas: desarrollo de nuevos modelos en México*. WWF-Fundación Gonzalo Río Arronte, I.A.P. México, D.F. 19 pages.

González-Mora, I.D. 2013. *Reservas de agua para la protección ecológica de las cuencas de los ríos Copalita, Coyula y Zimatán, Oaxaca. Memorias del III Congreso Nacional de Manejo de Cuencas Hidrográficas, Morelia*, 2013, pp. VI-81 – VI-91.

Mansourian, S. and Vallauri, D., 2014. Restoring Forest landscapes: important lessons learnt. *Environmental Management* 53(2): 241-251.

Martínez-Pacheco, A. I. 2010. *Monitoreo del Cambio de Uso del Suelo en Sierra Costera, Oaxaca. Periodo 2000-2010*. México, D.F. 28 pages.

Mendoza, A.J.G. and Meave, J.A., 2011. *Diversidad florística de Oaxaca: de musgos a angiospermas, colecciones y lista de especies*. Instituto de Biología Universidad Nacional Autónoma de México: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, 351 pages.

Olson, D. M., Dinerstein, E. 2002. The Global 200: Priority ecoregions for global conservation. *Annals of the Missouri Botanical Garden* 89(2):199-224.

Robson, J.P., 2007. Local approaches to biodiversity conservation: lessons from Oaxaca, southern Mexico. *International Journal of Sustainable Development*, 10(3), pp.267-286.

WWF, 2009. *Manejo del Agua en Cuencas Hidrográficas: Desarrollo de Nuevos Modelos en México. Propuesta de caudales ecológicos en las cuencas Copalita-Zimatán-Huatulco y su consideración en el estudio de disponibilidad de aguas superficiales*. Mexico : WWF, 148 pages.

Websites

CONABIO - <https://www.gob.mx/conabio>

<https://www.biodiversidad.gob.mx/pais/quees.html>

Global Water Watch - <http://www.globalwaterwatch.org>

USGS - <https://www.usgs.gov>

This report is part of a series that aims to share lessons learnt from WWF's long-term field programmes on Forest Landscape Restoration worldwide.

Citation:

Mansourian, S., González Mora, I.D., Palmas Tenorio, M.A., Spota Diericx, G. and Vallauri, D., 2020. *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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IN BRIEF

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UP TO YOU!
MAKE A
GOOD FIRST
PRINT

Over 15

In years the duration of WWF's commitment to this programme.

2.6

In million, the number of trees planted during phase III of the project, contributing to restore 2,625 ha of forest in the CZH landscape.



13

The number of agricultural alternatives tested, introduced and promoted to propose income-generating activities to communities.

22,196

The number of project beneficiaries – both direct and indirect.



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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