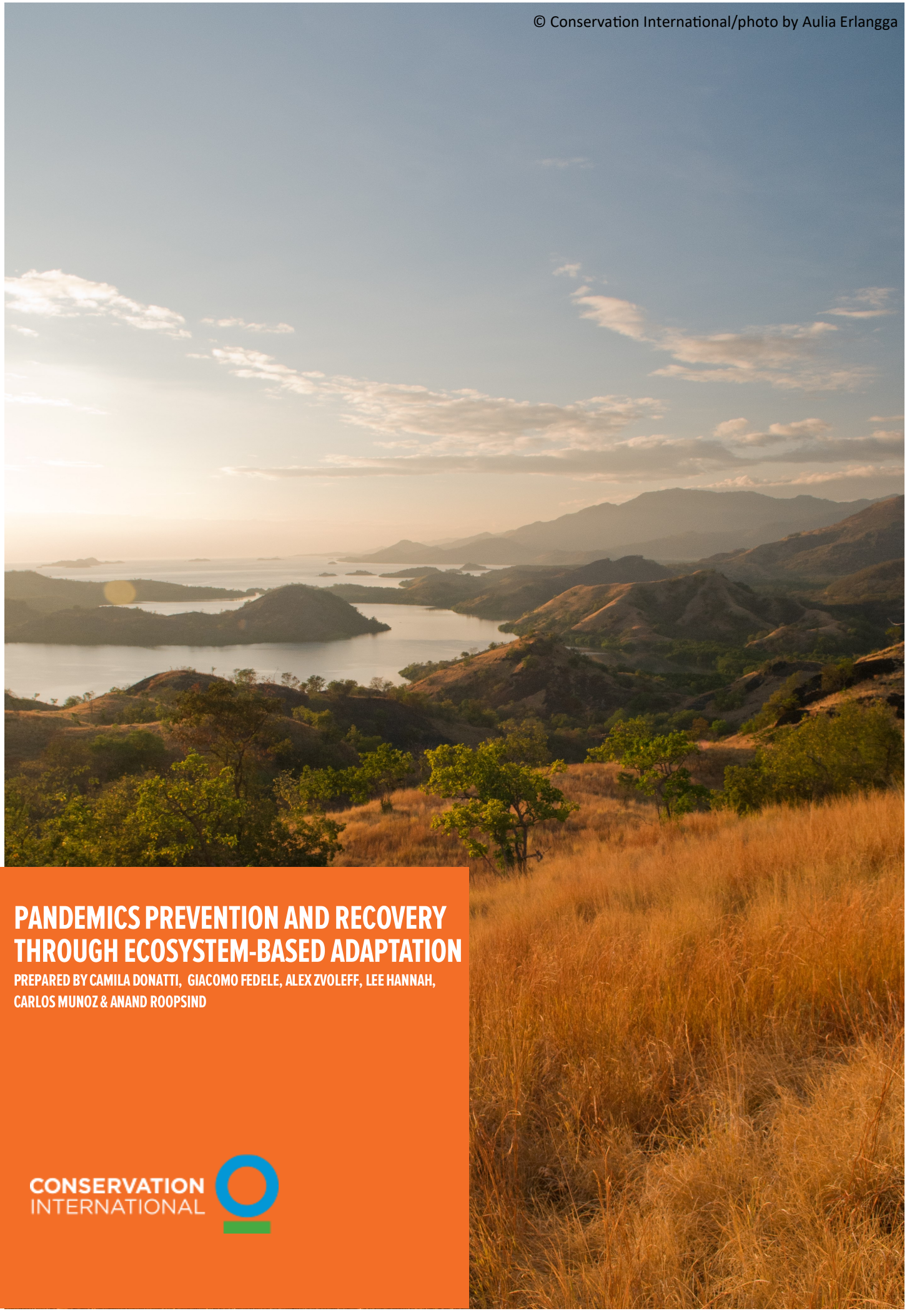

PANDEMICS PREVENTION AND RECOVERY THROUGH ECOSYSTEM-BASED ADAPTATION

PREPARED BY CAMILA DONATTI, GIACOMO FEDELE, ALEX ZVOLEFF, LEE HANNAH, CARLOS MUNOZ & ANAND ROOPSIND

CONSERVATION INTERNATIONAL

Overview

In evaluating the links between nature conservation, restoration and management and COVID-19 (and pandemics more broadly), discussions about Conservation International (CI)'s work have been organized around the impacts on two key categories: pandemics prevention, and pandemics recovery. Though there is some overlap between these categories, the discussions on linkages to pandemic "prevention" focus on how nature might help prevent the next pandemic, while for pandemic "recovery" the emphasis is on addressing how nature can help communities surpass the economic impacts associated to a pandemic.

CI's work on climate adaptation focuses on Ecosystem-based Adaptation (EbA): the use of nature to reduce negative impacts of climate change on people's lives and livelihoods (Vignola et al. 2015, Cohen-Shacham et al. 2019). This document reviews ways in which pandemic response and our work in EbA intersect and identifies specific opportunities based on CI's existing work. Our insights focus mainly on zoonotic diseases like COVID-19 in terms of transmission and potential economic impacts.

Poor communities are the most vulnerable to climate change given their low education levels and income, and limited access to technical assistance, markets and credits (Morton 2007). Poor communities have also been the most vulnerable to COVID-19, due to limited access to health services, limited savings, high number of household members and lack of minimum hygiene conditions (World Bank 2020).

The implementation of certain nature-based actions for climate change adaptation reduce the vulnerability of people to climate change, making them more likely to be food secure, have better household and hygiene conditions, and savings and a diversified source of income than more vulnerable neighboring communities. In the case of COVID-19, communities and individuals less vulnerable to climate change could be more apt, due to their higher capacity to adapt to shocks and stresses, to a) avoid forest incursions due to food security, b) avoid contacts with others due to self - sufficiency, practice social distancing due to better household conditions, and practice hand hygiene due to availability of clean water and c) recover more quickly from the economic impacts associated to the pandemic due to a more diversified livelihood.

The COVID-19 pandemic is providing opportunities to re-examine the way people interact with nature and for a much-needed transformation in unsustainable interactions. Nature-based actions for climate change adaptation, when targeting the most vulnerable, could help reduce inequalities and racial injustice, as there is a disproportionally high impact of COVID-19 on minority groups and on the poor (World Bank 2020). One of the lessons from COVID-19 is the importance of a resilient society to overcome the impacts. Nature can be an ally to make that happen due to the capacity to generate more resilient communities and economies.

Primary links between pandemic prevention and recovery, and EBA

Prevention

- **Improving forest conservation** in high deforestation settings reduces contacts between humans and disease hosts. Dobson et al (2020) calculate $4 billion in climate mitigation co-benefits for pandemic deforestation reduction efforts.
- **Implementing agroforestry and sylvopastoral systems, using wild relatives of crops or livestock breeds** increase community and family food security**,** thereby reducing forest incursions for poaching or logging during external shocks and minimizing contact between humans and disease hosts.
- **Ensuring forest and wetland protection and restoration** reduce the frequency and severity of flooding**,** therefore reducing the chances of emergence and incidence of insect-borne diseases.
- **Potential connections to CI's existing work:**
- Sustainable Landscapes in Eastern Madagascar
- Reduced emission from deforestation and forest degradation, plus the role of conservation, sustainable management of forests, and the enhancement of forest carbon stocks

Recovery

- **The implementation of agroforestry and silvopastoral systems, the incorporation of trees in the landscape, the use of farmer managed natural regeneration and the restoration of ecosystems** allow for diversified sources of income, leading to a faster recovery from pandemic-related economic impacts.
- **The protection of forest and tree plantation at the plot level** can provide additional sources of income for local communities through payment for ecosystem services, which can lead to a faster recovery from the economic impacts associated with pandemics.
- **The protection of ecosystems at the landscape level** can provide additional sources of income for local communities through carbon credit projects, increasing the capacity of those communities to recover from the impacts of pandemics.
- **Potential connections to CI's existing work:**
- Livestock Management in communal rangelands in South Africa
- Restoration in Kenya's Chyulu hills

Background on pandemic prevention links with EbA

Pandemic prevention refers to actions that could be implemented to avoid the next pandemic. It has been shown that pandemic prevention should focuses on four main components: managing deforested landscapes and reducing deforestation; reducing trade in high-risk species; improving on-farm hygiene in small animals (ducks, chickens, pigs) and early detection and outbreak control. All four of these need to be focused at the forest edge (and interior) to be effective. EbA and NCS actions can contribute more directly to the two first points.

Improving forest conservation in high population and high deforestation settings is the most important pandemic prevention activity. It is also the most costly, and have major co-benefits. Co-benefits of forest conservation include a wealth of ecosystem services, including adaptation and mitigation benefits, and reduced deforestation. Dobson et al (2020) calculate $4 billion in climate co-benefits for pandemic deforestation reduction efforts. The same methods (Amazon model or other) work for pandemic prevention as for NCS and both produce co-benefits for the other. EbA synergies with pandemic prevention are strongest in the EID hotspot work.

A sensible prevention program will combine anti-deforestation efforts over broad areas (ideally all the tropics) with targeted management of forest landscapes. The forest management is expensive, so needs to be targeted to the highest risk areas – the EID hotspots (Allen et al 2011). Forest management efforts would co-locate with community health and farm livestock programs to realize cost-savings associated with co-location. The anti-deforestation effort would be lower cost, following the model of the Brazil Amazon deforestation reduction effort 2005-2012, when deforestation in the Brazilian Amazon was reduced 40-70%. The purpose of the widespread deforestation reduction effort is to prevent new EID hotspots from emerging, even in areas currently at lower risk of EID.

Other important nature-based actions are **implementing agroforestry and silvopastoral systems, using wild relatives of crops or livestock breeds, and using farmer managed natural regeneration.** Those actions improve community and family food security**,** thereby reducing forest incursions for poaching or logging during external shocks. The reliance on wildlife for food security and income is a common strategy to overcome the negative impacts of climate change and other drivers on people's lives and livelihoods. As a COVID -19 is a zoonotic infectious disease, the contact between human and disease hosts is a key action to prevent pandemics of other diseases with similar origins. Over 650 surveys with key informants conducted by CI and other NGOs as part of the African Biodiversity collaborative group in Sub-Saharan Africa show that the main coping strategy farmers and pastoralists use when they face declines in crop and livestock productivity is logging for timber and charcoal and poaching, which ease exposure to contact and disease exchange between humans and animal species. Even though this type of information is not available in many regions, those coping strategies are very likely happening in other places outside of Africa.

EbA actions implemented at the plot and landscape levels improve the capacity of the most vulnerable to respond to shocks and stresses and provide on-site and off-site benefits (Vignola et al. 2015), potentially allowing them to rely less on wildlife and other forest products for their food security and income. Examples of EbA actions at the plot level include the implementation of agroforestry and sylvopastoral systems at the plot level to diversify farmer income (e.g., Verchot et al. 2007; Matocha et al. 2012), maintain soil fertility and provide sources of timber and non-timber products (Tscharntke et al. 2011; Somarriba & Beer 2011), increase stock rates and farmer productivity (Murgeitio et al. 2011) and enhance yield in some cases (Torralba et al. 2016). The use of wild relatives of crops or livestock breeds can improve the ability of existing crops to cope with high temperatures (Mercer et al. 2008, Sheehy et al 2005) and droughts (Farooq & Azam 2001) that are expected to occur more frequently under climate change, thereby maintaining or increasing productivity and contributing to food security, and to the broader sustainability of agricultural systems. At the landscape level, the incorporation of trees in the landscape and the use of the farmer managed natural regeneration leads to income diversification and increased fodder and fuel wood supply (Garrity et al. 2010).

Ensuring forest, wetland and mangrove protection and restoration in areas that are or will experience extreme rainfall events reduce the frequency and severity of flooding (Bradshaw et al. 2007)**,** therefore reducing the emergence and incidence of insect-borne diseases. Zika virus fever is an insect-borne disease that led to the 2015-2016 epidemic in Brazil and other parts of South America. Dengue hemorrhagic fever is also an insect-borne disease that has led to a major public health problem, especially in the Americas (Gubler et al. 1995). Insect-borne diseases, like the Zika virus fever and dengue fever, could be more prevalent in areas with frequent flooding events, where wastewater discharges are exacerbated and can provide supplemental nutrients to local mosquito populations (Yee et al. 2019).

EbA actions, such as forest and wetland protection and restoration, can decrease flooding following extreme rainfall events as deforestation amplifies flood risk and severity (Bradshaw et al. 2007). The restoration and protection of forests, wetlands and mangroves could reduce the frequency and severity of flooding, therefore reducing the emergence and incidence of insect-borne diseases.

Background on pandemic recovery links with EbA

Pandemic recovery refers to the capacity of communities and societies to rebound from the impacts of a pandemic. By relying on multiple crops, on a combination of crops and tree products, and on a nature-based and diverse livelihood, communities can more successfully adapt to impacts of extreme weather events. Furthermore, a person with a diversified sources of income, can more easily surpass the economic impacts associated to COVID-19, such as decrease in the demand and in the price of products that has happened and will continue to happen during post-pandemic (see World Bank 2020) and short-term unemployment.

The implementation of agroforestry and silvopastoral systems, the incorporation of trees in the landscape and the use of farmer managed natural regeneration and ecosystem restoration allow for a diversified set of products or income (Verchot et al. 2007, Somarriba & Beer 2011, Tscharntke et al. 2011, Matocha et al. 2012) and, when done in a transformative way (Giacomo et al. 2019, Giacomo et al. 2020), can lead to a faster recovery from pandemic-related economic impacts. Likewise, **ecosystem restoration** can generate income through programs such as the South Africa's National wetland Programme, or Working for Wetlands, (Dini & Bahadur 2016), and cooperatives that specializes in forest restoration, such as Brazil's COOPLANTAR (Mesquita et al. 2020).

The protection of forest or tree plantation at the plot level, such as the conservation of riparian vegetation in farms to ensure water purification and provision, as well as other ecosystem services, can help farmers adapt to climate change (Vignola et al. 2015) while providing an additional source of income through payment for ecosystem services (Jack et al. 2008), which can lead to a faster recovery from the economic impacts associated to pandemics. Likewise, **the protection of ecosystems at the landscape level** provides additional sources of income (and other job opportunities) for local communities through the revenue from carbon credit projects, increasing the capacity of those communities to recover from the economic impacted related to pandemics.

FOR MORE INFORMATION, PLEASE CONTACT CAMILA DONATTI, cdonatti@conservation.org

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