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The Myanmar Norway Environmental Programme's Capacity Building Achievements

Integrated Water Resources Management Institutional building and training

Improved management of protected areas, wetlands and biodiversity in Myanmar

Strengthened technical capabilities of hazardous and industrial waste management

Capacity building on waste management in the Bago Region

Photo: NIVA

Report

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Abstract
This report presents the key capacity building achievements resulting from the Myanmar Norway Environment Programme (2015-2018, and 2019-2023). The programme, a bilateral collaboration, between institutions of the Governments of Norway and Myanmar for improved environmental management enabled high achievement. The Programme included the following partners: In Myanmar, under MONREC, the Forest Department with the Watershed Management Division and the Nature and Wildlife Conservation Division, and the Environmental Conservation Department. In Norway, the Norwegian Environment Agency, NIVA and SINTEF. The Environmental Programme addressed the following topics, water Management, conservation of biodiversity, hazardous waste management and waste management on local level. The main activities and capacity building achievements from the four projects in the programme are presented.

Keywords: Capacity building, water management, biodiversity protection, hazardous waste management, waste management local level.
Emneord: Kapasitetsbygging, Vannressursforvaltning, Biologisk mangfold, Farlig avfall, Avfallshåndtering.

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Preface

The Myanmar Norway Environmental Programme 2015-2018 and 2019-2023 aimed for improved environmental management in Myanmar - by strengthening the institutional framework and capacity of the Ministry of Natural Resources and Environmental Conservation (MONREC).

The Environmental Programme referred to a MoU (2014) between MONREC, acting through its Forestry Department, the Environmental Conservation Department, and the Norwegian Ministry of Foreign Affairs through the Royal Norwegian Embassy to Myanmar in Yangon. From an initial meeting between Myanmar and Norwegian officials in 2012, the programme went through a planning and inception phase in 2014. Programme implementation was outlined in agreements and result impact frameworks for a first phase (2015- 2018) and a second phase (2019-2023). The programme comprised four projects in the areas of, developing an Integrated Water Resource Management system, Conservation of Biodiversity including strengthened management of wetlands and protected areas, management of hazardous waste, and waste management practices in the Bago Township.

The four projects in the programme were organized and implemented independently by the programme partners. The high achievement levels documented by the KPMG review in 2018 resulted from the effective and good collaboration between the project partners in Myanmar and Norway. The project addressing water management was the larger among the three on account of the broad aims, and the project funding. This report, edited by Ingrid Nesheim and Camilla F. Wedul (NIVA), presents the different projects' capacity building achievements. Ingrid Nesheim was the programme coordinator during the second phase of the programme.

We acknowledge the important contribution to the programme's achievements from a large number of people in Myanmar at the collaborating partner institutions, as well as from individuals at affiliated partner institutions, private companies, and civil society. The capacity building results have relied on the engagement and efforts from directors, senior officials, and technical staff in Myanmar. We would like to highlight that the results rests on the collaborative relationships, the efforts and time spent by Myanmar partners, and the Norwegian partners' efforts to take the Myanmar context into account and adapt the projects to the needs of the Myanmar partners. Due to the military coup in Myanmar, the partners, the WMD FD, the NWCD FD, ECD are not co-authors of this report.

The 'Integrated Water Resources Management – Institutional building and training' (the IWRM project) has been a collaboration between the Norwegian Institute for Water Research (NIVA) and the Watershed Management Division (WMD) of the MONREC Forest Department (FD). The project was led by Ingrid Nesheim at NIVA. Each of the project's components has been the responsibility of different groups of experts at NIVA and the WMD FD. The work addressing ecological status assessment was led by Andreas Ballot and Nikolai Friberg, together with Marit Mjelde, Tor Erik Eriksen, Johnny Håll. The work to develop the water quality laboratory was led by Kine Bæk and Tomas A. Blakseth together with Veronica S. Eftevåg and Elisabeth Lie. The development of the database and the data centre at FD was led by John Rune Selvik, Roar Brænden, and Ciaran J. Murray. The work to pilot the Myanmar National Water Framework Directive in selected catchments was led by Ingrid Nesheim and Hans Nicolai Adam. The monitoring and risk assessment in areas affected by mining was led by Hans Fredrik Veiteberg Braaten and Cathrine B Gundersen. In Myanmar we would like to acknowledge the contribution of, Bo Ni, Toe Toe Aung, Zaw Win Myint, May Thazin Phoo, Phyo Thet Naing, Si Thu Aung, Swuam Pyae Aye Aung, Nway Mon Mon Aung, May Aung, Thida Swe, Thida Cho at the WMD FD, and Zaw Lwin Tun, Hla Oo Nwe, Phyo Wei at IIWUMD MOALI, Sein Tun at DWIR MOTC.

“Conservation of Biodiversity in Myanmar – including strenghtened management of wetlands and protected areas" (the Biodiversity project) was a collaboration between the Norwegian Environment Agency (NEA) and the Nature and Wildlife Conservation Division (NWCD) of the MONREC Forest Department. The project was led by Jan-Petter Huberth Hansen at NEA. Central experts in the project team included Vibeke Husby, and Per Espen Fjeld, as well as Morten Wedege (in phase I), all at NEA. In Myanmar, Pyi Soe Aung and Naing Zaw Htun, both at NWCD, were crucial in coordination and implementing of the project, together with a range of other NWCD experts, including protected area managers.

“Strengthened technical capabilities of hazardous and industrial waste management”, or the HWM Project, Phase I, was implemented by ECD (under the leadership of U Hla Maung Thein, DG-ECD), NEA (Jon Fonnlid Larsen and Kristine Eine) and SINTEF (Kåre Helge Karstensen and Palash Kumar Saha). The HWM project would like to also acknowledge the valuable inputs and support of the representatives of participating institutions and ministries, including the MOPF, MOHS, MOI including DISI, MOE, MOEE, MOGE, MOALI, MOTC, DMA, MOC, YCDC, MCDC, MIA, MONREC (Department of Mines and Regional ECD), Golden Dowa, JICA Expert Team, and other key public, private, academic, and civil society stakeholders, as well as national and international consultants. Phase II of the project was implemented by ECD and SINTEF.

“Capacity building on waste management in the Bago Region” or the ‘Bago Waste’ project was included in the programme through an addendum in 2020 and was led by Hans Nicolai Adam and Ingrid Nesheim. The project built on long established relationships in the IWRM I, through which a relationship with Kyaw Min San was established, who was leading the local coordination of the project. Ye Htun Aung (MJT) and May Phoo (Justice for All) were crucial contributors across project phases with Dr. Saw Nyo Win from the Bago Region Government (MONRFEC) heading the Bago Waste Advisory group. We would also like to acknowledge the monasteries and its residents for proactive collaboration as well as staff from MJT and Justice for All. Various participating departments and ministries at the Bago Region level, including FD, ECD, DWIR, IWUMD, Region ministry MONFREC, DOA, Bago Township Development Committee supported and provided input, often through personal efforts by key personnel.

The development and the establishment of sector based “Knowledge Programmes”, a type of development cooperation between states funded by Norway, has been a strategy by the Norwegian Ministry of Foreign Affairs (White paper 17, 2017-2018). Typically, projects supported by “Knowledge Programmes” do not publish reports that reflect on the capacity building objectives achieved. This report presents for each of the four projects under the Environmental Programme, the capacity building aspects achieved, including reflections on success criteria, and challenges experienced. The report highlights achievements for (i) Administrative and technical personnel, (ii) by provision of infrastructure, (iii) by contribution to policy development, and (iv) awareness building of civil society.

Finally, we would like to acknowledge the support from the Royal Norwegian Embassy in Yangon, Myanmar, for the Environmental Programme over the years, since 2014 and until the present. The good communication, including availability, information and advice for the Norwegian partners have represented important enabling factors for the achievements gained.
We hope that the report with our reflections on the criteria for the success, and the challenges achieved, can be useful for partners in other development cooperations.

Abbreviations

CDC	City Development Committee
CS	Civil Society
CTI	Myanmar Co. Consulting engineers
DAR	Department of Agricultural Research
DISI	Department of Industrial Supervision and Inspection
DMH	Department of Meteorology and Hydrology
DOF	Department of Fisheries (MOALI)
DOM	Department of Mines
DWIR	Directorate of Water Resources and Improvement of River Systems
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
ESM	Environmentally Sound Management
EU WFD	European Union Water Framework Directive
FD	Forest Department
FRI	Forest Research Institute (MONREC)
IFC	International Finance Corporation
HCW	Health Care Waste
HIC	Hydro Informatic Centre
HW	Hazardous Waste
HWM	Hazardous Waste Management
IEE	Initial Environmental Examination
ITC	Irrigation Technology Centre
IWUMD	Irrigation and Water Utilization, Management Department
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
MA	Department of Marine Administration
MCDC	Mandalay City Development Committee
MCE	Ministry of Climate and Environment (Norway)
MFA	Ministry of Foreign Affairs (Norway)
MIA	Myanmar Industry Association
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOC	Ministry of Commerce
MOE	Ministry of Education
MOECAF	Ministry of Environmental Conservation and Forestry (Myanmar)
MOEE	Ministry of Electricity and Energy
MOGE	Myanmar Oil and Gas Enterprise
MOH	Ministry of Health
MOI	Ministry of Industry
MONRFEC	Ministry of Natural Resources, Forestry and Environmental Conservation (Myanmar)
MONREC	Ministry of Natural Resources and Environmental Conservation (Myanmar)
MOPF	Ministry of Planning and Finance
MOHS	The Ministry of Health & Sports
MOTC	Ministry of Transport and Communication
NIVA	Norwegian Institute for Water Research

NPT	Nay Pyi Taw
NEA	Norwegian Environment Agency
NGO	Non-Governmental Organization
NORAD	Norwegian Agency for Development Cooperation
NWRC	National Water Resources Committee
NWFD	National Water Framework Directive
NWRC EG	National Water Resources Committee Expert Group
NWRC AG	National Water Resources Committee Advisory Group
RBM	River basin management
SEZ	Special Economic Zone
SINTEF	The Foundation for Scientific and Technical Research
SME	Small & Medium Enterprises
SOE	State Owned Enterprises
TDC	Township Development Committee
WMD	Watershed Management Division
WtE	Waste to Energy
WEEE	Waste Electrical and Electronic Equipment, also known as e-waste
YCDC	Yangon City Development Committee
YTU	Yangon Technological University
USD	US Dollar

Summary

This report presents the key capacity building achievements resulting from the Myanmar Norway Environment Programme (2015-2018 and 2019-2023). The programme, a collaboration between institutions of the Governments of Norway and Myanmar for improved environmental management, has yielded good results, particularly in the programme's first phase. During the second phase of the programme the work was challenged, first by Covid-19 and then by the military coup which caused a freeze in most programme activities.

Chapter 1 of this report addresses the background of the programme and its development, focusing on the programme's four subprojects. The chapter also describes programme coordination, synergies between the projects, and capacity building achievements in the projects related to (i) provision of infrastructure, (ii) training of technical and administrative staff of the partner institutions, (iii) capacity building for policy development, and (iv) awareness building and knowledge raising for civil society. The projects all aim for improved environmental management but differ in size and the amount of funding distributed to the Norwegian and the Myanmar partners.

Chapter 2 presents the Integrated Water Resources Management Institution Building and Training project (2015–2018, and 2019–2023), the main partners (WMD and NIVA), and the affiliated partners (IWUMD and DWIR). The chapter presents achievements in the five project components: (i) Framework for water quality and ecological status assessment, (ii) Development of a National Water Quality Laboratory, (iii) Water Quality Database for Storage and Communication of Data, (iv) Two pilot cases on the Myanmar National Water Framework Directive, and (v) Monitoring plans and risk assessment for areas affected by the mining industry. The chapter describes important criteria for project achievements, challenges experienced, and mitigation activities undertaken. Main achievements are summarized, and a project publication list is provided.

Chapter 3 presents the project on Conservation of Biodiversity of biodiversity in Myanmar – including strengthened management of wetlands and protected areas (2015–2018, and 2019–2023), and gives an overview of main partners, associated partners, and experts. Then follows a brief overview of the situation for nature conservation and biodiversity and threats against it. Activities and achievements of the different project components are described, including: i) training and capacity building on nature management, ii) capacity building for the protection and the wise use of wetlands, iii) strengthened management of protected areas, and iv) enhanced capacity for the protection of wildlife and endangered species. Finally, reflections, success criteria, and challenges are described, along with main achievements of the project components.

Chapter 4 delves into the Hazardous Waste Management project, which spanned two phases: Phase I (2015–2019) and Phase II (2020–2023). The chapter outlines key partners such as ECD-MONREC, NEA, and SINTEF, as well as affiliated partners like regional ECDs, CDCs, and DISI-MOI of Yangon and Mandalay. The chapter goes on to present the results obtained across three main components: (i) Improving the regulatory framework for hazardous waste management, (ii) Enhancing technical capacity for hazardous waste management, and (iii) Developing the National Hazardous Waste Master Plan. Additionally, the chapter explores success criteria, challenges, and mitigation measures, summarizes major achievements, and provides a list of publications.

Chapter 5 presents the project on Capacity Building for Waste Management in the Bago Region (2020–2023). The overall project approach, achievements, and reflections are presented in connection with activities undertaken at the Bago Region level to improve the waste management situation. Four pilot cases formed the centrepiece of activities and are briefly summarised: (i) Waste management at a

market site area, (ii) The cleanup of a riverside waste dump, (iii) Implementing systemic waste management at monasteries, and (iv) Composting as a decentralized waste management approach. In addition, scientific studies (formal and informal waste management, microplastic monitoring) are presented before some final reflections and challenges on project implementation.

Chapter 6 presents reflections on overall success factors for the programme achievements, risks and challenges experienced, and mitigation activities undertaken. It also describes the programme's approach to defined cross cutting issues such as human rights, gender and equality, climate and environment, and anti-corruption.

Sammendrag

Denne rapporten presenterer de viktigste resultatene fra kapasitetsbyggingsprogrammet The Myanmar Norway Environment Programme (2015-2018 og 2019-2023). Programmet, som er et samarbeid mellom institusjoner i Norge og Myanmar for bedre miljøforvaltning, har gitt gode resultater, særlig i programmets første fase. I andre fase møtte programarbeidet store utfordringer, først av Covid-19 og deretter av militærkuppet som førte til stans i de fleste programaktivitetene.

Kapittel 1 i denne rapporten tar for seg bakgrunnen for og utviklingen av programmet med fokus på de fire underprosjektene. Kapittelet presenterer programkoordinering, synergier mellom prosjektene og kapasitetsbyggingsfokuset i forbindelse med: (i) anskaffelse og etablering av infrastruktur, (ii) opplæring av teknisk og administrativt personale ved partnerinstitusjonene, (iii) kapasitetsbygging for politikk-utvikling, og (iv) bevisstgjøring og kunnskapsheving for sivilsamfunnsrepresentanter.

Kapittel 2 presenterer Integrated Water Management Institution Building and Training-prosjektet, der WMD FD og NIVA var hovedpartnere. IWUMD og DWIR var andre viktige samarbeidspartnere. Kapittelet presenterer resultater fra fem prosjektkomponenter: (i) Rammeverk for vurdering av vannkvalitet og økologisk tilstand, (ii) Utvikling av et nasjonalt vannkvalitetslaboratorium, (iii) Database for lagring og kommunikasjon av data om vannkvalitet, (iv) To pilotstudier for implementering av Myanmars nasjonale vanndirektiv, og (v) Overvåkingsplaner og risikovurderinger for områder som berøres av gruveindustri. Kapittelet beskriver viktige kriterier for resultatoppnåelse, samt utfordringer og tiltak for å imøtegå disse. Prosjektets hovedresultater oppsummeres, og til slutt følger en publikasjonsliste.

Kapittel 3 presenterer prosjektet for bevaring av biologisk mangfold i Myanmar – inkludert styrket forvaltning av våtmarker og verneområder. Hovedpartnere og andre samabeidspartnere presenteres. Det gis en kort oversikt over situasjonen med hensyn til naturvern og biologisk mangfold og trusler mot dette. Aktiviteter og resultater fra de ulike prosjektkomponentene er beskrevet, inkludert: i) Opplæring og kapasitetsbygging om naturforvaltning, ii) Styrket kapasitet for vern og bærekraftig bruk av våtmarker, iii) Styrket forvaltning av verneområder, og iv) Økt kapasitet for beskyttelse av dyreliv og truede arter. Til slutt beskrives refleksjoner, suksesskriterier og utfordringer rundt prosjektet, sammen med hovedresultater og prosjektpublikasjoner.

Kapittel 4 tar for seg prosjektet for Hazardous Waste Management for fase I. Kapittelet presenterer sentrale samarbeidspartnere, ECD-MONREC, NEA og SINTEF, og andre samarbeidspartnere, som regionale ECD-er, CDC-er og DISI-MOI i Yangon og Mandalay. Deretter presenteres resultatene fra de tre hovedkomponentene: (i) Oppdatering av regelverket for håndtering av farlig avfall, (ii) Styrking av teknisk kapasitet innen håndtering av farlig avfall, og (iii) Utvikling av en nasjonal masterplan for farlig avfall. I tillegg tar kapittelet for seg suksesskriterier, utfordringer og risikoreduserende tiltak, og oppsummerer de viktigste resultatene. Avslutningsvis følger en liste over publikasjoner.

Kapittel 5 presenterer prosjektet Capacity Building for Waste Management in the Bago Region. Prosjektets overordnede mål, aktiviteter og kapasitetsbyggingsresultater med mål om forbedret avfallsforvaltning beskrives. Fire sentrale pilotprosjekter oppsummeres kort: (i) avfallshåndtering på et lokalt marked, (ii) opprydding av en søppelfylling langs elvebredden, (iii) implementering av systematisk avfallshåndtering i klostre og (iv) kompostering som desentralisert tilnærming til avfallshåndtering. I tillegg presenteres kort to vitenskapelige studier gjennomført i prosjektet – ett om avfallshåndtering i formell og uformell sektor med fokus på roller, ansvarsforhold og relasjoner, og et annet studerte overvåking av makroplast. Til slutt beskrives refleksjoner, suksesskriterier og utfordringer rundt prosjektet, sammen med hovedresultater og prosjektpublikasjoner.

Kapittel 6 presenterer refleksjoner rundt overordnede suksessfaktorer for programmets resultater, og utfordringer, samt tiltak for å redusere disse. Her beskrives også programmets tilnærming til tverrgående temaer som menneskerettigheter, kjønn og likestilling, klima, miljø og antikorrupsjon.

1 Introduction

Myanmar is a mostly tropical country with vast natural resources including water, biodiversity, timber, gems and minerals, oil and gas. More than 40 percent of the country is forest, and large rivers like the Ayeyarwady and Sittaung flow through the central alluvial plain. The central plain is surrounded by mountains in the west and the Shan Plateau in the east, from where two other large rivers, the Chindwin and the Salween flow south towards the Bay of Bengal and the Andaman Sea (Figures 1, 2). Around 70% of the 56 million multiethnic citizens live in rural areas. The country is divided into administrative subdivisions including seven regions and seven states (Tun et al., 2016). The Bamar majority mostly live in the central regions, and the ethnic minority groups live in states along the border areas.

Myanmar's history involves military control between 1962 and 2011 with strict international economic and diplomatic sanctions. In the 1980s the nation was impoverished. Liberalization was initiated in 1988 when the military government adopted policies and regulations to open the economy up to foreign investment (Nesheim et al. 2016). A military party continued to rule until the first multiparty election in 2011, and the first democratic election was organized in 2015. Following the democratic developments, economic sanctions were lifted, and national and international investments increased. Rapid industrialization and economic growth followed, along with unsustainable exploitation of natural resources. Environmental legislation was weak, the country lacked environmental standards and a framework for environmental impact assessments to enable sustainable management of the country's natural resources.

Development collaboration between Myanmar and Norway was initiated in October 2012 when Myanmar Union Minister U Win Tun visited Norway to discuss development collaboration. Part of the background for the visit was the need for capacity building of the newly established Ministry of Environmental Conservation and Forestry (later the Ministry of Natural Resources and Environmental Conservation (MONREC)) which was to be responsible for environmental management in Myanmar. Three years later, the ribbon was cut for the Myanmar Norwegian Environment Programme including four projects for the period 2015-2023 (Table 1, p. 16; Figure 1).

The Environmental Programme partners
In Myanmar, under MONREC, the Forest Department (FD) with the Watershed Management Division (WMD) and the Nature and Wildlife Conservation Department (NWCD), and the Environmental Conservation Department (ECD).
In Norway, the Norwegian Environment Agency (NEA), NIVA and SINTEF.

The Environmental Programme topics

- Water Management
- Conservation of Biodiversity
- Hazardous Waste management
- Waste management on local level

Structure of the report
This report presents a general overview of the Environmental Programme, followed by separate chapters for each of the projects under the programme.

The main activities and results of the four projects in the programme are presented, and capacity building achievements are presented for (i) authorities and technical personnel, (ii) provision of infrastructure, (iii) input to policy development, and (iv) awareness and capacity building of civil society and private actors. The report closes with a chapter on final considerations.

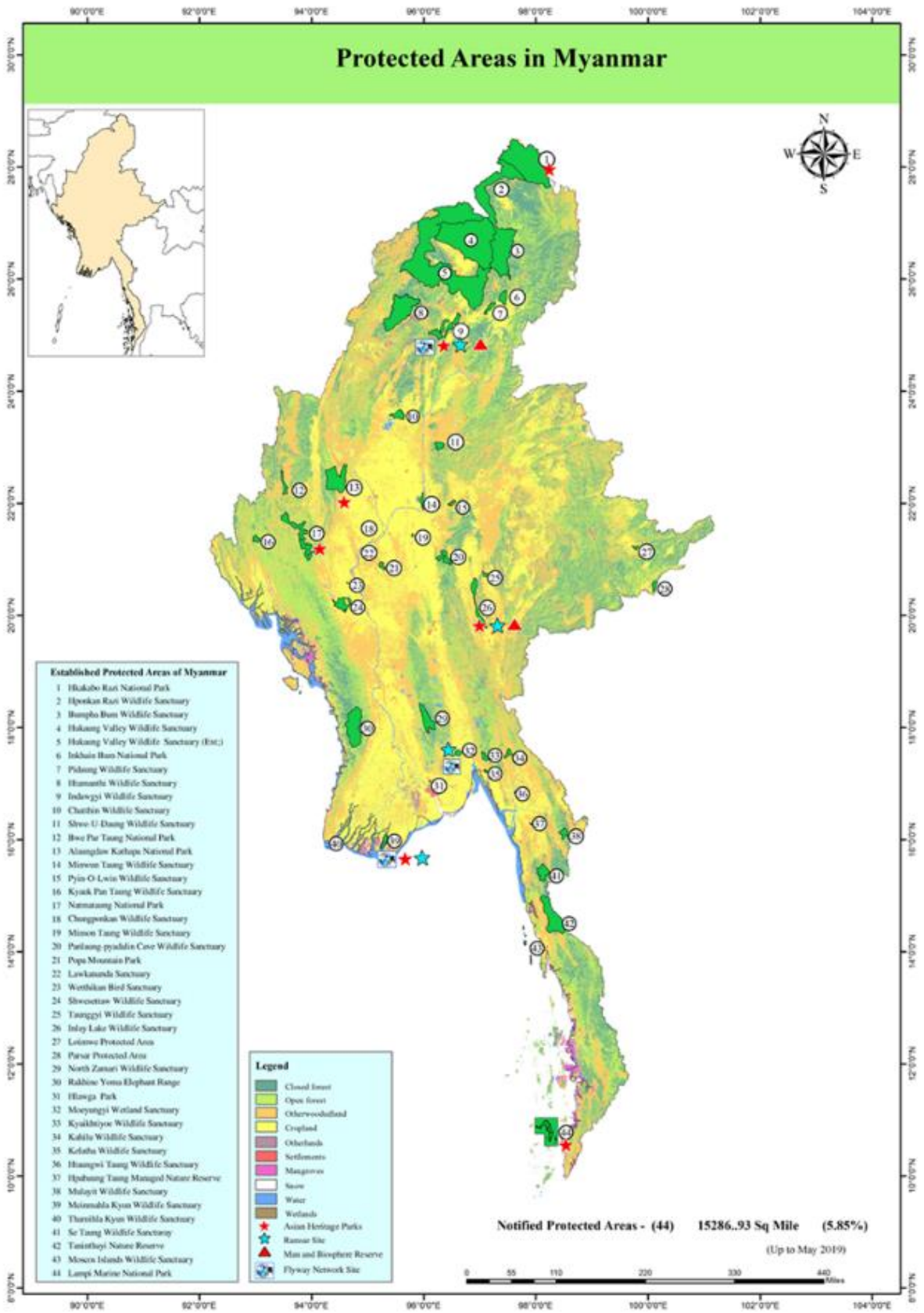


Figure 1. *Map of the locations and names of protected areas in Myanmar (MOECAF).*

The Myanmar Norway Environmental Programme

In December 2014, the Myanmar Ministry of Environment Conservation and Forestry (MOECAF) and the Norwegian Ministry of Climate and Environment signed a MOU on development cooperation. The bilateral Environmental Programme was signed by the Norwegian Embassy in Myanmar and MOECAF in October 2015. The development cooperation that followed was specified by programme and project descriptions and contracts between the different institutions on the Myanmar side and the Norwegian side.

Programme partners were the Norwegian Environment Agency (NEA), NIVA, and SINTEF in Norway, and the Environmental Conservation Department (ECD) and MOECAF Forest Department (FD) with subordinate Watershed Management Division and Nature and Wildlife Conservation Division in Myanmar (see Table 1, p. 16).

Phase 1 (2015-2018)
The first phase of the programme ran from 2015 to 2018, with an inception phase in 2014. The programme's overall aim was: "sustainable economic development of Myanmar through a strategy that builds capacities of stakeholders and strengthens institutional frameworks in the context of managing rich water and biological resources and hazardous waste".

The Programme's first phase included three projects and 11 specified outcomes (Table 1). Norwegian partners travelled frequently to Myanmar for fieldwork, data collection, workshops, and meetings – all important for the substantial achievements described in this report. A KPMG 2018 review described the programme as successful. This review, good collaboration among the partners, and acknowledging that three years is a very short period to improve a country's environmental status, were reasons that the programme was granted funding for a second phase.

Phase 2 (2019-2023)
The second phase represented a continuation of capacity building on the topics of integrated water management, protection of biodiversity, and hazardous waste management, involving the same collaborating partners. In 2020, an addendum was approved for the inclusion of a project on waste management on the local level. The second phase reflected the Myanmar Sustainable Development Plan (MSDP, 2018), that specified a strategy for, good water use practices, increasing renewable energy generation, climate change mitigation, increasing green investments, protecting biodiversity, improving waste management.

For the second phase NIVA was the programme coordinator on the Norwegian side, and the WMD FD was coordinating partner on the Myanmar side.

The co-operation activities were motivated by a shared belief in the overall development of a democratic Myanmar society following decades of authoritarian rule. This changed with the military coup February 1st 2021. After this, most of the programme's activities ceased. Only support for students in education and for the Bago waste project, which did not involve government partners, continued.

Programme annual meeting 2017 at FD in Nay Pyi Taw. (Photo: Ingrid Nesheim).

The Programme coordination
The programme coordinators, NIVA and WMD FD, promoted synergies among the projects such as identification and organization of programme level activities and seminars. In Myanmar, the WMD FD facilitated coordination between government departments and divisions. Overall, the coordination resulted in more regular meetings between partners and better communication in the programme and within the different projects. Programme coordination was a requirement of the Norwegian embassy to fund the second phase.

Programme synergies - highlights
Knowledge sharing gained. When partners worked in the same geographical areas, synergies between the projects were achieved. This was particularly the case in Indawgyi Lake Wildlife Sanctuary and Ramsar site, Kye-in lake (in Chattin Wildlife Sanctuary), Moeyungyi Wildlife Sanctuary, and Inle lake. In 2017, all three projects in Indawgyi focussed on the gold mining situation. Another example is the water quality monitoring activities undertaken by the IWRM project having value for the Biodiversity Project when developing management plans for these sites.

Synergies for administration included, organization of programme annual meetings, coordination, writing programme annual reports, and dissemination of budgets. The effort reduced the administration load for the embassy and the other partners. Regular half year meetings between partners in Myanmar and Norway to discuss various issues and possible synergies to be explored were organized.

Communication and disseminations activities. Larger programme level seminars such as the January 2018 "Seminar on the Myanmar – Norwegian Cooperation on the Bilateral Environmental Programme" in Nay Pyi Taw presented project results for a larger audience.

A web page presenting the programme and its underlying projects was developed by NIVA. The homepage also provides access to reports and other communication material.

Communication and dissemination
The programme homepage contains information about projects, activities, and how to contact project partners. Programme and project related publications have been made accessible for download by external actors.

Flyers and Facebook. A flyer presenting the objectives and partners of the programme and projects was developed as a collaborative effort among Myanmar and Norwegian partners in 2019. The IWRM and the Bago waste project also have Facebook pages where regular updates are posted.

Each of four projects presented by different chapter in this report includes a list of the project publications.

Impacts of Covid-19. In 2020, the pandemic caused delay and challenged the programme work. Myanmar partners' domestic travel, Norwegian experts travel to Myanmar, and physical gathering of people had to stop. The project partners responded by engaging in frequent online meetings and courses enabling progress despite the serious restrictions.

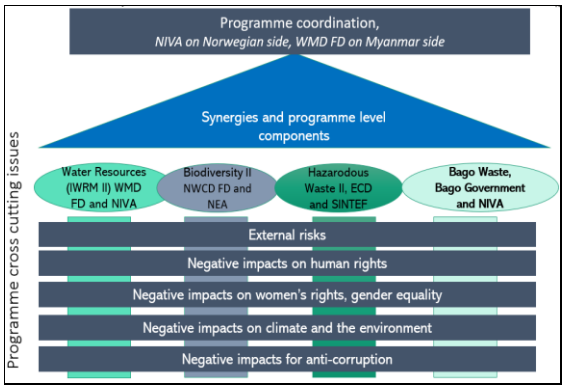


Figure 2. *The Programme's different elements (Source: Ingrid Nesheim, 2020).*

Projects	Years	Norwegian partner	Myanmar partner	Aims / specified outcomes
IWRM I, II	2015-2018	NIVA	WMD FD	• An Integrated Water Resources Management system implemented for inland waters • Management of Water Resources in line with National Water Framework Directive, • Capacity and competence at MONREC, the Ministry of Agriculture, Livestock and Irrigation, Ministry of Transport and Communications and relevant stakeholders
	2019-2023			• Ecological water quality status assessment operational • Myanmar National Water Quality Laboratory functional • Database and data user interface tools are used for communication of environ. Status • The Myanmar National Water Framework Directive is implemented in Sub-basins • Monitoring and risk assessment plans developed for areas with mining activities
Conservation and management of biodiversity I, II (Biodiversity projects)	2015-2018;	NEA	NWCF FD	• Conservation of biodiversity and management of protected areas in line with Myanmar´s National Biodiversity Strategy and Action Plan • Management in line with the Convention on Biological Diversity • Management in line with the Convention on Wetlands, • Strengthened capacity and competence within MONREC at all levels
	2019-2023			• Knowledge strengthened on nature management, incl. protected areas, wildlife, endangered species • The National Wetland Policy implemented • Management plans for protected areas completed • Red List compiled, and restoration plans implemented
Management of Hazardous Waste I,II	2015 -2018	NEA (SINTEF a NEA contract partner)	ECD	• Improved management of Hazardous Waste • Proposed regulatory framework for the management of HW, implementation of the Basel Conv. • Proposed Master plan for Hazardous Waste management (iv) Strengthened Capacity within Environmental Conservation Department.
	2020-2024	SINTEF		• Issues prioritised by the Myanmar Government from the hazardous waste Master Plan • Improved quantification on hazardous waste generation in Myanmar • Initiated co-processing in Myanmar's cement industry • Built technical capability on handling and treatment of hazardous waste • Strengthened awareness and capacity on environmental sound management of hazardous
Bago waste	2020- 2023	NIVA	Collaboration with local partners	• Improved waste management infrastructure and systems for waste management from land-based sources • Waste cleaned up from selected rivers and (plastic) waste properly managed • Private sector's sustainable production, use, and responsible waste management.

***Table 1**. The Programme projects in phase I and II, the partners, and the outcomes specified in the programme documents approved for funding in 2015, and in 2018.*

2 The Integrated Water Resources Management Institutional Building and Training Project

NIVA and WMD FD field campaign, Bago Region (Photo: Tor Erik Eriksen, 2017).

Myanmar has abundant water resources, including five main river basins and several large lakes, and two coastal areas (Figure 2). Earlier, management of water resources was the responsibility of different sector authorities, but in 2012 MOECAF was established to take responsibility for environmental management. However, water management in Myanmar is still fragmented, and increased coordination among institutions and stakeholders is needed. Deforestation, pollution from sewage, industrial waste, and solid waste disposal are serious environmental issues.

The Integrated Water Resource Management Instituion Building and Training project (IWRM) aimed at building water management capacity at individual and organizational levels in WMD FD. Two national policies represented important contexts: the National Water Policy (2014) and the National Water Framework Directive (2014). Both aim for integrated management of watersheds, rivers, lakes, reservoirs, groundwater aquifers, and coastal and marine waters in Myanmar.

The IWRM I project started in 2014/2015 with the development of workplans as a collaborative effort by the partners in Myanmar and in Norway. In this period it was important to gain understanding of the former and current water goveranace situation. Because of the fragmented water mangement situation, the project established close contact with several ministries and departments in Myanmar.

Workplans for each of the topics that the project adressed were developed by experts at NIVA together with experts from WMD FD and the affiliated partner, the Irrigation and Water Utilization, Management Department of the Ministry of Agriculture, Livestock, and Irrigation (IWUMD MOALI). This strengthened the Myanmar partners' ownership for the project.

Five main objectives adressed:

- Framework for water quality and ecological status assessment
- Development of a national water quality laboratory
- Development of a database for communication of environmental status
- The Myanmar National Water Framework Directive as pilots in selected sub-basins
- Monitoring and risk assessment in the mining industry

The work also involved support of two master students and a PhD student. Publications presenting the results are listed in this chapter.

Project contract partners: NIVA and the Watershed Management Division (WMD) of Forest Department under MONREC.

Affiliated partners: IWUMD MOALI and the Directorate of Water Resources and Improvement of River Systems under the Ministry of Transport and Communications.

The affiliated partners were involved in developing workplans, they attended trainings sessions at the water quality laboratory, on data management, and water quality sampling.

A Project Steering Group consisting of the project's main and affiliated partners, as well as the two MONREC Departments of Mines and of Environmental Conservation was formed in 2019. The Steering Group discussed coordination issues with other IWRM related projects and promoted other actors to participate in capacity building sessions and events.

The National Water Resources Committee (NWRC), the national apex body for the governance and management of water resources in Myanmar, was an important advisor for the project. Twice a year NIVA and the WFD FD presented project results and plans to the Committee for feedback.

Approach

Relationships and trust were built *inter alia* by enabling access to the same data and by social learning on both sides, acknowledging the need for the Norwegian partners to first understand the Myanmar context.

The project adressed different governance levels: The Bago Region was the main case study area for several project components. The Bago Forest Department coordinated decentralised activites and invited other departments and authorites in Bago Township to participate (Nesheim et al., 2016, 2018a, 2018b). A case study approach was important to understand local issues, practices, and challenges. The local anchoring enabled the development of a river basin management(RBM) plan for the Bago Sub-basin inspired by the EU WFD.

Non-governmental stakeholders. Civil society represenatives were also involved, primarly in Bago and Shwegyin Townships as part of the engagement of civil society actors in a reference group for the RBM approach.

Support for education of MONREC staff. One PhD students and two master students were supported by the Programme. The PhD student defended her thesis in 2023 at the University of South-Eastern Norway.

Gender: Both men and women attended courses / studies and took part in platforms for discussion and decision making. Some courses had a majority of, or exclusively, women participants.

Communication

Sharing project information and learning about other project approaches was considered important. Seminars, workshops, and meetings with external actors such as DWIR, IWUM, NWRC, JICA, the World Bank, HIC, and Arcadis were organized for this purpose.

A range of different outputs were produced including 12 reports, presentations at seminars and conferences, papers, policy briefs, and flyers (presented above). Reports and scientific papers had Myanmar co-authors. Guidelines and briefs were developed in English and Myanmar languages.

Covid-19 and the military coup

Covid-19 had significant negative impact on project achievments. Travel restrictions prevented NIVA from visiting Myanmar and Myanmar partners from traveling in their own country. Restrictions on public gatherings impeded workshops and meetings, particularly on decentralised levels. During the pandemic, regular online meetings and communication on virtual platforms increased extensively.

The February 1st 2021 coup implied a freeze of project activiites. Beside finalising of activities by the Norwegian partner, only support of the PhD student continued.

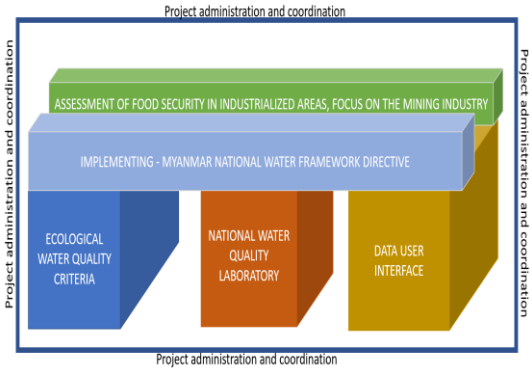


Figure 3: *Presenting the five project components (Source: Project description 2018).*

Framework for water quality and ecological status assessment

In 2014 Myanmar adopted a National Water Framework Directive inspired by the EU WFD. This highlighted the need for a framework for ecological status assessments adapted to Myanmar conditions. This project aimed to contribute to the development of such a framework.

Monitoring of a number of lakes and rivers was initiated to gain an understanding of the ecological situation in different bio-geographical areas of Myanmar. Work then continued on developing monitoring methods and a classification system for the assessment of ecological status. A summary of ecological surveys and ecological status assessments in selected rivers, lakes, and reservoirs in Myanmar was published (Ballot et al. 2023).

Capacity building for administrative and technical personnel

Surveys of macroinvertebrates in rivers and phytoplankton and aquatic macrophytes in lakes were undertaken yearly from 2014 to 2020. Physical measurements, analyses of water chemistry, cyanotoxins, and hydro-morphology were conducted. The parameters were analysed at NIVA and at the National Water Quality laboratory in Myanmar.

Field protocols for physico-chemical and biological sampling in Myanmar lakes and rivers were developed. Personel from WMD, NWCD, IWUMD, and the Fishery Department were trained and participated in sampling campaigns.

Lakes, reservoirs, river basins monitored
(Mjelde et al. 2018; Ballot et al. 2023).

Inlay Lake,Indawgyi Lake; Moeyingyi Reservoir, Meiktila Lake, Nga Laik Dam, Taung Taman Lake, Kantawgyi lake, Pyu Kan Lake, Khu Le Inn, Sakar Inn, Sunye In Tank, Pauk In, Pekon Lake, Kyetmauk Taung Dam, Yezin Dam, Wethtigan lake. The Bago River Sub-basin, Salween River Basin

Provision of infrastructure

For monitoring of water quality and ecological status assessment, the Myanmar partner was equipped with tools for sampling and measurements in the field and for analysis at the laboratory.

Capacity building for policy development

A system combining a centralised and a decentralised approach to monitoring was formed. This involved establishing a team of experts at Union level including technical personnel from WMD FD and IWUMD, and a regional sampling team including staff from different local departments in the Bago Region.

In the past, monitoring was limited and only conducted by a few technical staff at Union level. Staff were trained in the field and worked together with experts from other ministries. This was important for sharing of data among sector authorities, for synergies, and for anchoring of practices.

Left: Water quality monitoring training sessions with WMD and IWUMD, Bago River (Photo: Tor Erik Eriksen, 2016). Right: Staff from WMD FD in a monitoring water (Photo: WMD FD, 2020).

Development of a National Water Quality Laboratory

Prior to this project, MONREC had only a small laboratory with limited capacity for water quality analysis. The project constructed a large laboratory, purchased and installed instruments, and provided training for staff. The National Water Quality Laboratory is located at the Forest Research Institute (FRI, MONREC). It delivers water quality analysis services for environmental and socio-economic impact assessments to MONREC, other ministries and private actors (Cho, 2019).

Provision of infrastructure
MONREC provided funding for the construction of the National Water Quality Laboratory building in 2019. NIVA provided guidance, and funding for furniture and instrumentation (Box).

Infrastructure and equipment provided
A water purification system, an uninterrupted power supply system to prevent damage on instruments, fume hoods for safety requirements, muffle furnace, oven for drying of equipment and measurements of residue of ignition, internet for long distance assistance.

Instruments: Man-Tech analyzing robot for physical parameters, Dionex Ionechromato-graph for analysis of ions, Skalar Sequential Flow Analyzer for analysis of nutrients, instruments for analysis of bacteria, E. coli, robot and incubator for analysis of biological oxygen, GFAAS for metal analysis.

Capacity building for technical personnel
Staff at the laboratory were trained to provide analyses of physiochemical parameters, bacteria, heavy metals, and organic pollutants. There was further training for quality assurance of the analysis, reporting of results, and the import of results to the national database . Training material included presentations, exercises, and video tutorials. Laboratory staff sent short videos of their lab activities to NIVA for follow up and troubleshooting. From 2019 to February 2021, weekly zoom meetings were organised for support.

Twelve staff from MONREC, IWUMD, DWIR, and the Department of Agricultural Research were trained. The IWUMD staff had many years of lab experience, and this opened up for later collaboration between the two laboratories. Staff also took part in a training course at NIVA in Oslo 2019.

Capacity building for policy development
An action plan including a business model for economic sustainability of the lab was prepared by FRI and NIVA (MONREC, 2017). A business plan which involved selling of analysis services was implemented as a pilot, and income was chanelled to a bank account. The laboratory also provided services to private actors, mainly universities.

Staff from NIVA and FRI FD in front of the construction site for the water quality laboratory (Photo: FRI, 2019).

The finished national water quality laboratory (Photo: Thida Cho, 2020).

Water quality database for storage and communication of data

Good data governance and safe data storage are key to sustainable water resource management. An aim for this project was to establish a database for storage of water quality data from lakes and rivers. Another aim was to heighten the ability of FD technical staff to query, combine, and visualize data from a variety of sources and in many different formats, as well as to ensure and enable the sustainable operation of the FD Data Centre established by the project.

Provision of infrastructure
A new and modern data centre with IT infra-structure was built at the Forest Department in Nay Pyi Taw. The Aquamonitor SI system was established within this infrastructure. The data centre is a compact infrastructure, for easy maintenance, backup, and recovery operations. Following a service agreement with the local company Inyaland, technical operation of the database was set up with near completely stable and uninterrupted service. Infrastructure was set up to allow secure access to the data centre from outside of the FD.

Capacity building for technical personnel
Users of Aquamonitor SI can search, view, retrieve, and display monitoring data via a map and user defined data. Time series graphs enable the user to study development over time. Data can be downloaded to an excel sheet for further analysis and use in presentations. Display of processed environment classification according to draft water classification criteria is partly enabled.

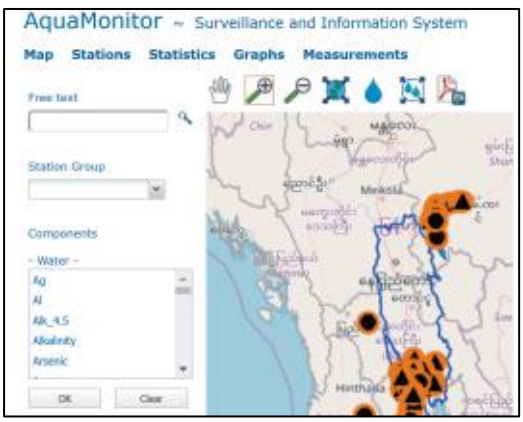
In addition to the yearly training sessions, two intensive courses covering the use of Excel to manipulate monitoring data, make simple statistical analysis, and produce simple figures were organised – one at NIVA in 2019, and one one-week course on a virtual platform in 2020 (13 participants from WMD and IWUMD completed the course).

A WMD FD & FRI database team was established to take an active part in the process of adding laboratory results to the database. Data on more than 3000 individual measurements from 128 samples taken in 2020 were added to the database. Relations between the database group and other sections and institutions are built by the inclusion of their staff in trainings.

Capacity building for policy development
FRI database staff prepared a video in Myanmar language to be shared with other users and institutions, showing how to access data.

Further coordination and possible collaboration related to the project's training on data user interface tools with the cross ministry HIC were initiated by NIVA and WMD FD in 2018 and 2019, but this needed further follow up.

Training session with WMD, FRI, IUMD in Nay Pyi Taw (Photo: WMD FD)



Screenshot of the aquamonitor data base system.

The Myanmar National Water Framework Directive pilot cases

The National Water Resources Committee (NWRC), adressing management of water resources across 13 ministries, adopted the Myanmar National Water Framework Directive in 2014 as a strategy for river basin management (RBM). The RBM approach was tested through pilots in Bago and Shwegyin townships. The steps and the process of these pilots are documented and published in reports and on the project's Facebook page (publication list this chapter).

Capacity building for technical personnel
Initiated by the project, in 2016-2017 a group involving, among others, WMD, IWUMD, DWIR, DMH, and ITC identified river basins and sub-basins for enabling an RBM approach (Tun, 2016).

The RBM pilot cases enabled capacity building of sector authorities and technical staff on Union, region, and township levels. The aim was to develop a sub-basin management plan (RBMP) for the two catchments in the Bago Region. This development follwed similar steps as that of the EU WFD, and "a learning by doing" approach (Nesheim et al. 2018b). The steps included (i) characterization and problem definition (Eriksen et al. 2017), (ii) identification of environmental objectives (Nesheim et al. 2016), and (iii) a Programme of Measures. For Bago Township, the Bago Region FD was the local partner leading the work in collaboration with NIVA. The Bago RBMP was developed and signed by 13 departments, and in 2018 it was signed by the Bago Chief Minister in a public event. An updated Programme of Measures was developed by the departments in 2020.

The associated practical water management activites included water sampling by the Region sampling team, sending the samples to the laboratory for analysis, and disseminating the results to the different sector departments. This was coordinated by the Bago Region FD in collaboration with NIVA.

In Shwegyin Township, the RBM appraoch was initated in 2019-2020 by identifying water users and uses, pressures, and environmental aims in workshops with local authorities and stakeholders. The continuation of the work was challenged by Covid-19 and the subsequent coup represented a final stop.

Capacity building for policy development
The RBM pilots can be described as a type of collaborative governance as it focused on bringing multiple stakeholders together for deliberation and developing an agreed (consensus-based) Bago Sub-basin Management Plan.

The RBM cases included aspects of institution development and building. In both Bago and Shwegyin the work involved the establishment of a committee of local authorities, an elected chair, a Terms of Reference document, and the establishement of a reference group of civil society representaitves.

Awareness building of civil society
The establishment of a reference group as part of the RBM cases contributed to the dissemination of the RBM approach for general awareness building to civil society.

Workshop in Shwegyin in Bago Region in 2019 the Myanmar NWFD (Photo: WMD FD).

Monitoring and risk assessment in areas affected by mining

The mining sector in Myanmar includes extraction of gems and minerals like lead, zinc, copper, iron, chromium, antimony, manganese, coal, nickel, barite, limestone, gypsum, gold, and tin. Mercury is used in small-scale gold mining for the gold extraction process. As a result it is released to the local environment, where it poses a significant risk to humans and wildlife through consumption of contaminated fish and, potentially, rice.

The lack of a systematic baseline with respect to water pollution and soil toxins in mining areas was the background for the project. The aim was to monitor selected rivers and lakes affected by the mining industry, develop relevant monitoring programmes, and assess environmental and human risks from metals exposure.

Capacity building for administrative and technical personnel
Another aim was to provide competence for national, regional and local authorities to assess, analyse, and interpret data on bioaccumulation of metals.

In 2017, samples of water, sediments and fish were collected in the Indawgyi Lake area to investigate mercury concentrations. As part of one sampling campaign, training was held by NIVA together with staff from WMD, NWCD, FRI, and ECD. Analysis results showed that mercury concentrations were low in all matrices, with sedimentation from high particle input being considered a larger threat to the lake than mercury pollution (Braaten et al. 2019).

Investigation of pollution from mining areas around Shwegyin River (Bago Region) and in Monywa Lake (Sagaing Region) took place in 2020 after acceptance from the Mining Department. Local staff and technical personnel from Union level WMD FD and IWUMD received practical training as part of the sampling campaigns in Shwegyin. Personell received training on sampling for general chemistry (e.g. carbon, nutrients, particles, sulphate, and conductivity) and metals (e.g. lead, copper, cadmium, nickel zinc, and mercury). Also samples of sediments and fish were collected in Shwegyin.

Fish from Monywa in Mandalay were sampled for mercury by IWUMD. Staff from the Fishery Department participated in some campaigns.

Capacity development for policy development
Prior to the IWRM II project no meetings or discussions had been organised between the WMD FD and the Mining Department. Before the coup in 2021, the project fascilitated contact and initiated talks on collaboration for monitoring of metals from the mining industry.

Left: NIVA demonstrating water quality sampling for local park wardens at Indawgyi sanctuary (Photo: Jan-Petter Huberth Hansen, NEA). Right: water quality sampling campaign and training at Shwegyin with local staff from FD, IWUM, DOF, and SCOs (Photo: Ingrid Nesheim, February 2020).

The IWRM project, reflections on success criteria, and challenges

Important criteria for project success

- Capacity building objectives must be in line with the institutional functioning and priorities of the Myanmar partners.
- Establishment of trust among partners, and with other authorities and actors in Myanmar, through physical presence and through adjusting the training, approaches, and equipment to local conditions.
- Invovling the "affiliated partners" i.e. the IWUMD, and the DWIR, in all the capacity builiding activites was crucial as these departments have core water management responsibilites. It was also important for access to arenas to inform about the project, and for access to necessary information and resources.
- Getting feedback on project workplans from NWRC and HIC, and informing them about results was important for anchoring of the project and for impact.
- Interaction with other actors leading water related projects, such as JICA, Arcadis and the World Bank, were needed for coordinaiton, possible collaboration and to avoid overlap.
- Addressing capacity building objectives on different governance levels, i.e. region/ state and township enabled a case stdy approach, better understanding of actual practices, and targeted activites.
- The Bago Sub-basin approach as a pilot provided experience for the national level by testing the approach on local level.
- Working together across sector departments to develop the sub-basin management plan, and on practical water mangement tasks, enabled access to sector policy objectives and responsibilites.
- A step-by-step approach, learning and adjusting based on gained experiences was important to adapt to the Myanmar context.

Challenges and mitigation activites

Personnel turnover: The Myanmar practice of changing staff every second year represented a genereal challenge for continuity. The challenge was adressed by training several central experts not to rely on a few persons. Continuity of staff was emphasized in dialgoue with high level partner representatives, and was to some extent achived.

*Training of technical staff. S*taff at the water quality laboratory of the Forest Research Institute, and WMD staff responsible for the database and server, required more training than first anticipated. Training is a long term task and sufficient time for staff to engage in the project is crucial; capacity building was successful when these important requirements were met to a significant degree. The coup effectively stopped this learning process.

Import of instruments and equipment. Import was more time consuming than anticipated. Few had knowledge about this process and requirements changed often. Different solutions were tried and competence was built on how to do this.

Unstable power supply. Unstable power supply challenged cooling of the server room at FD, and caused an externally broken internet line. This was addressed through the purchase of an adequate battery and by signing a service agreement with the local company Inyaland.

Need for approval. The project objectives implied the need for approval from other ministries. An example was the development of the national water quality laboratory. This was addressed by informing about benefits, by involving and communicating about the laboratory to a range of ministries, departments, and actors.

Main achievements of the Integrated Water Resources Management Project

- Knowledge about freshwater ecology conveyed to staff of MONREC and affiliated partners, doctoral studies of a student from Myanmar supported. The project included surveys of several biological groups such as macroinvertebrates in rivers and phytoplankton and aquatic macrophytes in lakes. In addition, physical measurements, analyses of water chemistry, cyanotoxins, and hydro-morphology were conducted (Ballot, et al. 2023). The project has contributed to the development of a system for ecological status classification and criteria adapted to Myanmar conditions.

- A water quality laboratory constructed at the MONREC Forest Research Institute with instruments and staff able to provide high quality analysis of physiochemical parameters, bacteria, heavy metals, and organic pollutants. Instruments and training for using (i) an automated system for measuring physical parameters, (ii) an ion chromatograph, (iii) a sequential flow analyser for nutrient analysis, (iv) processing software for data storage and remote control of instruments, (v) instrument for analysis of bacteria, (vi) instrument for analysis of biological oxygen demand. A business model was for the laboratory was implemented for ensuring economic sustainably. Income was from selling water quality analysis was saved at the bank for future economic sustainability of water lab.

- A database, the Aquamonitor SI database system, was developed for storage of water quality data. A database team including seven core members from the WMD FD plus staff from NWCD FD and IWUMD MOALI were trained in data management and the use of the database. An environmental data laboratory centre including servers and computers was established for the Forest Department at the Watershed Management Division. A service agreement with Inyaland Ltd for technical follow up of the server functionality was established.

- Platforms for coordination of authorities in two sub-basins – in line with the EU WFD administrative set-up – were established in Bago Region. In 2016, a Bago Sub-basin Area Committee including regional staff from 11 different departments was established. The Committee chair was the MONFREC minister. The Committee members met twice a year during 2016-2018 to discuss water management issues. In 2019, a similar committee for coordination of local authorities was established in Shwegyin Township. Awareness of the need for a coordinated approach to find good solutions to water-related problems in rivers, dams and reservoirs was achieved.

- Platforms for involvement of NGOs and civil society in water management issues were established. In 2017 in Bago Township, and in 2019 in Shwegyin Township, non-governmental stakeholder groups were established, each with 30-40 representatives from civil society and different ethnic groups. Elected secretaries of the groups were responsible for arranging meetings to discuss local pressures and problems. Plenary meetings for the exchange of information between the Sub-basin Area Committees and the non-governmental stakeholder groups were established.

- The river basin management approach was implemented as a pilot in the Bago River Sub-basin. Practical water management tasks included identifying pressures, environmental objectives, and a Programme of Measures. A holistic water management plan for Bago based on involvement from local, regional, and national authorities as well as civil society was published. The final plan was approved by the Bago Chief Minister and supported publicly in an open seminar in Bago, September 2018.

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- News Brief: The National Water Quality Laboratory, Nay Pyi Taw
- The Myanmar National Water Framework Directive – implemented in selected Myanmar Sub-basins
- Bago River Sub-basin Management Plan
- Policy Brief: The River Basin Management Approach in the Sittaung River Basin

Publications in Myanmar Language

- Bago Sub-basin Management Plan
- Assessing ecological status in Inlay Lake Preliminary report
- Framework notes and recommendations for Integrated Water Resource Management in Myanmar
- Water usage and introduction to water quality criteria for lakes and rivers in Myanmar Preliminary report

Facebook: https://www.facebook.com/profile.php?id=100064632404688

3 Conservation of biodiversity and protected areas

Fishing in Kyin Lake, Chatthin Wildlife Sanctuary (Photo: Vibeke Husby, NEA, 2016)

Myanmar, the largest country in mainland Southeast Asia, is widely regarded as one of the most biodiverse countries in the Asia Pacific Region. It has plentiful natural resources and one of the lowest population densities in the region. Myanmar has an extreme variety of biodiversity and ecosystems, parts of which are still intact or in a relatively pristine condition. This includes coral reefs and lowland forests in the south, large rain forests, extensive river systems and east Himalayan mountains higher than 5.800 meters above sea level.

Nature conservation has a long history in Myanmar, from religious practices that ban hunting and fishing in sacred areas, to traditional cultivation systems that protect riparian and watershed forests. In 1918, hunting was banned in some areas due to declining wildlife populations. Modern conservation efforts, however, go back to the 1980s.

A nature conservation project was jointly implemented by the UNDP and the government 1981–1984. The Nature and Wildlife Conservation Division (NWCD), part of the Forest Department (FD) under MONREC, is responsible for nature conservation and protected areas (PAs) and was established as a follow-up of this project. Until 1996, PAs covered less than 1 % of Myanmar's territory. In the mid-1990s, the focus of new designations of PAs shifted from protection of selected species and habitats to protection of entire landscapes and ecosystems. As of 2022, there are 46 protected areas covering 6 % (41.154 km^2) of Myanmar. This is far from the 17 % originally recommended by the Convention on Biological Diversity, and very far from meeting the new ambitious goals (2022) of 30 % protection.

Like many other countries, Myanmar has a major challenge in how to reduce human disturbances on biodiversity, ecosystems, and landscapes. Deforestation, forest degradation, destruction of wetlands and other ecosystems take place at an alarming rate. The result is a major loss of biodiversity which may have substantial negative impact on human livelihood. The country's high biodiversity combined with high levels of existing and potential human interference, classify Myanmar as one of 36 biodiversity hotspots of the world.

The project "Conservation of Biodiversity and Improved Management of Protected Areas" was carried out in two phases between 2014 and 2023. The overall aim was to secure that efforts are in line with the Convention on Biological Diversity and the Ramsar Convention on Wetlands.

Four main objectives addressed:

- Training and capacity building on nature management
- Capacity for the protection and the wise use of wetlands
- Strengthen management of protected areas
- Capacity for the protection of wildlife and endangered species

The project contract partners: The Norwegian Environment Agency (NEA) and the Nature and Wildlife Conservation Department.

Project Steering Group – and contributions from other experts
The project's contracting partners, the Norwegian Environment Agency and the Nature and Wildlife Conservation Department (NWCD), formed the steering group. Essential results regarding protection and wise use of wetlands were reached with assistance from experts that had previously worked in the secretariat of the Ramsar Convention. These included: Nick Davidson, Rob McInnes, Christine Prietto, and Sandra Hails. Also, two local NGOs, BANCA and Friends of Wildlife, were hired to compile draft management plans for protected areas. Cooperation was established with the Wildlife Conservation Society, Fauna & Flora International, and Institutio Oikos.

The project approach
From the very beginning there was a joint understanding of the challenges. There was a common desire to halt and reverse the negative trend in biodiversity and to improve management of protected areas. A solid foundation for the development of the project, built on trust and a cooperative atmosphere, was laid during a gathering in a mountain lodge in Norway in 2013. Regular meetings and visits to Norway and Myanmar were crucial for building trust and good cooperation. Several of the attendees from both countries continue to be involved in both phases of the project.

Project dissemination
At an early stage, NEA in cooperation with the FD/NWCD took the initiative to organise a larger workshop where all organizations, including UN bodies, NGOs, and donors that had some kind of agreement or cooperation with FD/NWCD were invited to share information about ongoing or planned activities. Dissemination of results and information from the project, and learning from other related projects, was on the schedule throughout the project period, and several meetings and workshops were arranged.

A National Ramsar Committee consisting of representatives from nine ministries was established as a result of the project. Activities carried out, results and planned actions underway or planned were presented to the committee.

Internationally, arrangements were made for broad dissemination of activities and results achieved regrading conservation and the wise use of wetlands, e.g., at the Ramsar COP13 in Dubai in 2018.

NWCD and NEA prepared information brochures on protected areas for wider dissemination in both English and Myanmar languages. Reports, policy documents, and plans published as part of the project are listed at the end of this chapter.

Covid-19 and the military coup
Covid-19 put a hindrance on some project activities. Restrictions on travel both internationally and within Myanmar stopped most field activities but intensified the use of Zoom for meetings. This follow-up of possible activities kept the project alive.

However, after the military coup 1 February 2021, almost all activities were suspended. Follow-up of the PhD and MSc students at University of Science and Tecnology (NTNU) continued, and some wetland reports were completed by external consultants.

Rhododendron forest, Natma Taung National Park (Photo: Jan-Petter Huberth Hansen, NEA, 2013).

Training and capacity building on nature management

Loss of biodiversity is the most pressing environmental problem, because species extinction is irreversible. The need for training of staff in ecology and management in order to manage the biodiversity values of protected areas was conveyed by the NWCD.

Capacity for management of nature was built by courses and study tours in Myanmar, Thailand and India. Further, funds and supervision were provided for 11 NWCD staff at master studies and PhD studies (eight and three respectively). After receiving their degrees, the staff were given higher positions and responsibility in MOECAF. In addition to professional knowledge, the sstudents brought new ideas with them back home. The staff who received training and education were selected by NWCD in a transparent procedure based on a set of criteria.

Capacity building for administrative and technical personnell

Training on management planning. Courses on law enforcement, biodiversity education, management planning, ecotourism, and restoration were organsied yearly for staff in 20 protected areas. A workshop on participatory scenario planning to promote adaptive co-management was organised in Natma Taung National Park in 2018. Feedback indicated that the courses considerably increased knowledge and capacity of staff. Lecturers were hired from the Wildlife Conservation Society and Istituto Oikos.

Training on Spatial Monitoring and Reporting. SMART training courses were organized in twenty PAs. In total probably more than 100 staff particpated in these courses.

Master of Science and PhD Programmes. Eight FD staff completed master's degrees, and two completed PhD studies in natural resource management at NTNU in Norway. One staff undertook a PHD study at the Yeungnam University in Korea (see specifications in publication list).

Courses at Wildlife Institute of India. 8-10 NWCD staff from different protected areas joined training courses, either a 10-month diploma course or a 3-month certificate course at the Wildlife Institute of India in Dehradun each year.

Capacity building for policy development

*Cooperation with the University of Yangon***.** In 2016, the University of Yangon (UY), NWCD and NEA organized the first international workshop on biodiversity in Myanmar. This initatied collaboration between the Forest Department and UY where previously there had been none. The project awareded small grants to several MSc students. Field excursions to Moeuyngyi wetlands were organized for lectures on wetlands, biodiversity and limnology.

A cooperation between UY and NEA on management of sea turtles took place on Thaemeehla Island Wildlife Sanctuary in phase II of the project.

Research on Green Turtle (Chelonia mydas) at Themeehla Island WS. Photo: Zoological Department, University of Yangon.

Capacity for the protection and the wise use of wetlands

Wetlands are essential areas for biodiversity, and they are widespread in Myanmar. The project contributed to increased knowledge and better management of wetlands through the implementation of conservation measures. The project also contributed significantly to general awareness of the importance of wetlands as hotspots for biodiversity and providers of ecosystem services. This enabled Myanmar to better follow up on its obligations under international agreements, especially the Ramsar Convention on Wetlands and the Convention of Biological Diversity.

Capacity building for administrative and technical personnell

A series of training courses for wetland site managers addressing participatory approaches, livelihood systems, improved management, and the wise use of wetlands were organized by FD and NEA in collaboration with experts on Ramsar-related topics from 2015 to 2021.

A study tour on wetland management to Thailand was organised in 2017 in cooperation with the Thailand Ramsar Authority. The purpose was to build NWCD staff capacity on wetland related challenges in a neighbouring country, and to establish a network of wetland managers. Ramsar experts from Thailand later visited four Ramsar Sites in Myanmar to share experiences and offer advice on wetlands management.

In collaboration with NIVA, training of NWCD staff was organised in Indawgyi Lake Wildlife Sanctuary in 2019. Topics covered were sampling and analysis of water and fish tissue for mercury levels, and planning of mitigation measures for negative impacts of gold mining.

Capacity building for policy development

The Ramsar Convention and the Ramsar Regional Initiative. Myanmar is a a contracting party to the Ramsar Convention since 2005.

Participation from Myanmar at Ramsar COP13. The project facilitated participation from Myanmar at Ramsar COP13 in Dubai in 2018. Prior to the COP, Ramsar Convention experts assisted in compiling Myanmar's National Report, and during the COP a joint Myanmar-Norway side event was convened to share success stories of Myanmar's wetlands conservation. Also in 2018, the 2nd Indo-Burma Ramsar Regional Initiative meeting was held in Yangon with the support of the project.

Ramsar Site Designation. As of 2020, Myanmar has designated six sites: Moeyungyi Wildlife Sanctuary, Meinmahla Kyun Wildlife Sanctuary, Indawgyi Lake Wildlife Sanctuary, Gulf of Martaban, Inle Lake Wildlife Sanctuary, and Nathar Island & Mayyu Estuary. Ramsar sites are wetlands regarded as of international importance under the Ramsar Convention.

In 2021, a Ramsar Sites Designation Strategy was drafted by the project to help identify more sites. The Strategy was later elaborated and adapted to include all five member countries of the Indo-Burmese Regional Ramsar Initiative, published (IUCN, 2024).

The National Wetlands Committee (NWC). In line with the recommendation in the Ramsar Convention, an NWC was established through project support in 2016. The committee was formed with 14 senior officers from all relevant ministries. To Myanmar, the NWC represented an arena to coordinate and discuss wetland issues across ministries and sector interests.

A Moeyungyi Wildlife Sanctuary management plan was developed as a collaborative effort between NEA, the project Ramsar experts, Moeyungyi sanctuary staff, and park wardens from three other wetlands. Ramsar Convention methods and guidelines represented a new and efficient way of developing management plans. The Moeyungyi Wildlife Sanctuary is Myanmar's first Ramsar site and the management plan was

the first of its kind using the Ramsar Convention gudielines.

Draft management plans set up by the NGO Fauna and Flora International for two other Ramsar sites, Indawgyi Lake Wetland Site and Meinmahla Kyun Wetland Site, were reviewed by the project experts.

Development of an action plan for wetlands. In 2015, NWCD staff, Ramsar-related experts, and NEA experts discussed important wetland issues that needed action. In 2016, this resulted in the report "Towards improved management and wise use of valuable wetlands". The report was subsequently developed into the "Action Plan for the Delivery of Improved Management and Wise Use of Valuable Wetlands" which was presented to the National Wetlands Committee for consideration and approval. The plan was also widely circulated. Implementation of 12 priority actions in the Action Plan started immediately after the plan's approval.

Development of a National Wetlands Policy and Strategic Action Plan was a top priority. A draft plan was submitted to the authorities for approval in 2018.

Development of a National Wetlands Inventory. As a follow up of the Wetlands Action Plan an inventory of wetlands for Myanmar was made in 2017. Compiling the inventory, Ramsar-related experts had collected data on Myanmar wetlands including all wetland types defined by the Ramsar Convention, from coral reefs and mangrove forest to marshes, lakes, and high altitudes rivers. NWCD and NEA provided advice. Geographical information system (GIS) was established to specify locations. By means of the published inventory, information about Myanmar's wetlands was disseminated and made accessible for wider use. The inventory represents a milestone as it provides an important tool to different ministries and other administrative units.

Outreach – World Wetlands Day. The Ramsar-iniated World Wetlands Day (2nd February) was celebrated annually throughout the project period. In 2019 the Union Minister of MONREC participated in the celebration in Moeyungyi. On the NWCD's request, work was started to develop a Ramsar CEPA Action Plan (Communication, Education, Participation, and Awareness), looking to Norway's and Australia's draft plans. Also, information handouts about the Ramsar sites and other proteced areas in Myanmar were produced in two languages.

Moeyungyi Wildlife Sanctuary (Photo: Vibeke Husby, NEA).

Indawgyi Lake Wildlife Sanctuary & Ramsar Site (Photo: Jan-Petter Huberth Hansen, NEA 2017).

Entrance to Moeyungyi Wildlife Sanctuary & Ramsar Site (Photo: Jan-Petter Huberth Hansen, NEA).

Strengthening management of protected areas

Several protected areas (PA) in Myanmar face huge threats from human impact. An overview on PAs by Instituto Oikos (2011), knowledge and data from NWCD, and site visits by NEA formed the baseline for the activities undertaken to strengthen PA management. Conservation measures and increased management capacity were enabled in 24 protected areas where basic management regimes were already in place.

To manage protected areas in a long-term perspective, it is necessary to raise public awareness and involve local and indigenous people as well as stakeholders from different sectors. This was done through a series of meetings while management plans for the protected areas were being worked out.

Provision of equipment, infrastructure
Field equipment, office facilities, boundary demarcations, signboards, and solar power installations were provided to protected areas for improved management. All 24 PAs received rangers' equipment such as motorboats, motorbikes, drones, binoculars, guide books, GPS, walkie talkies, and wildlife cameras.

An education center in the Popa PA was renovated. Forest camps for rangers were established in several PAs. Nurseries to provide naitive seedlings for habitat restoration were established in six sites.

Capacity building for administrative and technical staff
Strengthening Myanmar's capacity to obtain and act on knowlegde of biodiversity status and trends were undertaken by inventories, mapping and surveys.

Spatial Monitoring And Reporting Tool (SMART) consists of a set of software and analysis tools to effectively manage and protect wildlife and habitats. SMART was provided to help standardize and streamline data collection, analysis, and reporting. This enabled transmission of key information from the field to decision-makers. Enabled by the project, the SMART tool was used by 20 PAs.

Capacity building for policy development
Development of management plans for protected areas was initiated in 2016 by NWCD and NEA with assistance from the Biodiversity and Nature Conservation Association (BANCA), Friends of Wildlife, and the Ramsar-related experts for Chatthin Wildlife Sanctuary, Popa Mountain Park, Shwesettaw Wildlife Sanctuary and Moeyungyi Wetland Sanctuary. The process compised three inception workshops for the PAs and the forming of PA coordination committees. The four draft management plans developed were later approved by the Union Minister of MONREC. *Bilangual booklets for protected areas* were developed for most of the protected areas with an administrative regime.

Workshop to discuss management plan for protected areas. (Photo: Vibeke Husby, NEA).

Capacity for the protection of wildlife and endangered species

Myanmar's political authorities and MONREC staff have expressed a wish for enhanced understanding of the country's diverse and unique wildlife. According to the NBSAP (2015-2020), Myanmar will most likely experience the same pattern of species extinction as has been seen elsewhere in South-East Asia if efforts to protect nationally and globally threatened species are not improved. Knowledge levels increased during the project, but can still be further raised.

A particular focus was given to: (i) Eld's deer (also known as thamin) found in Chatthin and Shwesettaw wildlife sanctuaries. This is one of Myanmar's most endangered species and the most endangered deer species in the world. ii) Sea turtles, especially in Thamehla Island WS.

Provision of equipment, infrastructure
NWCD and local staff in the different protected areas were aware of the advantages of using camera traps for detecting and estimating wildlife populations. This could be crucial information for management purposes. A large number of camera traps were provided and distributed to selected sites. Training on how to use them was also provided. In addition, hundreds of binoculars and GPS were provied.

Capacity building of administrative and technical staff
Mapping and monitoring. Data gathered from six priority protected areas were reviewed and prioritized for monitoring needs. Existing legislation concerning protected areas was also reviewed. A wildlife survey was conducted in Shwesettaw WS including the use of camera traps to record and report on wildlife populations.

Costs and benefits associated with natural resource exploitation in Chatthin Wildlife Sanctuary in Myanmar, was the item in a MSc thesis by one of the Biodiversity Project's students (Thant, 2017).

Baseline surveys for biodiversity, forest cover, socio-economic livelihood, and ecotourism were conducted in several PAs. In Moeyungyi wetlands and Indawgyi lake water quality and macrophytes were studied and reported on by NIVA, resulting in e.g. a macrophyte atlas for the Indawgyi. This information was valuable for the development of management plans.

Migratory bird surveys in the wetland sites of Moeyungyi, Indawgyi, Inlay, and Meinmahla Kyun WS were conducted and a variety of bird species were recorded, including species never spotted in Myanmar before.

NEA engaged the NTNU to conduct a pilot bird survey in Natma Taung National Park which could also be used as a basis for developing ecotourism.

Thameehla Kyun Wildlife Sanctuary is an off-shore island with rough sea, rocky shore, and a formerly huge population of Green Sea Turtles (Chelonia mydas) and other turtle species that nest on the beaches. A mission to explore the island and study its sea turtles was conducted in 2018 by NEA, NWCD, and the University of Yangon Department of Zoology. A second visit was carried out in 2019. Based on this field visit an Action Plan for Thameehla Island was developed and a short documentary film was made to promote conservation and improved management.

Reflections on success criteria, and challenges

Important criteria for the project success

- The Myanmar partners comprised dedicated and educated staff who expressed great need and motivation to learn and cooperate on nature management issues.
- The close relationship between the project partners were decisive to the success of the project. Regular meetings and visits to Norway and Myanmar were crucial for building trust and good cooperation.
- Myanmar is party to the Convention on Biodiversity and the Convention on Wetlands (Ramsar). The project activities filled a gap by enabling Myanmar's fulfilment of obligations under these conventions.
- The written agreement between MOECAF and NEA and good communication between the parties (including the Norwegian embassy) formed a solid basis for the collaboration.
- Efforts to bring together staff from the protected areas for training and capacity building were important. Rangers from many sites met for the very first time in November 2013, and several gatherings were held at Popa Mountain Park. The sharing of experince and networking had high value.
- Rapid identification of needs and prompt delivery of requested tools and equipment contributed to trust and good cooperation.
- MSc and PhD studies at NTNU for MOECAF/ FD/ NWCD staff were very fruitful. After completing their studies the students were promoted in MOECAF. Other benefits were the new values and experiences they brough with them home
- Study trips to neighboring countries provided insight in relevant cases of wetlands and national park management in a context that resembled the situation in Myanmar. This also facilitated bilateral cooperation.
- The strong desire from the University of Yangon to make contact with Norway and Norwegian institutions made it easy and exciting to collaborate both on lectures, excursions and fieldwork. This collaboration further enhaced the biodiversity knowledge in the Ministry of Forestry/ NWCD.
- Flexibility and quick clarifications regarding alternative use of budget if an activity was delayed or the like, were obviously crucial for successful implemenation of the project

Challenges and mitigation activites

Personnel turnover in the Ministry and its underlying units, including the protected areas, was a continuing challenge for several of the project activities. For instance, as soon as a park warden had gained valuable knowledge of a protected area and had learned how to manage the area in the best possible way, they were replaced, often by a new warden unfamiliar with the protected area.

Covid-19 and the coup. The project's solid foundation made continued online collaboration possible during Covid-19.

The military coup in 2021 made life in Myanmar difficult and continuation of the project impossible.

The exception was for the MSc and PhD students studying in Trondheim at the time, all of whom completed their degrees. In addition, some work by the Ramsar-related experts was completed.

Main achivements in the Biodiversity Project

- Significant strengthening the level of knowledge within Ministry of Natural Resources and Environmental Conservation in terms of nature conservation and resource management through educating staff at the Norwegian University of Science and Technology. All MSc and PhD degrees were completed.

- Park rangers from protected areas attended certificate and diploma courses in applied wildlife management at the Wildlife Institute of India (Dehradun). They could in turn teach their colleagues. Considerable strengthening of capacity and improved management of protected areas.

- Large amounts of basic and adequate field equipment were acquired and put to use by rangers after training by NEA, WCS, and others. Law enforcement, mapping, and monitoring were considerably improved in protected areas.

- Initiated a trilateral cooperation between the University of Yangon Department of Zoology, the Forest Department under MONREC, and NEA. This made scientific information and training courses available to government staff, and students were advised, e.g., on suitable topics for their master thesis.

- Training courses on the most important topics in protected area management were organised yearly for staff in 20 protected areas. The courses were in high demand and much appreciated.

- Policy documents, inventories, guidelines, and managements plans developed to improve the implementation of the Convention on Wetlands (Ramsar) in Myanmar.

- Identification of valuable wetlands and inclusion of sites on the Convention's list of wetlands of international importance (Ramsar Sites), which safeguards habitats of great conservation value and contributes to Myanmar fulfills obligations under the Convention.

- Management plans for protected areas – a prerequisite to ensure satisfactory management of national parks and other protected areas – were drafted for selected sites in cooperation with NGOs and park staff. Implementation of selected activities started already during the drafting of the reports.

- Almost all species of sea turtles are threatened and/or red listed. A much-needed Action Plan with concrete recommendations to strengthen the management of Thameehla Kyun Wildlife Sanctuary ("turtle island") was developed in close cooperation with FD/NWDCP and the Ministry of Fisheries.

Biodiversity project – publication list

PhD & MSc thesis

Thant, Zaw Min *"Anthropogenic and Environmental factors driving the Human–Elephant Conflict in Myanmar".* PhD thesis. NTNU. Trondheim. 2022

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Htay, Thazin *"Determinants of Conservation Support in Local Communities: A Case Study of Indawgyi Wildlife Sanctuary, Myanmar".* Master thesis. NTNU. Trondheim. 2020

San, Khin Nyein *"Impacts on the biodiversity by living inside a protected area, Natma Taung National Park, Myanmar; A human perspective".* Master thesis. NTNU. Trondheim. 2017

Thuzar Win, Phyo *"Effects of Ecotourism Benefits on Local Support for Conservation - A Case Study of Local Perceptions of Inlay Lake, Myanmar".* Master thesis. NTNU. Trondheim. 2018

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Prietto, C. & McInnes, R.J. *"Study Tour to Thailand for Myanmar Wetland Site Managers: 26th March to 1st April 2017"*. RM Wetlands & Environment+ Ltd. Oxfordshire. U.K. 2017

Ministry of Natural Resources and Environmental Conservation, Forest Department, Nature and Wildlife Conservation Division. *"Moeyungyi Wetland Wildlife Sanctuary Ramsar Site. Management Plan 2018 – 2022".* Nay Pyi Taw. 2018

Ministry of Natural Resources and Environmental Conservation, Forest Department, Nature and Wildlife Conservation Division (NWCD). *"Republic of the Union of Myanmar: National Wetland Inventory. Vol. 1: **Technical Data**".* Nay Pyi Taw. 2019. 16 p

Ministry of Natural Resources and Environmental Conservation, Forest Department, Nature and Wildlife Conservation Division (NWCD). *"Republic of the Union of Myanmar: National Wetland Inventory. Vol. 2: **The Wetlands of Myanmar** ".* Nay Pyi Taw. 2020. 127 p (draft only)

Davidson, N. C., McInnes, R.J. & Stroud, D.A. *"A Myanmar Strategy and Guiding Principles for the identification and prioritising of wetlands for Ramsar Site designation".* RM Wetlands & Environment+ Ltd. Oxfordshire. U.K. 2021

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Protected areas - management plans & inventories

BANCA (Biodiversity And Nature Conservation Association) *"Management Plan for Popa Mountain Park (2018 to 2023)*". DRAFT 2018

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Video

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4 Hazardous Waste Management

Hazardous waste encompasses any waste or combination of wastes that possess the potential to cause adverse effects on the environment or human health due to specific characteristics such as flammability, corrosiveness, carcinogenicity, infectiousness, ecotoxicity, among others. These types of waste can originate from various sources, including household, commercial, industrial, healthcare, and agricultural activities. Improper management of hazardous and healthcare wastes can lead to groundwater contamination, emissions from open burning, spread of communicable diseases, as well as aesthetic and odour issues.

In Myanmar, the volume, complexity, and impact of hazardous waste have been increasing rapidly in response to economic growth. However, prior to the initiation of the Hazardous Waste Management (HWM) project in 2015, Myanmar lacked regulations and comprehensive data on hazardous waste. Institutional capacity and awareness regarding chemical risks and toxic emissions were also low, despite the establishment of the Environmental Conservation Department (ECD) as the key authority for hazardous waste management in 2012.

The HWM project aimed to address these challenges by enhancing the regulatory framework and providing technical assistance for environmentally sound hazardous waste management. This involved capacity-building efforts targeting various stakeholders, including the Ministry of Natural Resources and Environmental Conservation (MONREC), ECD, relevant ministries, city development committees, industries, and academia.

During Phase I of the project (2015-March 2019), collaboration between the Norwegian Environment Agency (NEA) and ECD focused on capacity-building to help Myanmar fulfil its obligations under the Basel Convention. This included the development of a baseline regulatory framework and the formulation of the 'Procedure on Transboundary Movement of Hazardous Wastes and other Wastes'. Myanmar formally ratified the Basel Convention in January 2015, committing to environmentally sound hazardous waste management practices.

SINTEF main deliverables during the study included conducted the first-generation hazardous waste inventory, feasibility studies, and delivery of the National Hazardous Waste Master Plan to MONREC. This plan was subsequently submitted to parliament for final approval. Additionally, in 2020, SINTEF supported three ECD officials in pursuing a two-year master's programme in Environmental Engineering and Management at the Asian Institute of Technology in Thailand.

Objectives of the HWM-project
The Hazardous Waste Management project in Myanmar aimed to achieve three main objectives:

1. Improving the regulatory framework for hazardous waste management
2. Enhancing the technical capacity of hazardous waste management
3. Developing the National Hazardous Waste Master Plan

Overall, these three objectives were essential components of the HWM project, contributing to the promotion of environmentally sound hazardous waste management practices and the protection of human health and the environment in Myanmar.

Project Partners

Phase I of the HWM project involved collaboration between the ECD under MONREC, the Norwegian Environment Agency (NEA), and the Foundation for Scientific and Technical Research (SINTEF). In Phase II, SINTEF became the primary contract partner with the ECD. Additionally, affiliated partners closely engaged in the project included the regional Environmental Conservation Departments of Yangon and Mandalay, the Yangon and Mandalay City Development Committees (CDCs), and the Department of Industrial Supervision and Inspection (DISI) under the Ministry of Industry (MOI). Local consultancies EQM and EGUARD were hired by SINTEF to conduct the first-generation hazardous waste inventory.

Project Approach

A Project Management Group comprising representatives from NEA, SINTEF, and ECD was established in 2015 to develop project work plans and conduct regular project reviews. NEA and SINTEF facilitated hands-on training and capacity building workshops for ECD personnel and staff from various ministries and agencies, including the Ministry of Health and Sports (MOHS), the Ministry of Industry, the MONREC Department of Mining, and City Development Committees.

A Regulatory Working Group (RWG) was established by NEA and ECD in 2016 to discuss the scope of a national hazardous waste regulation. RWG consisted of members from NEA, ECD, ten union level ministries, and from City Development Committees in Yangon, Mandalay, and Nay Pyi Taw. RWG members met nine times during 2016-18, mostly in Nay Pyi Taw. In addition, two half-day consultation meetings were organised, one each in Nay Pyi Taw (2018) and Yangon (2019) to finalise the report on 'Existing regulatory framework and institutional arrangements for HW in Myanmar. RWG examined the current regulations, orders, and standards pertaining to hazardous waste. The team conducted evaluations of monitoring initiatives and law enforcement measures, identifying gaps that need addressing to ensure more effective hazardous waste management.

A Technical Task Force (TTF) was formed in 2015 by SINTEF and ECD with participants from regional ECDs, regional DISIs , City Development Committees in Yangon and Mandalay, members from Industrial Zones, and SINTEF's local consultants. Periodically, observers from other international projects, consultancies, and NGOs joined the meetings. The TTF played a crucial role in the selection of industries for surveys and in assessing current waste management practices. It also identified potential deficits and impacts, and discussed future needs for waste treatment options, including collection, storage, final disposal, and resource recovery. From 2016 to 2018, SINTEF and ECD conducted six TTF meetings in Yangon and five in Mandalay. In phase II, the task force prioritized issues in the national hazardous waste master plan.

The HWM project organized study trips to Norway (2016), Thailand (2017), and South Korea (2019), led by NEA. These trips involved workshops focusing on hazardous waste regulations, policies, and matters related to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Representatives from Customs, MONREC/ECD, CDCs, MOHS, MOI, and the Ministry of Construction participated in these workshops and visited various facilities such as recycling centres, waste-to-energy facilities, landfills, waste pre-treatment plants, and cement plants.

Project Dissemination Efforts

ECD, NEA, and SINTEF organized multiple joint workshops focusing on various aspects of waste management, including waste from the oil and gas sector, draft hazardous waste notification,

implementation of the Basel Convention, and environmentally sound management of hazardous waste in Yangon and Nay Pyi Taw.

ECD and SINTEF conducted multiple half-day or one-day workshops on co-processing with major cement companies in Mandalay. Other workshops covered topics such as the impacts of hazardous waste and chemicals (held in Yangon, Mandalay, and Nay Pyi Taw), hazardous waste inventory and treatment (at Yangon CDC), environmentally sound management of hazardous waste (at Myanmar Industry Association, Yangon), and global environmental and resources challenges & international environmental conventions (at Mandalay Technological University). An intensive course was also conducted at Yangon Technological University for over 50 engineering students.

SINTEF was invited to workshops organized by other organizations, such as Golden Dowa and UNEP-IGES, to present findings from the HWM project. Over 50 technical presentations were made, attracting a diverse audience of over 1300 participants, with a notable 40% representation of women.

The Hazardous Waste Master Plan underwent a participatory and consultative process involving key stakeholders such as ministries, industries, academia, and civil society organizations. The plan underwent multiple stages of review and consultation at regional and national levels to integrate valuable inputs. The final draft was submitted to the Minister's office at MONREC in 2019 and was pending cabinet approval at the time of writing.

ECD and SINTEF collaborated on the preparation of informational brochures on hazardous waste management, disseminated in both English and Myanmar languages. Reports and articles published as part of the project are listed at the end of this chapter.

Covid-19 and the Military Coup

The Covid-19 pandemic in 2020 disrupted several project activities that required travel and physical meetings. In response to a request from the Director General of ECD, SINTEF prepared a report titled 'Covid-19 Situation in Myanmar and its Possible Impact on Waste Management' as an additional activity to address the challenges posed by the pandemic.

Following the military coup on February 1st, 2021, project activities were suspended. However, as an exception, three ECD officials who had enrolled in the master's programme in Environmental Engineering and Management at the Asian Institute of Technology, Thailand in August 2020 were permitted to continue their studies until June 2022.

Government officials from Myanmar visiting a cement plant in Norway to witness co-processing (Photo: NEA)

Improving the Regulatory Framework

This objective focused on strengthening the legal and regulatory framework governing hazardous waste management practices in Myanmar. It involved the development and implementation of policies, regulations, and guidelines to ensure compliance with international standards and obligations, such as those outlined in the Basel Convention.

At the outset of the project, Myanmar lacked a comprehensive regulatory framework specifically addressing hazardous waste management. While the Environmental Conservation Law (2012) provided a general definition of hazardous waste and designated

MONREC as the national regulating authority, there were no specific regulations in place.

Regulatory responsibilities for hazardous waste were distributed across various Union level ministries and decentralized government levels, leading to fragmentation and lack of clarity in enforcement jurisdictions. Regional administrations, particularly in states and regions like Yangon and Mandalay, held significant sway in hazardous waste management, with limited oversight from the ECD at regional level.

City Development Committees, through their Pollution Control and Cleansing Departments, were independently tasked with managing solid waste and hazardous industrial waste in urban areas. This decentralized structure further complicated regulatory enforcement and compliance efforts.

The lack of a clear regulatory framework contributed to widespread non-compliance with existing regulations. Additionally, the industry lacked the technical expertise and capacity to handle hazardous wastes effectively. Addressing these challenges would require strong leadership, allocation of resources, and time to build the necessary technical capabilities and ensure regulatory compliance across sectors.

Relevant regulations for HWM in Myanmar

- The Environmental Conservation Law (MONREC, 2012)
- The Environmental Conservation Rules- (MONREC, 2014)
- Environmental Impact Assessment (EIA) Procedure (MONREC, 2015)
- National Environmental Quality (Emission) Guidelines (MONREC, 2015)
- Prevention of Hazard from Chemical and Related Substances Law (2016) and Rules (MOI, 2016)
- The List of Prohibited Chemicals (MOI, 2016)
- Draft Health Care Waste Management SOP/ Guideline by MOHS
- The Procedures related to the pesticide Law (MOALI, 1991)
- Myanmar Port Authority Rules (MOTC, 2016)
- Draft Petroleum Exploration and Production Law (MOEE)

Myanmar becomes party to the Basel Convention

Myanmar became a party to the Basel Convention in 2015, which mandates the implementation of the Prior Informed Consent procedure for the transboundary movement of hazardous waste and other wastes. While the convention primarily focuses on the transboundary movement of hazardous waste, it also includes provisions for domestic regulation and management.

The Ministry of Commerce plays a key role in issuing licenses for export and import in cooperation with the Competent Authority of Myanmar under the Basel Convention, i.e. MONREC.

Capacity Building for Policy Development

NEA, with inputs from the Regulatory Working Group, prepared a baseline regulatory framework on hazardous waste management in 2018, providing an overview of the existing legislation related to hazardous waste management, roles, and responsibilities of public institutions at the national, regional, and local levels, and thereby establishing the enabling criteria for the implementation of the Basel Convention. A “Procedure on Transboundary Movement of Hazardous Wastes and Other Wastes” was developed outlining specific steps and guidelines. The procedure included a ban on the import of hazardous waste and waste electrical and electronic equipment (WEEE).

In 2018, NEA and ECD also drafted the National Hazardous Waste Regulations and a list of hazardous wastes. A revised draft of the rules was sent to SINTEF for comments in 2020. SINTEF provided feedback on topics such as waste classification, transfer station functions, monitoring of waste treatment facilities, and management of transboundary movement of hazardous wastes. The rules are to be coordinated with other laws and regulations, particularly the Prevention of Hazard from Chemical and Related Substances Law, and ongoing amendments under the Ministry of Industry.

As of 2021, both the procedure and the hazardous waste regulation were pending sub-cabinet approval.

Enhancing the Technical Capacity

This objective aimed to build the technical expertise and skills necessary for effective hazardous waste management practices. Capacity-building activities included training programmes, workshops, and technical assistance aimed at government officials, industry professionals, and other stakeholders involved in hazardous waste management.

Statistics on Hazardous Waste Generation
Accurate data on hazardous waste generation is crucial for effective planning, implementation, and monitoring of waste management systems. In the initial stages of development, first-generation inventories are created using basic calculations and a review of management practices to identify priority waste streams, sources, risks, and key players.

The project extensively collected data on hazardous wastes in Myanmar from 2016 to 2018, using government records and conducting surveys. The resulting inventory, submitted to the ECD, served as a crucial tool for the technical task force to describe the situation and recommend solutions for Myanmar's Hazardous Waste Master Plan.

Data collection for the inventory involved visits to 180 privately owned industries in Yangon and Myanmar, surveys at 25 state-owned enterprises nationwide, including various industrial zones, Thilawa Special Economic Zone, and sectors such as oil and gas establishments, healthcare facilities, e-waste recycling vendors, gold mining sites, and automobile service stations. Additional data sources for the inventory included Persistent Organic Pollutants (POPs) from the UNIDO project, mining wastes from the Department of Mining, and port wastes from the Department of Maritime Administration (DMA).

The inventory findings revealed that a significant majority, 85%, of industries in Myanmar are classified as small and medium-scale enterprises, with nearly 60% of them operating in the food and beverage sector. In 2017, the country generated approximately 280,600 tonnes per year of hazardous waste, with projections indicating a 2.4-fold increase by 2030 compared to 2017 figures. Despite this, the per capita generation of hazardous waste was estimated to be only 5.5 kg.

Evaluation of available Treatment Options for Hazardous Waste
An evaluation of existing treatment options for HW was conducted focusing on precautionary measures, sustainability, technical feasibility, economic viability, and overall impacts on the environment, human health, and society. These studies, grounded in the inventory data and current management regimes, provided key recommendations, including prioritizing legislation, regulations, and enforcement mechanisms. Drawing on lessons from internationally accepted treatment options for hazardous wastes and Asia's development experience, the reports emphasized the need for effective practices due to concerns about groundwater contamination, emissions, and public health issues. The adoption of principles of industrial symbiosis, resource efficiency, and a circular economy, with a focus on recycling and integrated treatment options, was advocated.

Syringes and sharps incinerated in an old incinerator operated by MCDC in Mandalay without any flue gas treatment (Photo: SINTEF)

Capacity Building for Policy Development
Currently, no cement plants in Myanmar engage in waste co-processing. However, as of 2017, the country had 17 cement companies operating a total of 23 cement kilns, with an annual production capacity of approximately nine million tonnes. SINTEF conducted pre-feasibility assessments for waste co-processing at selected cement plants, such as the Alpha Cement and Double Rhino Cement plants in the Mandalay region. Additionally, draft Guidelines for Co-processing of wastes in the cement industry were prepared by SINTEF, accompanied by nationwide capacity-building workshops for the entire Myanmar cement industry to explore potential future waste management activities.

Capacity Building for Administrative and Technical Personnel
Ten technical workshops on hazardous waste management were organized in Yangon, Mandalay, and Nay Pyi Taw, targeting industrial zones, industry associations, government institutes, and ministries. These workshops, conducted by SINTEF in collaboration with ECD, City Development Committees (CDCs), and the Ministry of Industry, were attended by authorities, industries, academia, and civil society organizations.

Intensive Course at Yangon Technological University (YTU): SINTEF organized an intensive course at YTU for over 50 students from chemical and civil engineering faculties, offering valuable insights into hazardous waste management practices.

Support for Master Students: In 2020, three ECD officials were enrolled in a two-year master's program in Environmental Engineering and Management (EEM) at the Asian Institute of Technology, Thailand (AIT), facilitated by SINTEF. This initiative aimed to enhance their expertise in environmental management and contribute to capacity-building efforts in the country.

Developing the Hazardous Waste Master Plan

The project sought to develop a comprehensive and strategic plan for the management of hazardous waste at the national level. The Hazardous Waste Master Plan (HWMP) draft, developed by the project, marks the first national initiative for the environmental management of hazardous wastes in Myanmar. The master plan outlines the goals, objectives, strategies, and action plans needed to address the challenges and priorities related to hazardous waste management in Myanmar. It serves as a roadmap for guiding future initiatives and investments in this area.

Aligned with Myanmar's National Waste Management Strategy and Master Plan, and compliant with the Basel Convention, the HWMP emphasizes policy frameworks, regulatory issues, institutional mechanisms, capacity building, financing, effective monitoring, and compliance. It outlines priority actions for implementation in the short (2018-2020), medium (2020-2025), and long terms (2025-2030).

In the HWMP, a lead responsible institution and supporting responsible institution(s) are proposed for each activity. The lead responsible oversees the activity's achievements and seeks support from the supporting responsible. Progress on these activities is reported to relevant government authorities. Some activities may require support from external donors and national and international professional consultants. Key suggestions in the HWMP:

- Develop localized or state-level action plans with a strong emphasis on waste minimization, cleaner production, and promoting practices such as reuse, recycle, and recovery.

- Enact comprehensive national hazardous waste regulations delineating clear responsibilities among stakeholders.

- Formulate technical guidelines for hazardous waste management covering aspects such as collection, storage, transportation, and treatment.

- Strengthen the capabilities of the Environmental Conservation Department to effectively monitor, regulate, and enforce hazardous waste management regulations and licensing requirements.

- Establish advanced treatment facilities for healthcare wastes in key urban centres such as Yangon and Mandalay to ensure safe and proper disposal.

- Explore the feasibility of co-processing hazardous waste in cement kilns as a sustainable disposal solution, potentially mitigating environmental impacts.

- Consider the establishment of a dedicated hazardous waste landfill in Mandalay to facilitate safe disposal and minimize risks associated with hazardous waste management.

Capacity Building for Policy Development
SINTEF led the development of the master plan draft with regulatory inputs from the Norwegian Environment Agency (NEA). The initial draft underwent review by members of the Technical Task Force and Regulatory Working Group. To enrich its content and garner consensus consultations were held at regional and national levels involving stakeholders such as ministries, industries, academia, and civil society organizations. Four full-day consultation workshops were organized by ECD, NEA, and SINTEF in 2018 and 2019, facilitating discussions on the latest draft of the Master Plan. Inputs received were integrated into subsequent versions.

The final draft of the national master plan (9th version) was submitted to the Minister's office at MONREC in 2019. The plan was awaiting cabinet approval as of February 2021.

The master plan recommendations are informed by investigations into current practices and the risks posed by hazardous wastes to public health and the environment. Limited financial and administrative resources necessitate prioritization of problems within the broader context of hazardous waste management goals. Detailed action plans are required for each state, region, union territory, self-administered zones, or districts.

Participants in one of the HW Master Plan consultation meetings (Photo: SINTEF)

Reflections on success criteria and challenges

The project effectively aligned with the expressed needs of ECD officials by focusing on attainable objectives within the constraints of limited institutional and financial resources. Practical and realistic guidance provided to MONREC/ECD officials has yielded tangible outcomes, such as the development of regulations, hazardous waste inventory, and the Hazardous Waste Master Plan, which are pertinent to MONREC/ECD as well as to other state entities with shared regulatory responsibilities.

MONREC/ECD's heightened engagement with the Basel Convention and related international institutes represents a significant advancement in future policy development. Continued collaboration with these entities is anticipated to provide ongoing guidance and support. The involvement of a diverse stakeholder group from government and industry in both the Regulatory Working Group and Technical Task Force facilitated improved coordination and the establishment of a unified approach to hazardous waste management.

Tailored capacity-building workshops, including identification of training needs and hands-on training sessions, as well as study trips to Norway, Thailand, and South Korea, have enhanced the hazardous waste management competency of MONREC/ECD, other ministries, CDCs, Myanmar Industry Association, and industrial zones in hazardous waste management.

Challenges and Mitigation

Conducting the hazardous waste inventory met with challenges due to the absence of a national definition, resulting in data collection with specific assumptions for classification. Cross-verification with secondary data sources and consultations with the Technical Task Force aimed to ensure accuracy and reliability.

Compliance issues among waste generators, particularly SMEs, were observed due to limited knowledge and the absence of treatment facilities. Technical feasibility studies recommended prioritizing treatment capacity for specific waste streams and highlighted the potential for industrial symbiosis and resource efficiency.

The coup in Myanmar raises concerns about the continuity of project initiatives. The suspension of project operations since February 2021 and the uncertain political situation may pose challenges in re-establishing contact and resuming project activities, especially considering the departure of trained officials.

Main achievements Hazardous Waste Management Project

- Developed a regulatory framework for hazardous waste management in Myanmar, which was submitted to ECD.
- A draft of the 'Procedure on Transboundary Movement of Hazardous Wastes and other wastes' is awaiting sub-cabinet approval. This procedure includes a ban on importing hazardous waste and Waste Electrical and Electronic Equipment (WEEE). NEA and ECD also collaborated on drafting the National Hazardous Waste Regulations and a list of Hazardous Wastes.
- Conducted a comprehensive first-generation hazardous waste inventory (2016-2018) with extensive data collection from 180 privately owned industries in Yangon and Myanmar, 25 state-owned enterprises nationwide, Thilawa Special Economic Zone, oil and gas establishments, healthcare facilities in Yangon, Mandalay, and Nay Pyi Taw, e-waste recycling vendors in Yangon, gold mining sites in Mandalay Region, and automobile service stations in Yangon.Evaluated treatment options at key waste management facilities across multiple regions (Yangon, Mandalay Region, Mon State, Tanintharyi Region, and Nay Pyi Taw), emphasizing principles of industrial symbiosis, resource efficiency, and a circular economy, with a focus on recycling and integrated treatment approaches.
- Capacity-building initiatives strengthened MONREC/ECD, other relevant Ministries, City Development Committees, industry, and stakeholders in hazardous waste management. Over 1300 participants, including 40% females, attended these workshops. SINTEF conducted a course at YTU in early 2017. In 2020, three officials from ECD were enrolled in the two-year master's program in Environmental Engineering and Management (EEM) at the Asian Institute of Technology, Thailand (AIT).
- The final version of the Master Plan (9th version) was submitted in April 2019 after multiple consultation meetings held in Yangon, Mandalay, and Nay Pyi Taw; awaits cabinet approval.

HWM publications

Reports

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ECD, MONREC, 2019. National Master Plan for Hazardous Waste Management in Myanmar, the Republic of the Union of Myanmar, Nay Pyi Taw, Myanmar.

Saha, P. K., Karstensen, K. H., Ohnmar, M. T. H., Zay, P. N., Win, T. A., Oo, K. T., Mar, Y. Y., 2019, 'First Generation Hazardous Waste Inventory for Myanmar- Master Plan for Hazardous Waste Management in Myanmar', 127 pages.

Saha, P. K., Karstensen, K. H., Zay, P. N., Win, T. A., Oo, K. T., Mar, Y. Y. 2018. 'Report on Healthcare Waste Management in Myanmar- Master Plan for Hazardous Waste Management in Myanmar', 26 pages

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Articles/ Papers

Karstensen, K. H., Saha, P. K., 2023. 'First Generation Hazardous Waste Inventory for developing a Master Plan for Hazardous Waste Management in Myanmar', Journal of Solid Waste Technology and Management (JSWTM), Volume 49, Issue 4, December 2023.
http://doi.org/10.5276/jswtm/iswmaw/494/2023.305

Karstensen, K. H., Saha, P. K., Win, T. A., Oo, K. T., Mar, Y. Y., 2017. 'Generation and Management of Hazardous Wastes in Myanmar', Ministry of Natural Resources and Environment Conservation, Forest Department, Leaflet No. 5/2017, December 2017.

Karstensen, K. H., Saha, P. K., 2017. 'Myanmar 's co-processing potential', International Cement Review, May 2017. p104-106.

5 Waste management in the Bago Region

After clean-up of a river side waste dump in (Photo: Kyaw Min San, 2020)

The Bago Waste project (Capacity building for waste management in the Bago Region, 2020-2023) aimed to reduce (plastic) pollution and gain a better understanding of the waste management situation in Myanmar with focus on Bago Region, and the Bago Township.

Prior to project start-up an assessment of the existing knowledge, actors, challenges, and needs in Bago township was carried out to inform project activities. This was enabled through NIVA's engagement in Bago Region since 2015 (IWRM I and II projects in this report). Building on this, in 2020 an advisory board was established which included representatives from the Bago Region government, local authorities, the waste collection company (MJT Agriculturals based in Bago township), and civil society. The local advisory board, headed by then Bago Region MONREC minister, was involved in developing the project workplan. This platform was important for the project's participatory approach by providing input, feedback, and critical insights on a continuous basis. By involving diverse actors, the project brought together diverse viewpoints and concerns, ensuring that activities were adapted to the local context and that the approach was anchored within local development plans.

Following the military coup in February 2021, activities that would require collaboration with the military government were stopped and the advisory board was dissolved. The project re-directed its focus to activities in Buddhist monasteries which represent autonomous entities with independent institutions and decision-making processes.

The project followed an action research-oriented approach, with Bago-based local partners who carried out research and activities in the Bago Township in close co-ordination with NIVA experts. Regular digital communication on a weekly, and sometimes daily, basis was key to ensuring project continuity and effectiveness while working remotely.

Two studies and four pilot cases

To contribute to the overall project targets, two research studies and four pilot cases on waste management were undertaken in the project.

- Study on the formal and informal waste sectors in Bago Township
- Study on macroplastics
- Clean up and restoration of a river side waste dump
- Introduction of waste management systems at a market site
- Introduction of waste management systems at selected monasteries
- Composting as a decentralised waste management strategy

Publications presenting results are listed at the end of this report.

The project's extended consortium

An extended partnership arrangement between Kyaw Min San (founder-director of law firm Justice for All) and Ye Htun Aung (MJT waste collection company), both based in Bago City, and NIVA was established in 2020. The local partners ensured communication flow and research support, and they were responsible for the implementation of local activities. Prior to the 2021 coup, the partners included local authorities and actors in the planning and coordination of project activities i.e. "the Bago Waste advisory group". After the coup, this shifted to regular communication and engagement with deputy monks and nuns of the monasteries that were part of the pilots in the project.

An overview of the main components of the project are presented below. Thereafter, the pilot cases are described, before reflections on the work and the project achievements are presented.

Study on macroplastics

Monitoring work was carried out using a structured template for a visual observation-based methodology over a six-month period in 2023 to characterise the loads, typologies, and spatiotemporal variabilities of macroplastic pollution in the Bago River. The goal was to relate the impact of mismanaged waste to the amount of plastic litter present in the riverine environment. Urban centres, such as Bago City, play a key role as a source of pollution to the river. The study provides (first of its kind) insights on the influence of seasonality on the riverine macroplastic loads in the Bago River.

Study on the formal and informal waste sectors in Bago Township

The waste management system in the Bago Region (within a Myanmar governance context) was examined through the lens of its key actors, their characteristics, and interactions. The primary data collected in the project is presented and analysed in relation to theoretical literature on the formal and informal waste sectors. The analysis documents the roles of various actors, with their diverse interdependencies, and complex social and institutional dynamics.

Four pilot cases to promote sustainable practices

This involved the participation of six monasteries in Bago township. Monasteries serve as nodal points for education, cultural and social activities in Myanmar society. Each monastery represents a system of institutional autonomy where deputy monks and nuns govern.

A study tour to Kerala, India

In order to enhance learning and experiences from best international practices on waste management that are relevant to the socio-economic setting of Myanmar, a five-day study tour was organised to the Indian state of Kerala in 2022. NIVA experts and the local partners from Myanmar took part in field visits, workshops and expert lectures in Kerala's state capital. This study tour also represented an opportunity to meet physically following the Covid-19 pandemic and the coup.

Dissemination efforts

Reports on waste management in the Bago Region were published, (i) "Towards improved waste management in Bago Region, Myanmar–An initial assessment-Baseline report" (2022), (ii) "Towards sustainable waste management in Myanmar–key results from the project 'Capacity building on waste management in the Bago Region'" (2023). *A scientific paper* on the study of the formal and informal waste sectors (2024).

Flyers: Three information flyers about the project, and fact sheet on Riverbank Clean-Up and Restoration in English and Burmese language, (for download on FB and from the Programme homepage).

Three videos were produced (in Myanmar language) and distributed over social media to raise awareness about the waste management situation in the Bago Township, inform about project activities, and suggest approaches that can help remedy the situation. The videos are available for download on FB and at the Programme webpage.

Facebook: Events, and publications were posted on the Bago waste FB-page enabling wide local and global dissemination. After the coup, several posts were removed.

The cleanup of a riverside waste dump

Smaller and larger waste dumps can be observed along the shoreline of the Bago River. This motivated for a project component involving cleanup and restoration of a riverside area (See, Nesheim et al. 2023). It represented a pilot for an encouraging model for better waste management. The riverside cleared and restored covers about 150 metres in length and 15 metres in width and is located west of the main bridge in the Bago City area.

The pilot aimed to: (I) Raise awareness in the local neighbourhood; (II) Safely remove waste and contaminated soil, (III) Avoid erosion of the river side, (IV) Restoring the cleaned riverside with vegetation, (V) Transition the site from a dumping ground for waste to a place for recreation, (VI) Encourage institutional collaboration and trust-building among various actors.

Capacity building of authorities – an adaptive management approach
Jurisdictional overlap and lack of co-coordination between different departments was identified as a key barrier to effective waste management. The Bago Waste Advisory board was a first of its kind group that involved all key actors on waste management in Bago Township. It served as an important platform that illustrated the commitment from different local authorities, which also allowed for the official sanctioning of project activities. The strong involvement of the authorities also promoted coordination and awareness raising about the impact of plastic pollution and how to approach and address related challenges.

Infrastructure capacity building
The MJT waste collection company provided most of the machinery needed for the removal of waste and construction activities. The Forest Department provided the soil, seeds, and trees and was responsible for ecological restoration.

Various government departments contributed with their own resources; the Ministry of Health and Sports provided funds for a playground, and streetlights were installed on this stretch by local municipal authorities to make the site more accessible and safer.

Capacity building – awareness of civil society and private actors
The clean-up activities involved local neighbourhood groups in waste collection campaigns.

Activities were undertaken to transform the area from a place of neglect and waste accumulation to a public space that is attractive for community use. The wall area on the monastery side was painted with artwork with messages that inspire environmental conservation and waste management. The area became a site for recreation (Photo, page 56).

The river side area after clean-up and restoration (Photo: MJT, 2021).

Group taking part in a clean-up campaign at the riverside area (Photo: Kyaw Min San, 2020).

Waste management at a market site area

Small and medium scale shops as well as food courts in markets represent important sources of waste generation (especially of single use plastic but also organic waste). However, most markets in Myanmar are only partly or not at all included in formal waste collection schemes. Considering this situation, it was decided by the Bago Waste advisory group to work in a select market area. It was agreed to start with the Phyazay market, an intermediate sized market in Bago township with around 150-160 shop keepers.

Capacity building – an adaptive management approach

In close collaboration with the Phyazay market committee, local authorities, and the MJT waste collection company it was decided to address waste management at this market in a more systematic fashion (See, Nesheim et al. 2023). A working group involving local project partners, the market committee, and local authorities was established for development and anchoring of workplans, and to coordinate activities.

Provision of needed infrastructure

The market working group identified a need for waste bins for the shopkeepers at the market, and a large container where shop keepers could discard waste bags. Three types of large waste bins enabling segregation of waste were provided for the shop keepers: green for organic waste, blue for recyclable waste, and black for general waste.

Capacity building – awareness building of civil society and private actors

Improving the waste management infra-structure was coupled with activities to raise awareness among shopkeepers, customers, and the market administration committee.

The project provided information on the impact of mismanaged waste on the natural environment, health, and the potential benefits of attracting more customers through an inviting and cleaner market area. In this process informal dialogues were held, flyers distributed, and videos and presentations shared with the shopkeepers and market administration committee. In addition, interactive events were also organised. One such event was *"The best clean shop".* This was an informal competition among the shopkeepers at the market for the cleanest shop. The winner received a cup with the logo "Clean Bago". The opportunity to use this clean shop competition initiative as a project measure to motivate awareness in a wider format was limited, however, by Covid-19 related restrictions in 2020.

The local media reported about the pilot on local television and in newspapers in 2020. Follow-up and monitoring of the situation was undertaken on a weekly basis for more than a month. Following the military coup, activities ceased.

Left: Local media interview of Kyaw Min San (Photo: MJT, 2020). Right: Dialogue with shop keepers (Photo: Aung Myo Htut, 2020).

Implementing systemic waste management at monasteries

Only few monasteries surveyed had rules and guidelines in place for waste management. In response to this, the project enrolled selected monasteries as pilots for implementing better waste management. An important aim was for these monasteries to become 'model sites' for more effective waste collection and segregation. A total of six monasteries were included as project pilots from 2021 to 2023.

Capacity building of deputies and staff at the monasteries

The different monasteries were engaged in the project at different time periods, i.e. during June-December 2021, as it was important to enable learning from experiences and adjust approaches before involving a new monastery. Working groups were established at each of the monasteries. The project's local partners held physical meetings with deputy monks, nuns, and other key informants prior to each event and activity. Their insights were used to tailor and adapt activities to respective monastery context.

Provision of needed infrastructure

Provision of waste bins was necessary to support waste collection, as bins were lacking in all the pilot cases. Initially, only a few waste bins were purchased to gain experience on their usage before purchasing additional ones. To guide waste segregation and the use of the bins, posters developed by the waste collection company were place beside the waste bins.

Waste collection service: The waste collection company provided a schedule for collection, where organic waste was collected on specific days. The company was not always able to collect according to schedule. This situation worsened when the economic situation became difficult related to Covid-19, and later the military coup.

Capacity building – awareness building of civil society and private actors

Awareness raising activities addressed, the potentially harmful consequences of mismanaged waste and plastics, segregation of waste, and waste disposal. These activities were carried out in workshops organized at each of the six pilot monasteries. It was discussed at the workshops, how monasteries can become examples and propagators of responsible waste management to the residents of Bago and the younger generation.

Waste collection campaigns and clean up events were also organised with the participation of monks and nuns and the local project partners. This contributed to raising awareness about waste and the benefits of a clean monastery compound. Awareness raising materials produced included flyers and videos addressing the wider problem of plastic waste management in Myanmar and Bago. Refillable water bottles were provided to reduce single use plastics.

Interviews with head monks and nuns on improving waste management system (Photo: Aung Myo Htut 2022).

Awareness raising in U Win Monastery January 2022 (Photo: Aung Myo Htut, 2022)

Composting as a decentralized waste management approach

Decentralised management of waste can be a promising approach in contexts where there are insufficient, formal waste collection services. Decentralised management of organic waste furthermore reduces the amount sent to the landfill. From a sustainability perspective, creating small circular loops where waste is handled for reuse or recycling has also a good climate impact. The pilot was undertaken through a scoping phase in January-February 2023, followed by an active phase from March 2023 to August-September 2023. The monastery continues to segregate organic waste for disposal in the compost bins to produce compost. Below, the implementation of the pilot is presented.

Capacity building of authorities – an adaptive management approach

Following an expression of interest by the chief nun at the Tha Dhamma Gone Yi Nun Monastery, an awareness workshop about decentralised waste management and composting was organised at the monastery in January 2023. It was reflected on the need for improving their waste management, and composting was motivated by the aim to grow vegetables. A *compost working group* was established consisting of the chief nun, students at the monastery, the local project partners, and a compost expert from the MJT waste collection company. The different responsibilities and work involved were discussed in the working group.

Provision of needed infrastructure

The project provided material for the construction of two bamboo tents. Issues of consideration were: (i) The pathway for people bringing the organic waste from the kitchen to the bins; (ii) storage space for dry leaves with proper coverage and locked to prevent cats/dogs from littering on them, (iii) storage for bins, (iv) wash-areas for bins, (v) the requirement for hosepipes for watering, and (vi) storage of all tools and EM Bokashi liquid for the composting process.

Capacity building – awareness building of civil society and private actors

Measures for change of practice included information and practical demonstration and support for how to prepare compost.

Practical demonstration addressed the following work tasks: Branches to be put on the bottom for aeration and to avoid water from gathering; organic waste from the kitchen is put on top; some soil which includes bacteria; dry leaves are added, water is showered onto the dry leaves It is covered by a tarpaulin so as to maintain heat levels, Watering the compost, and provision of EM Bokashi liquid in case of a need to speed up the composting process.

The local project partners including the compost expert returned twice for follow up. Interviews with the local working group was undertaken for feedback on the process (Nesheim et al. 2023).

Left: Clean-up to prepare the area for construction of the compost bins. Right: Construction of the compost bins (Both photos: Aung Myo Htut, 2023).

Reflections on success criteria, and challenges

The Bago Waste project was from the start well anchored with the Bago Regional government and its institutional priorities, non-governmental actors, and the private sector. Following the coup, the modular project set-up allowed a limited continuation without government participation. Below, some key criteria for success are listed.

Important criteria for success

- The pilot cases differed in many aspects but were guided by a common approach and objective. The market case and the riverside clean-up pilots were both started and implemented in 2020 prior to the military coup, with strong engagement from local authorities, civil society and private actors in Bago Township. This situation provided legitimacy, a mandate, enabled trust building and allowed for scaled project activities to take place. The measures available to the project comprised awareness raising and knowledge building, and some provision of infrastructure. The types of measures aimed to increase the intrinsic motivation of actors to work towards better waste management practices.

• Negotiating a common ground, building trust and a shared vision requires a platform and significant efforts. An intrinsic motivation and leadership from the head monks/nuns for such schemes is needed to succeed.

• An adaptative management approach and close follow-up and trust-building with the participants allowed for effectively addressing and remediate actions. Responsible deputy monks/nuns in each monastery provide an important contact point and ensure that someone felt responsibility for the success of the pilots. Clear expectations, ideally through contracts, between the waste management companies and the monasteries to foster accountability between the actors is critical.

- The Bago Waste project operated in a very focused manner at a local/regional setting. This 'local' focus and integration allowed for impactful activities to take place and followed a 'change in practice' approach. Monasteries as pilot studies for responsible waste management worked well: More than 388 novices and monks participated in the first round of awareness raising sessions, while 779 monks and novices participated in the second round of sessions. While they do not have the position to enforce legal, economic, and infrastructure policy instruments, monasteries provide education and are important religious authorities.

- The project team built on a long-term term collaboration with one of the key partners since 2015 (Justice for All) through the IWRM I project, which carried over into the Bago Waste project. This ensured that the activities, at different levels of intensity, continued throughout. Mid-way through the project (in 2022) a physical meeting was arranged in a third country (India) to have the entire project team, and partners get together to discuss progress and have informal and formal discussions. This provided motivation and impetus for further project activities.

- In addition to physical meetings, NIVA and the local partners adapted to the use of digital tools over the Covid-19 period, but also following the military coup. This involved responding to local preferences and requirements in terms of the safety, accessibility, and availability of messenger services. For example, Signal and Telegram emerged as popular tools for communication which are not so widely used in the Norwegian context. Continuous communication, often on daily basis, was important for all partners and required flexibility on the part of the project team. Extensive video and picture documentation tools were important to document and monitor work progress.

- An important aspect of the project approach following the military coup was to ensure the safety of all associated project members in Myanmar. The local knowledge of partners and awareness of the political and safety setting was fundamental in deciding, how when and if activities could be undertaken at all. This resulted in an adaptive approach, also in communication with funders, to minimise risks but also allow for some project continuity based on local demand and capacity of partners.

Risks and Challenges

- The Covid-19 pandemic and the military coup represented a 'double' challenge for project implementation. It impeded the ability to meet physically, posed difficulties in implementation of activities and created economic and financial challenges for local partners.

- The attention and allocation of resources towards the two model pilot sites is limited and poses a sustainability risk due to lack of government priority following the coup. On the other hand, some of the educational and awareness raising activities are expected to outlast the project (e.g. activities at the monasteries).

- In the socio-economic and political scenario of Myanmar following the coup there remain doubts on how far waste management, policy regimes and their alignment at national, regional and local levels will proceed. Several of the engaged persons at municipal and regional level in this field are no longer working with government institutions and resource allocations are prioritised towards other fields.

- The economic model for waste collection, whereby the company pays the local authorities for the right to collect waste, the history and practice of disposal of waste into the river, and the lack of mandatory policies and rules for waste management all represented important challenges. For some monasteries, and in particular with older monks, waste and waste handling practices are not seen as important focal areas for monasteries.

Children playing at the playground next to river side clean-up. (Photo, Kyaw Min San 2020).

Awareness workshop at laik Pyar Kan Nun Monastery (Photo, Kyaw Min San, 2023).

Interview with waste picker (Photo: the project partner Justice for All, 2023).

Main achievements in the Bago Waste Project

- Significant awareness and knowledge on sustainable waste management was built in Bago Region and Township among local authorities, monks and nuns, shopkeepers through the production of communication material (factsheets, flyers, brochures, videos), seminars, training sessions and the provision of infrastructure. Communication material was translated into Myanmar language to be widely accessible.

- Scientific write-ups provided a state-of-the-art knowledge base on waste management issues in the Bago Region and beyond. This includes studies on: the intricate (informal and formal) waste management system in Bago township; characterisation of macroplastic litter in the Bago river; review of existing policy regimes and approaches towards waste management in Myanmar and Bago Region; analysis and reflections on approaches and interventions in Bago Region to achieve better waste management. These were first of its kind publications in the Bago Region.

- The pilots at one market and one river side in Bago Township contributed to the introduction of encouraging models of waste management and led to the removal of waste from central public spaces in Bago township while being anchored in a local community context. Infrastructure was provided in combination with local need assessments.

- Trust was built and institutional approaches strengthened (prior to the coup) through the first ever set up of the 'Bago Waste advisory group' which involved multiple stakeholders from government (FD, ECD, DWIR, IWUMD, Region ministry MONFREC, DOA, Bago Township development committee), civil society and private sector. This group facilitated discussion, coordination and enabled integrated decision making.

- A good system for decentralised waste management was achieved for the nun monastery that engaged in the pilot focusing on the segregation of organic waste to make compost. Protocols and guidelines were developed for decentralized waste management and composting at the monasteries which can be replicated in other monasteries.

- Project members trained in international best practices on waste management through a study tour in India. The participation of the project members enabled learning and enhanced exposure to a setting of decentralized waste management from a similar development context.

- Civil society actors were supported during the difficult phase following the military coup, including a former member of the IWRM II project team.

Bago waste project publication list

Reports

Nesheim, I., Rognerud, I., Nøklebye, E.F., Tartiu, V. and Adam, H.N., 2022. Towards improved waste management in Bago Region, Myanmar–An initial assessment-Baseline report. https://niva.brage.unit.no/niva-xmlui/handle/11250/2981667

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Bago Waste Project Factsheet (2021). Phyazay Market site, Bago City. https://https://mnenvironment.files.wordpress.com/2021/01/factsheet-1-phayazay-market-site-bago-city-1.pdf

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Project flyer. Capacity building on Waste Management in Bago Region (2020). https://mnenvironment.files.wordpress.com/2021/01/project-flyer-bago-waste.pdf

Videos

Plastic pollution in Bago city, waste segregation (2022) https://www.facebook.com/100081324760015/videos/1212454236320447

Plastic pollution in Bago city, waste segregation (2021) https://www.facebook.com/BagoWasteProject/videos/378177734077515

Introducing composting and waste management at monasteries (2024) https://www.facebook.com/BagoWasteProject/posts/pfbid0RPhxgG1P9tr32CfcmNp9vqncgXhNzuQTiZNEUenrrwdwHgaiG4iz1mcqBnxru8zkl?notif_id=1711100233858696&notif_t=feedback_reaction_generic&ref=notif

6 Reflections on programme achievements

The four projects under the programme shared the common goal of improving environmental management and status in Myanmar. However, they differed in their focus areas and approach. High achivements were made in capacity building for technical and administrative personel at MONREC and other ministries, and in contribution to policy development. Supporting master's and PhD studies for staff at the partner institutions was particularly important.

Capacity building by provision of infrastructure and equipment, and awareness raising of civil society actors were primarily addressed by the IWRM, the Biodiversity Project and the Bago Waste Project. The main project achievements are presented for each project in the respective chapters.

Overall success components important for achievements across projects, and challenges and mitigation activites are reflected on.

Overall success components highlighted

- Capacity building objectives framed by the program were in line with the institutional priorities and functioning of the Myanmar partners.
- Several physical meetings during the project formulation and inception phase built mutual understanding and trust around project objectives, approach, and expectations.
- An adaptative management approach with close follow-up allowed for effectively addressing and remediating actions.
- Frequent informal communication on social media, and virtual meetings, in addition to the more formal email communication of letters and concept notes were core for good understanding among partners of possibilities and challenges.
- All Myanmar partners were fluent in English, this was an essential asset, and it prevented language barriers in meetings, workshops with Myanmar participants.

The KPMG evaluation report (2019): Evidence that the institutional capacity and competence of MONREC is strengthened, at the national levels, among field personnel and in two collaborating Ministries. The beneficiaries of training report using their new knowledge, skill and attitude in their regular performance of their responsibilities. They are more confident, and generally perceive that their performance has improved.

Risks, challenges and mitigation activities

Risk of turnover of staff. This was adressed by training several central experts to not only relay on a few persons. Continuity of staff in the project was emphasised in dialgoue with high level partner representatives, and this was to some extent achieved.

Risk of ineffective overlap with other projects. Continuous contact with other actors and presence by both the Norwegian and Myanmar project partners at relevant arenas and platforms addressed this risk. It was made sure to invite other actors to seminars workshops arranged by the respective projects.

Covid-19 - travels and training. Severe challenges following the Covid-19 pandemic restricted activities. The projects were able to continue by adapting to the situation. By being innovative, and by frequent meetings, courses and teaching on virtual platforms capacity building activities continued. This was possible due to the relationships, the trust, and the collaboration previously established.

The military coup and the subsequent freeze. Most programme activities stopped with the military coup in February 2021. In the post-coup situation, the collaboration with the Myanmar government partners did not continue. Students already enrolled in PhD and Master programmes completed their studies. The Bago Waste project activities continued by collaboration with private actors.

The Programme cross cutting issues (Figure 1) Myanmar is a diverse country with regard to biodiversity, different ethnic groups, culture, history and political regimes; this situation was considered by the partners when developing workplans, and in particular when involving institutions and civil society in workshops and other platforms established by the projects. *Negative impacts on human rights: P*roper attention to local sensitivities, in particular to those of ethnic minority rural communities residing in project areas were ensured by discussion among partners prior to activities for awareness and consideration.

Negative impacts on women's rights, gender equality: The projects have taken actions to promote and ensure the participation of women and other vulnerable groups in all relevant project activities. Both men and women attended courses / studies and took part in platforms for discussion and decision making.

Negative impacts on climate and environment: A precautionary principle has been followed for those aspects of their activities which represent challenges in terms of possible impact on the environment and their activities complies with the prevailing national environmental legislation.

Negative impacts for anti-corruption: The program partners want to emphasise that there has been no suspicion of any corruption during the program period. All economic transfers have (based on our knowledge), been conducted according to common accepted codes of conduct. All costs are justified and that payments have the necessary documentation in the form of receipts.

Top: Pagodas, Shwegyin Township (2019); Centre: Indawgyi Lake and the Shwe Myintzu Ye Lae Pagoda (2017); Bottom: Fisherman on Inle Lake (2016) All photos: Ingrid Nesheim.

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