Food and Agriculture Organization
of the United Nations

Restoring degraded land in Rohingya refugee camps in Cox's Bazar, Bangladesh

SOLAW21 Technical background report

Restoring degraded land in Rohingya refugee camps in Cox's Bazar, Bangladesh

By

Mahamud R, Jalal R, Ritu S, Donegan E, Arif T A, Kumar M F, Arafat F, De Gaetano M, Kabir H, and Henry M.

Food and Agriculture Organization of the United Nations
Rome, 2022

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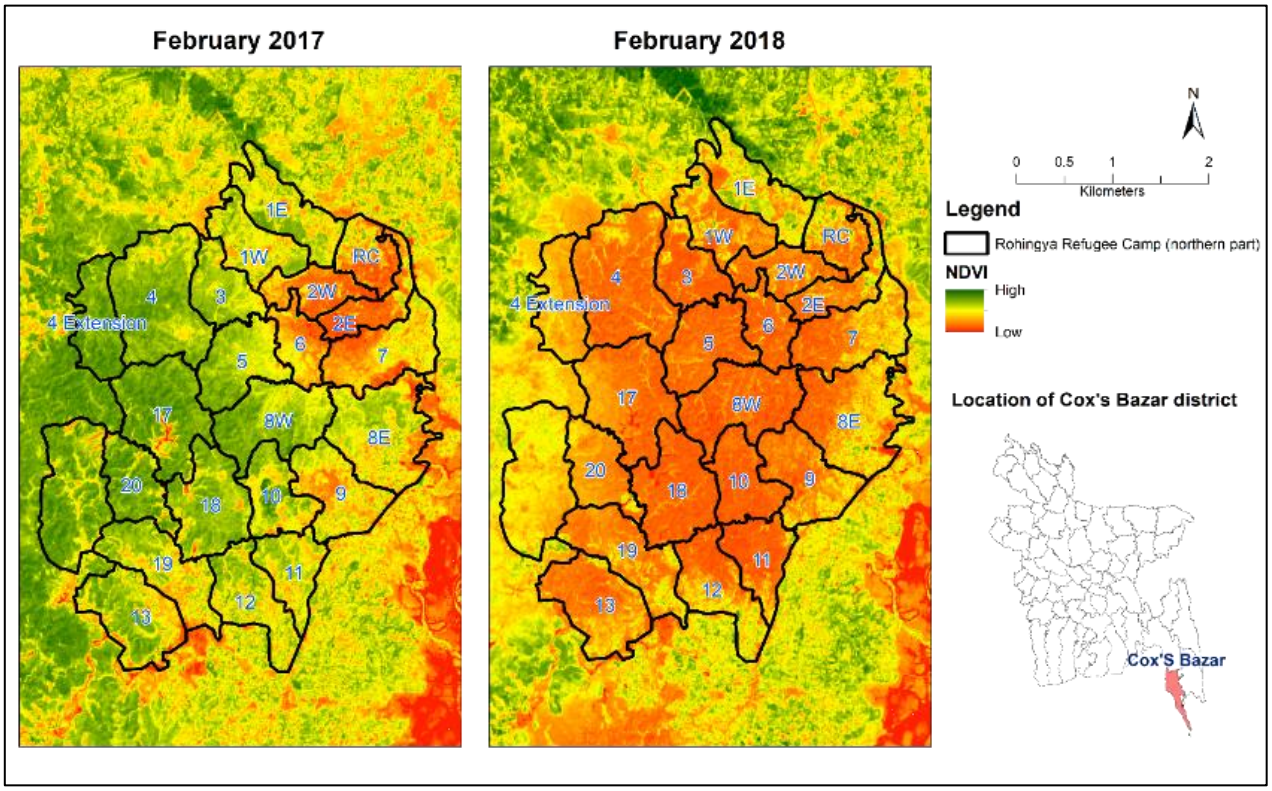
Introduction

Forced displacement has almost doubled in the past decade, from 41 million people in 2010 to 79.5 million people as of the end of 2019 (UNHCR, 2020). As more people become displaced and fewer are able to return home, the protracted displacement situations can be exacerbated by the interplay between climate, land degradation, conflict, hunger, poverty, persecution and the COVID19 pandemic, which makes the situation increasingly complex and unstable, and more urgent than ever.

The Rohingya refugee crisis in Cox's Bazar (the southernmost coastal district of Bangladesh) and surrounding areas demonstrates the complexity of the situation. Rohingya refugees have been arriving in Bangladesh since the 1970s in fluctuating but persistent numbers. There has been a significant increase in the numbers of displaced Rohingya people over the past five years, with a massive influx to Bangladesh: 742 000 refugees have fled to Bangladesh since 25 August 2017 according to UNHCR (2020). This led to the development of the largest refugee camp in the world in Cox's Bazar, which has put major pressure on the regional landscape.

Remote sensing analysis of the area pre- and post-influx identified 7 220 hectares of degraded forest land (see figure) in and around the camp area (Mahamud *et al*., 2018). Experts predicted that the entire forested area of Cox's Bazar was likely to disappear by 2019 if the rate of deforestation continued unabated. The removal of trees, roots and grass cover, along with excavation, hill cutting and leveling to build shelter and provide fuel for nearly a million people within the space of few months (UNDP and UN WOMEN, 2018), greatly increased the loss of forests, topsoil, and intensified surface runoff. This amplified the risk of landslides and flash floods, putting hundreds of thousands of people at risk and stoking conflicts between host communities and the Rohingya refugees.

Figure 1. Change of vegetation between February 2017 and 2018 as depicted by a decreased normalized difference vegetation index (NDVI). A lower NDVI means less vegetation cover.



Source: Mahamud, R., Tanjim, A., Ritu, S., Mondal, F.K. & Arafat, F. 2021.

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The initial humanitarian response to land degradation in the area had mixed results, mainly due to a lack of informed decision-making and collaboration. Over the past three years, an integrated approach has evolved and this is helping to reverse the degradation of hundreds of hectares of land, reducing the risk of natural disasters and improving the living conditions of the refugees.

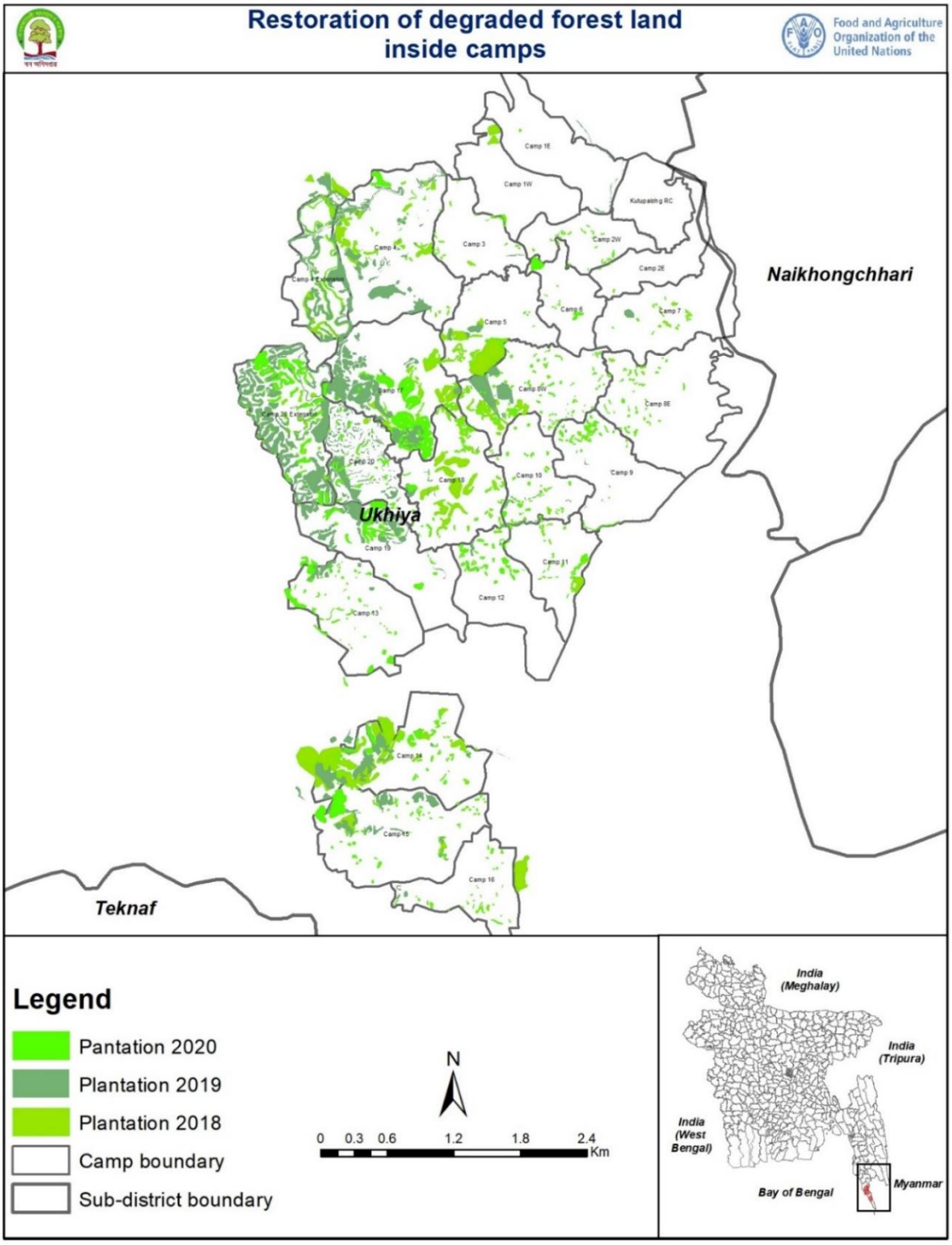
The Food and Agriculture Organization of the United Nations (FAO), in close coordination with the Energy and Environment Technical Working Group (EETWG), various UN agencies (the International Organization for Migration [IOM], the World Food Programme [WFP] and the United Nations Refugee Agency [UNHCR]), international and national partners, the Forest Department of the Government of Bangladesh Ministry of Environment, Forest and Climate Change (MoEFCC) and, most importantly, the local communities and Rohingya refugees, have worked to create a land restoration programme. The programme was made possible through an integrated approach that: i) engaged a range of partners in coordinated planning to implement and monitor land restoration activities; ii) used evidence-based information to assess gaps and needs, particularly related to basic subsistence requirements such as energy supply; iii) prepared technical guidance for land restoration activities and activities to increase

the supply of woodfuel and energy; and iv) conducted geospatial analyses to plan, coordinate and monitor land restoration activities. This case study illustrates how new geospatial techniques can provide timely and detailed information for monitoring natural resources and sustainable land management in complex settings, such as refugee camps, as part of a humanitarian response.

Collaborative implementation of restoration activities

Stakeholder involvement at every stage of land restoration has been essential, requiring substantial coordination between local authorities, community leaders, United Nations agencies, non-governmental organizations and other partner organizations. More than 20 organizations have been involved in the restoration efforts over the past three years. Plantation activities inside the camps are coordinated by the EETWG (see Figure 2), while the Inter Sector Coordination Group (ISCG) is responsible for coordinating interventions in food security, energy (e.g., the supply of liquefied petroleum gas or LPG), water and sanitation and health. The Site Management and Site Development (SMSD) team assists in overall camp planning and management. The Bangladesh Forest Department plays a crucial role in providing technical guidance in the design and implementation process (e.g., plant selection, plantation management, logistics). Refugees are involved in various land restoration activities, such as site preparation, plantation management, and camp maintenance, while the host communities carry out restoration activities outside the camps. Various national and international partners are working to ensure the maintenance and management of the plantations, while a sensitization programme helps raise awareness among refugees and host communities about the importance of maintaining ecosystem services. A community co-management approach is being promoted to achieve the restoration goal.

Figure 2. The areas in which partner organizations have collaborated on land restoration since 2018



Source: Author, 2018, base map HDX, 2020 https://data.humdata.org/dataset?q=cox modified by authors to comply with [applicable UN map]

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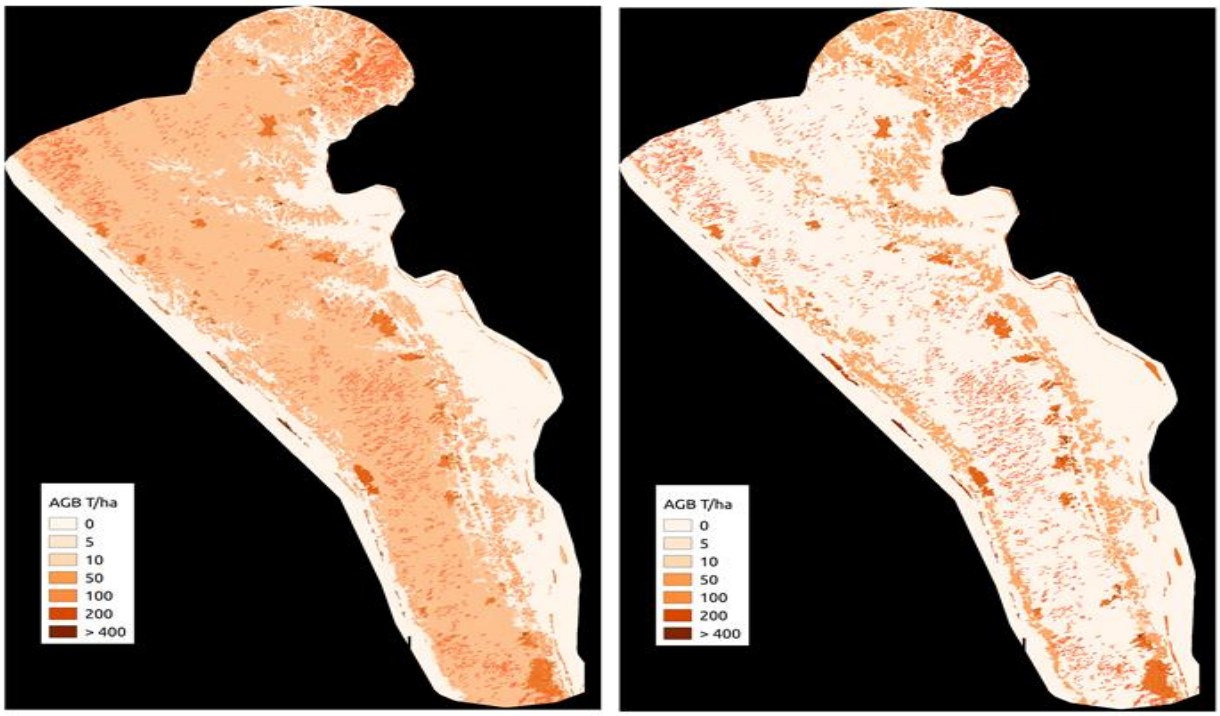
An assessment of wood fuel supply and demand to reduce pressure on natural resources

Most of the land degradation is driven by energy demand for subsistence needs such as cooking. An assessment of woodfuel supply and demand was essential to determine the sustainable optimum for energy supply from plantations, considering the reduction of demand due to improved energy consumption and/or the use of alternative energy sources (e.g., solar energy, LPG). Understanding supply and demand is critical for informing decision-making (e.g., what stocking rates are required for successful reforestation programmes) and achieving sustainability of energy supply and ecosystem function. This assessment was done in 2016, before the massive refugee influx, using technical guidance developed by FAO and UNHCR (D'Annunzio *et al*., 2016), which was based on the collection, analysis, and integration of biophysical, socio-economic and remote sensing data. The assessment was updated after the refugee influx, revealing a six-fold increase in fuelwood demand, from 54 542 tonnes per year in 2016 to 312 807 tonnes per year in 2017 (estimated from the total number of refugee households) and signaling immense pressure on existing forest resources (IOM and FAO, 2017). The assessment was essential for raising awareness around the importance of safe access to fuel and energy as well as land restoration activities.

Figure 3. Monitoring biomass and woodfuel availability using remote sensing and ground-truthing (IOM and FAO, 2017). The maps show aboveground biomass change over the period 1994 – 2016



FAO and IOM, 2017.

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Restoration activities

The technical specifications for the restoration activities were prepared by the World Overview of Conservation Approaches and Technologies (WOCAT)[12] (2019) and documented in consultation with experts and stakeholders (Mahamud *et al.* 2018). The document provides guidance for landscape restoration, with detailed information on planning, coordination, decision-making, maintenance, and the enhancement of knowledge sharing. Particular attention was paid to the sustainability of plantation activities, taking into account aspects such as the supply of seedlings from nurseries, vegetation growth, vegetation layers, inputs and workforce, as well as ensuring the maintenance of plant biodiversity and promoting the use of native species. By using multiple vegetation layers, including long rooted grass species to stabilize topsoils, leguminous shrubs for increasing soil fertility, bamboo as living reinforcement on vulnerable slopes and fast-growing tree species for quick vegetation cover, the project has been able to reduce the risk of rainfall-induced landslides considerably as well as to rehabilitate post-landslide slopes.

Figure 4. Using multiple vegetation layers to reduce the risk of rainfall-induced landslides and facilitate post-landslide slope rehabilitation (credit: Saikat Mazumder, FAO)

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[1] EETWG is a technical body created by the Inert-Sector Coordination Group (ISCG) for overseeing and coordinating the activities related to the energy and environment inside the Rohingya camps.

[2] WOCAT is a global network on sustainable land management that promotes the documentation, sharing and use of knowledge to promote adaptation and innovation.

The use of remote sensing and geospatial analyses to plan and monitor land restoration

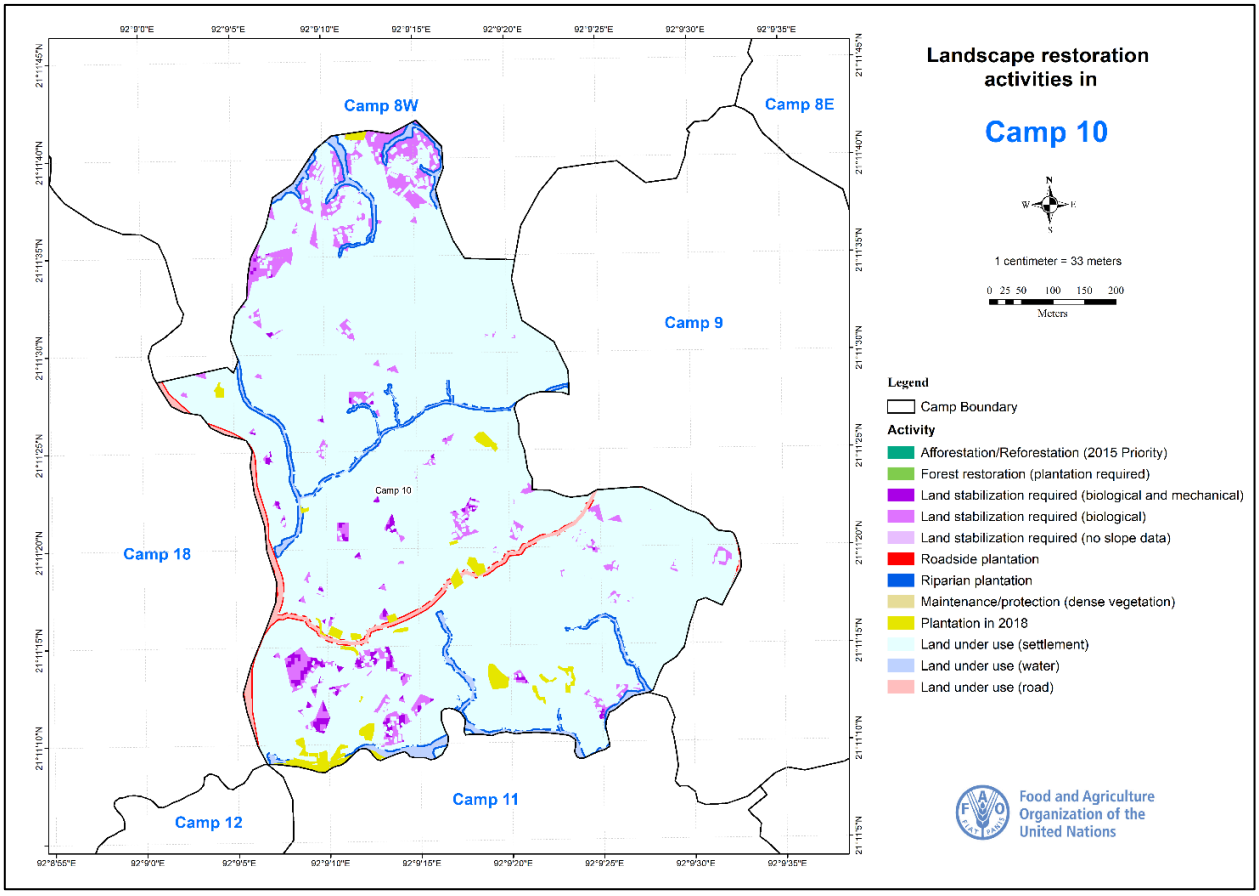
The approach is continuously updated as more data become available. New data, such as settlement footprint inside the camp and high-resolution digital elevation models (DEM) were added to help locate potential areas for restoration and planning such activities as riparian plantation, roadside plantation, land stabilization, afforestation/reforestation, and forest restoration. The identification of the land through earth observation data and geospatial analyses was validated on the ground before taking action.

The following steps were used for the land suitability analysis in 2019 and an example of the results is shown in figure.

- Land was classified and delineated using five broad land cover classes (water, bare land, settlement, sparse vegetation, and dense vegetation) and NDVI in January 2019.[3]
- Buffer areas of 5 metres around rivers and streams, and 1 metre around buildings, roads, and water bodies (with an area greater than 0.5 ha) were designated as underused land.
- Land within the 5 metres buffer of land under use (waterside) was designated for a riparian plantation.
- Areas within 1 metre from the road were kept as underused land. From the edge of the underused land (roadside), a 2-metre buffer was delineated for a roadside plantation.
- Land dedicated for plantation in 2018 was retained as plantation area in 2019.
- Bare land was allocated for land stabilization.
- Land with sparse vegetation and identified as non-forest land according to the land cover 2015 (Jalal *et al*., 2019) was designated for afforestation/reforestation.
- Land with sparse vegetation and identified as forest land according to a land cover study in 2015 was designated for forest restoration.
- Land with dense vegetation was selected for maintenance and protection.

[3] Sentinel 2 multispectral 10 metres images with maximum cloud cover of 10 percent were used for NDVI analysis.

Figure 5. A land restoration plan map for one camp in 2019



Source: Author, 2019, base map HDX, 2020 https://data.humdata.org/dataset?q=cox modified by authors to comply with [applicable UN map]

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Maintaining sufficient planting materials

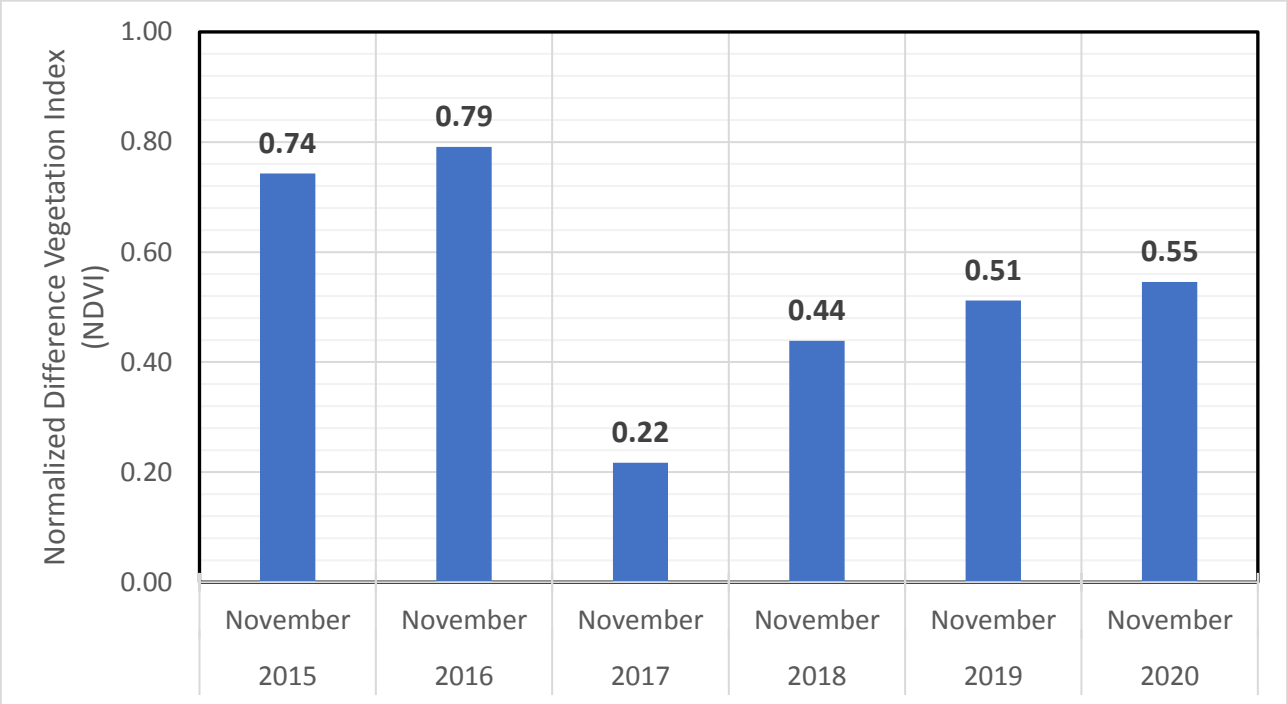
The detailed technical specifications in the technical guidelines for restoration (Mahamud *et al,.* 2018) provide clear information about the activities and the inputs required, such as number of seedlings, seeds, manure and workforce. Quality planting materials are critical to the success of any restoration initiative, thus plant nurseries were developed, with the support of the Forest Department and the host communities around the camps. Sixty-six nursery owners were brought into the Nursery Management Team (NMT). They received technical and logistical support on producing quality seedlings from seed and vegetative propagation, improving survival rates and distributing material the various partners. The Arannayk Foundation, a national NGO, is supporting the preparation of a web-based platform that will have up-to-date information about the seedling production capacity at different nurseries.

An overview of the results

About 450 hectares of degraded land are now being rehabilitated inside the camps, an effort that has involved more than 100 000 person-days. Landslide risk has been reduced through land stabilization. Plant biodiversity is being protected through the use of native tree species. In addition, 2 000 hectares of forestland and important watershed areas outside the camp area have been subject to restoration activities in 2020.

The land restoration initiative inside the camps is being updated regularly through the EETWG (that included the area of plantation, types of species used, silvicultural treatment applied, challenges faced and mitigation measure taken) and the results from the restoration activities are monitored in the field and using remote sensing. Figure presents a representative example of the evolution of the vegetation (using NDVI) in the degraded forestlands from November 2015 until November 2020. The figure shows that prior to 2017, the average NDVI values in the area were medium to high. After the influx of refugees in 2017, NDVI decreased drastically, representing a near-complete loss of tree cover. After just one year of plantation activities, which began in September 2018, the NDVI is approaching its previous level.

Figure 6. Cloud-masked NDVI from 2015 to 2020 from Landsat 8 near Camp 16 (latitude: 21.1575, Longitude: 92.152778)



Source: authors (this paper)

Key messages and recommendations

Ecosystem restoration is bringing positive changes to both refugee and host communities while highlighting the importance of considering environmental conditions in protracted refugee contexts. The unprecedented land degradation in Cox's Bazar required an urgent response and immediate restoration activities. The longer degradation persists, the more difficult it becomes to restore the landscape. In the most severely affected areas, there was

a substantial risk of irreversible damage, with a total loss of large tracts of forest. There had been instances of scattered plantation interventions with limited consideration of the local context, which aggravated the crisis by contributing to conflict. The availability of information on land degradation and land tenure, the identification and prioritization of suitable land for restoration and other interventions, and a collaborative and inclusive approach to implementation were necessary preconditions for success.

The project approach was critical to designing, implementing and monitoring restoration activities. Remote sensing and geospatial analyses were effective for the preliminary assessment of degradation and the identification and prioritization of suitable restoration areas. However, the results needed to be validated by ground observation before commencing restoration activities. Given the emergency nature of the problem, the project took a practical and intuitive approach, which was later enhanced with additional data and information. Good preparation and proper implementation of the technical guidelines helped the partners to avoid unplanned activities, protect plant biodiversity, and allocate resources efficiently. Information related to the supply and demand of woodfuel was very important in developing ways to ease the demand while restoration initiatives worked on increasing available stocks. Finally, the collaborative implementation of restoration activities, with due attention to different and sometimes conflicting interests of stakeholders, was critical to the success of the programme.

Successfully implementing and sustaining restoration activities in an emergency displacement setting is extraordinarily challenging: it requires an integrated, multidisciplinary approach that considers the entire landscape, including the people and ecosystems it contains. After three years of establishing nurseries, stabilizing the land stabilization and planting trees inside and outside of the camps, satellite images and field-level observations reveal the positive impact of nature-based solutions, even in such a complicated humanitarian context. Recognizing that every challenge is unique, the approach adopted in Cox's Bazar could be applied – with proper contextualization – in similar displacement settings.

Looking ahead, the methodology applied here is flexible enough to incorporate newly-available data from high-resolution satellite imagery and laser ranging, such as global ecosystem dynamics investigation (GEDI), as well as other advanced techniques. Platforms, such as the System for Earth Observation Data Access, Processing, and Analysis for Land Monitoring (SEPAL),[4] are available to facilitate access to such data as well as providing computing power and an easy-to-use interface, helping to remove barriers to advanced analyses. Incorporating more accurate information, including on ecosystem services, and making processes more collaborative and inclusive can radically improve decisions on how to better protect people and the environment.

[4] Developed by FAO, SEPAL helps countries monitor and report on forests and land use. SEPAL offers users unparalleled access to satellite data, an easy-to-use interface, cloud-based super computers, paving the way for improved climate change mitigation plans and data-driven land-use policies.

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The unprecedented increase in forced displacement over the past decade poses critical challenges to human health, food security, nutrition, water supply and sanitation, shelter, education, environmental services and energy, not only for the people who have been uprooted from their homes but also for their host communities. The environmental degradation resulting from the unsustainable extraction of natural resources in and around refugee camps may become irreversible if action is not soon taken to reduce its impacts. In Cox's Bazar, Bangladesh, an integrated approach to fighting degradation combines participatory processes, energy supply, demand assessment and sustainable land management. The approach uses native plant species for soil stabilization, the rehabilitation of degraded forestland and advanced geospatial technologies and remote sensing to mount a coordinated and timely response that can halt irreversible land degradation, reduce risks from natural disasters, and improve ecosystem services and living conditions inside and around the camps. This case study presents the lessons learned from ongoing efforts to use field and remote sensing information to monitor and restore degraded land in and around the Rohingya refugee camps of Cox's Bazar, Bangladesh.