Environmental Expert Support Mission
United Nations Disaster Assessment and Coordination
Flooding Assessment

Technical Report
Peru – May 2017
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**Description of Participating Entities:**

The **UN Environment/OCHA Joint Unit (JEU)** assists Member States in preparing for and responding to environmental emergencies by coordinating international efforts and mobilizing partners to aid affected countries requesting assistance. By pairing the environmental expertise of United Nations Environment and the humanitarian response network coordinated by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the JEU ensures an integrated approach in responding to environmental emergencies. The Environmental Emergencies Centre (EEC) (www.eecentre.org) is an online tool designed to build the capacity of national responders to environmental emergencies developed by the JEU.

**United Nations Disaster Assessment and Coordination (UNDAC)** is part of the international emergency response system for sudden-onset emergencies. UNDAC is designed to help the United Nations and governments of disaster-affected countries during the first phase of a sudden-onset emergency.

The **European Union Civil Protection Mechanism (UCPM)**, through the DG ECHO (European Civil Protection and Humanitarian Aid Operations) of the European Commission, facilitates co-operation in disaster response, preparedness, and prevention among 31 European states (EU-28 and the Former Yugoslav Republic of Macedonia, Iceland, and Norway). With the support of the European Commission, Participating States pool resources and experts that can be made available to disaster-stricken countries all over the world as well as for prevention and preparedness operations. When activated, the Mechanism coordinates the provision of assistance from its Participating states. The European Commission manages the Mechanism through the Emergency Response Coordination Centre (ERCC). Operating 24/7, the ERCC monitors risks and emergencies around the world and serves as an information and coordination hub during emergencies. Among other tasks, the ERCC also ensures that Participating States are fully aware of the situation on-site and can make informed decisions for providing financial and in-kind assistance. For more information, please refer to the ECHO website and/or ERCC Portal. The Union Civil Protection mechanism closely cooperates with the United Nations and has participated in several joint missions.
Executive Summary

This report summarizes the mission carried out in Peru from 23 March 2017 to 14 April 2017 by Maria-Helena Ramos (IRSTEA, France), an associate environmental expert deployed as part of the UN Disaster Assessment and Coordination (UNDAC) team. The expert was mobilized at the request of the UN Environment/OCHA Joint Unit (JEU) through the European Union Civil Protection Mechanism (UCPM). The aim of the mission was to identify and assess secondary environment hazards and impacts following the floods and landslides in Peru.

The main findings of the expert involve the clear needs of sanitation and solid waste management for the early recovery of the population affected. The impacts on humans and natural resources include negative effects on the quality of water bodies (mainly rivers) due to pollution from muddy runoff and from wastewater and solid waste reaching the rivers. There were also reported impacts due to inadequate and lack of hygienic disposal of domestic waste water and human excreta, as well as the disposal of non-treated water from local industries directly into water bodies. In addition, possible contamination of aquifers was identified as an impact, through infiltration or leachate flow from unregulated solid waste landfills, related to the absence of solid waste collection and disposal. Furthermore, there were impacts related to air pollution, enhanced by the burning of solid waste without previous recycling and the increased number of motorized transportation in the cities and affected areas.

Other secondary impacts were highlighted as well. These include impacts related to soil contamination, most notably in agricultural areas due to contaminated flooding/muddy waters. Possible impacts on water pollution (and, consequently, on human health) from mining activities located upstream the river catchment areas in the region of Tumbes were also highlighted. Finally, a risk of having an increase in deforestation problems as a consequence of uncontrolled and unsupervised (re)building activities in areas where several houses were destroyed was identified. This is mainly a possible impact at a long-term timeframe.

Several key recommendations emerged from this mission. First, there is need for domestic waste collection and disposal in the areas where the service was stopped or revealed to be inefficient given the flooding situation. Moreover, adequate sewer systems or human excreta disposal infrastructures must be set up to prevent people from throwing human excreta on the streets. There are needs for supervision of rebuilding activities, namely to provide orientation on (and the means for) the correct disposal of building materials from destroyed houses, and the choice of materials and building techniques to be used on new constructions to enhance resilience to future natural hazards.

In the long term, it is recommended that good land use management practices are embraced through the mapping of areas at risk of flooding and to promote development towards disaster-resilient societies.
List of abbreviations, acronyms and glossary of terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>COEN</td>
<td>Centro de Operaciones de Emergencia Nacional (National Emergency Operations Centre)</td>
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<td>ECHO</td>
<td>European Civil Protection and Humanitarian Aid Operations</td>
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<td>ECMWF</td>
<td>European Centre of Medium-Range Weather Forecasts</td>
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<td>EEC</td>
<td>Environmental Emergencies Centre</td>
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<td>ERCC</td>
<td>Emergency Response Coordination Centre</td>
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<td>FEAT</td>
<td>Flash Environmental Assessment Tool</td>
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<td>IRD France</td>
<td>Institut de recherche pour le développement</td>
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<tr>
<td>IRSTEA</td>
<td>Institut national de recherche en sciences et technologies pour l’environnement et l’agriculture</td>
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<tr>
<td>JEU</td>
<td>UN Environment/OCHA Joint Unit</td>
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<tr>
<td>OCHA</td>
<td>(UN) Office for the Coordination of Humanitarian Affairs</td>
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<tr>
<td>RHN</td>
<td>Red Humanitaria Nacional</td>
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<tr>
<td>SENAMHI</td>
<td>Servicio Nacional de Hidrología y Meteorología (National hydro-meterological service)</td>
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<tr>
<td>SIRAD</td>
<td>Sistema de Información sobre Recursos para la Atención de Desastres</td>
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<tr>
<td>UCPM</td>
<td>European Union Civil Protection Mechanism</td>
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<td>UN</td>
<td>United Nations</td>
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<td>UNDAC</td>
<td>United Nations Disaster Assessment and Coordination</td>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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An environmental emergency is defined as a sudden onset disaster or accident resulting from natural, technological or human-induced factors, or a combination of these, that cause or threaten to cause severe environmental damage as well as harm to human health and/or livelihoods.

UNEP/GC.22/INF/5, 13 November 2002
1. **Mission background and scope**

Following severe flooding in Peru in March 2017, an associate environmental expert was deployed as part of the UNDAC team, mobilized at the request of the JEU through the European Union Civil Protection Mechanism. The key role of the environmental expert was to identify and assess secondary environment hazards and impacts following the floods and landslides in Peru.

1.1 **Context**

The overall situation in the most affected areas was the consequence of unusually heavy rainfall that, falling intermittently since the start of the year, had caused landslides and flash floods, mainly in the north coast region of Peru. Heavy localized rainfall and rainfall over this long duration were associated with a phenomenon called “El Niño Costero”, which usually affects the countries of Peru and Ecuador.

During the mission, the severity of the disaster was increased by a hydrometeorological situation in Piura that had an impact on the entire context of the environmental assessments. After a first strong rain/flood event in the north coast region in late January/beginning February and a second one by mid-March, more rainfall and severe flooding occurred in Piura in the evening of 26-27 March, during the assessment field missions. This changed the focus of UN action to Piura and highlighted the needs to carry out a more delicate assessment and coordination. The condition also led the local government to release decrees of emergency state in the Lambayeque, Tumbes and Piura departments on 29 March 2017. The UNDAC team in Piura only came back to Lima on the second week of April.

According to local authorities, this phenomenon had not been observed since 1925. The last situation report produced by the Office for the Coordination of Humanitarian Affairs (OCHA) team in collaboration with the Red Humanitaria Nacional (RHN) on 27 April reported 1.3 million people affected and over 42,000 collapsed houses.\(^1\) On 4 May, 136 deaths and 18 missing people were reported.

1.2 **Mission objective**

The objective of the mission was to identify and assess secondary environment hazards and impacts following the floods and landslides in Peru.

Maria-Helena Ramos participated in this mission as an associate member to the UNDAC team from the European Civil Protection and Humanitarian Aid Operations Programme (ECHO) with the support of the Emergency Response Coordination Centre (ERCC). The expert arrived on 24 March 2017 to conduct environmental assessments related to the floods and landslides affecting Peru’s northern coast. The expert works for the French Government through the National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA).

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2. **Key activities and findings**

2.1 **Mission activities**

The expert arrived on 24 March and had briefings on the main environmental issues in Peru that could be affected by floods and heavy rain. The expert was also briefed on UN tools of assessment such as the Flash Environmental Assessment Tool (FEAT).

On 26 March the expert began a two-day field visit to Chiclayo in the Lambayeque region, which was one of the regions most affected by the floods. The field mission contributed to the assessment of impacts and environment issues with regard to urban as well as rural areas. There were discussions with the United Nations Development Programme (UNDP) office in Lima, representatives of NGOs including CARE and Save the Children, and local civil defense and public institutions. There were also discussions with several actors in Peru working with environment and water-related issues (see Annex 5.2).

There were several sectoral meetings in Lima, which were accompanied by informal conversations with the sectoral team members. Several documents collected from experts and advisors, and produced by the UNDAC team, were analyzed, including situation reports. There were also debriefings with the UNDAC team members that had been to the Piura region for the field needs assessment.

2.2 **Other activities and interactions**

In addition to the environmental mission tasks, the expert also contributed to the activities of the UNDAC team, notably with the translation of documents from Spanish to English and with some graphical analyses of the data from the Flash Appeal.

The expert was in constant contact with the UCPM-ECHO delegation in Lima. There were several face-to-face meetings at the UN and the EU delegation, and SMS/email exchanges. The expert was in contact with the technical people from the National Emergency Operation Centre (COEN) and the National hydro-meteorological service (SENAMHI), who were specialists on geographic information system, hydrological modelling and flood forecasting. This contact was established following her expertise on hydrological research for flood forecasting and in order to contribute to the use and understanding of weather forecasts coming from the European Centre of Medium-range Weather Forecasts (ECMWF). These forecasts were kindly provided, specifically for the emergency situation, after an official request from the expert to ECMWF, asking for permission to visualize their weather forecasts for Peru. COEN and SENAMHI were receiving data and support from ECMWF for the emergency situation. Technicians were then able to learn with the experience of this event to plan future alliances and collaborations in the area.

This interaction triggered collaboration between ECMWF and the national authorities. Today, national authorities are considering signing an agreement with ECMWF to get their products and enhance their capability to forecast extreme events such as the one that was responsible for this year’s floods. Better forecasts mean better preparedness for such events, which can also translate into improvements in the efficiency of response actions. Additionally, hydro-meteorological forecasts can help the emergency and UNDAC teams in the field (to better prepare their actions) and the immediate response at the early recovery phase (for example, to know when an event is expected to finish or if another is expected to occur). Furthermore, these aspects can be linked to flooding maps to help emergency services evacuate or, for instance, to pump water from inundated areas.

The expert was also contacted by the French Embassy in Lima and met the Ambassador and his team in Lima on 30 March.
2.3 Findings

Overall, the Lima region and surroundings, where mining issues with potential to highly impact the environment exist, were ultimately less affected, in comparison to the flooding situation that was observed in Tumbes, Lambayeque and, most strongly, in Piura. Piura’s situation got worse on 27-28 March and remained critical, as a state of emergency was declared.

Impacts on the quality of water bodies (mainly rivers) due to pollution from muddy runoff and from wastewater and solid waste reaching the rivers were observed. This issue is very closely related to sanitation issues as the population was in direct contact with flooding waters, mainly in rural areas (including children who were playing in muddy water pools). The environmental expert noted that impacts from river flooding waters propagation up to the coast were not emphasized as potentially significantly to the environment at the time of her assessment.

There were often inadequate or a complete lack of hygienic disposal of domestic waste water and human excreta. There was also disposal of non-treated water from local industries directly into water bodies. As a consequence, impacts on riverine fauna and flora, as well as on human’s health, are expected.

The contamination of aquifers, through infiltration or leachate flow from unregulated solid waste landfills (related to the absence of solid waste collection and disposal) also appeared as a key issue.

Additionally, as large amounts of solid waste are periodically and uncontrollably burned, there is a risk that the quality of soils be affected. Furthermore, this could damage aquifers if infiltration occurs. This also contributes to increased air pollution, which will eventually have negative consequences to the health of the population living and working nearby.

Air pollution was also detected as a key issue for the environment and population health. This type of pollution appeared to be enhanced by the increased number of motorized transportation/transfers due to arrival of flooding assistance to the cities and affected areas.

Soil contamination (notably in agricultural areas due to contaminated flood/muddy waters) may also be an issue of environment pollution, notably if the preparation of agricultural lands after the flood event is not surveyed by specialists (soil cleaning and disposal).

Water pollution from mines was indicated as potentially an issue (although no evidence had yet been directly reported), mainly in the Tumbes region, given the existence of mining activities upstream the river catchment areas, in Ecuador.

Finally, there is a risk of having an increase in deforestation problems as a consequence of uncontrolled and unsupervised (re)building activities in areas where several houses were destroyed (mainly a possible impact at longer time scales).
3. **Summary**

3.1 **Conclusions**

In the beginning of the field visit to Chiclayo/Lambayeque, it appeared very clearly that sanitation and solid waste management were two inter-related challenges that are having a negative impact on the early recovery of the population affected. This first noticeable impact on environment (as well as on population’s health, nutrition and hygiene, at short to long time frames) was confirmed through subsequent discussions with key actors after the field trip.

The main environmental impacts included the quality of water bodies (mainly rivers) due to pollution from muddy runoff and from wastewater and solid waste reaching the rivers. There are also impacts from hygienic disposal of domestic waste water and human excreta, as well as the disposal of non-treated water from local industries directly into water bodies. Other impacts include the contamination of aquifers, air pollution, soil contamination, potential water pollution from mines, and potential long-term risk of increased deforestation.

The overall impact of the floods, given the severity of such rare event, is considered strong on both the population living in the affected areas and on the environment. Attention must be paid to sanitation issues, mainly solid waste management and human excreta disposal, which can affect population’s health as well as water and soil (land) resources.

3.2 **Recommendations**

Domestic waste collection and disposal should be given priority in the areas where the service was stopped or revealed to be inefficient given the flooding situation. It is important to take the opportunity to guide and encourage the population to recycle, including safe recycling of hazardous materials, as this will contribute to a more efficient and sustainable disposal of domestic waste, potentially reducing landfill waste and improving landfill management.

While, in general, water supply systems damaged by the floods were fixed, sewer systems or human excreta disposal infrastructures were visibly in need of solutions to prevent people from throwing human excreta on the streets. Although mobile toilets were installed at some affected places, quickly recovering residence septic systems is also recommended. Hygiene guidance actions could also contribute to a better management of human waste.

Several houses were reported destroyed or severely damaged. Having a shelter is often a priority for families who, understandably, wish to quickly come back to ‘normal conditions’. However, building conditions need to be supervised to avoid repeating errors from the past. This include providing orientation on (and the means for) the correct disposal of building materials from destroyed houses, the choice of materials to be used on new constructions, and the choice of building techniques in order to build houses that can resist future natural hazards.

Land use management also includes supervision of human occupation in flood prone areas. The mapping of areas at risk of flooding can be useful to guide future land development. They can also be combined with the mapping of areas at risk of erosion, for instance, where appropriate. These maps should be co-built with local authorities and clearly communicated to the population.

Actions towards early recovery should go hand in hand with planning for building resilience in the exposed and most vulnerable areas. Nothing guarantees another similar or strong/impacting event will not happen in the near future. It is therefore recommended that people involved in emergency recovery and development interact to promote, on one hand, development that focus on facilitating recovery, and, on the other hand, recovery that follows guidelines towards building disaster-resilient societies.
4. References


Other useful Links:

Environmental Emergencies Centre:
http://www.eecentre.org

Infographics for Peru:
http://www.redhum.org

Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture
http://www.irstea.fr/accueil

Video produced by UNDP Communication Officer:
https://www.facebook.com/PNUDPe/videos/vb.235391323233632/1108796702559752/?type=2&theater
5. **Annexes**

5.1 **Mission timeline**

**Thursday 23/03**: Departure from Paris, France.

**Friday, 24/03**: Arrival in Lima, Peru, at the Hotel Inkari Suites in the morning. Contact made with the UNDAC Team Leader in Peru, Rogério Mobilia. Presence at the situation room in the offices of UN in the afternoon. Meeting with team members from UNDAC/OCHA/RHN, and getting familiar with the overall situation.

**Saturday, 25/03**: Presence at UN offices all day. Overview of the main environmental concerns in the country and the assessment tools of UNDAC, such as Flash Environmental Assessment Tool (FEAT), Map-X data platform for the extractives sector, as well as other available tools (ex., SIRAD - Sistema de Información sobre Recursos para la Atención de Desastres). Meeting with ECHO-EUCP team members in the evening.

**Sunday, 26/03**: Departure to field mission in the Lambayeque region at 6am. Flight from air forces airport and arrival in Chiclayo in the morning. The field trip focused on the needs in rural areas.

**Monday, 27/03**: Chiclayo all day. The field trip focused on the needs in urban areas.

**Tuesday, 28/03**: Departure from Chiclayo and arrival in Lima. Presence at UN offices.

**Wednesday, 29/03 to Wednesday 12/04**: Work in Lima at UN offices, including meetings with sectorial groups and visits that included: EU delegation (EUCP team), COEN, SENAMHI, French Embassy, IRD, Red Cross Red Crescent Climate Centre.

**Thursday 13/04**: Departure from Lima.

**Friday 14/04**: Arrival in Paris, France.
5.2 Mission discussions

The expert engaged in many fruitful discussions throughout the mission, including with:

- Ms. Anita van Breda (WWF-US)
- Mr. Boris Teunis from The Netherlands (water expert of the UCPM team), with whom the expert exchanged viewpoints on the water and sanitation situation and established contacts at COEN
- Ms. Fabiola Riva Melofiro (Coordinadora Programa Educacion y Sensibilizacion Ambiental CORBIDI)
- Mr. James Leslie of UNDP Lima
- Dr. Jean Loup Guyot and colleagues from IRD France (Institut de recherche pour le développement)
- Dr. Juan Bazo (Technical Advisor at Red Cross/ Red Crescent, Climate Centre)
- Local civil defense and public institutions
- Ms. Luisa Sterponi (Consultora – Docente TELEDETECCIÓN Y SIG at COEN)
- Dr. Oscar Felipe Obando and Dr. Wilson Suarez (Ministry of Environment; National Meteorology and Hydrology Service of Peru, SENAMHI)
- Representatives of NGOs (CARE, Save the Children)
- Technical advisors at UNDP (Ecosistemas y Cambio Climatico)

The expert also engaged in Skype discussion and email exchanges with expert Dan Stothart (Regional Disasters and Conflicts Programme Coordinator / Humanitarian Affairs Officer, Latin America and the Caribbean, UN Environment)
5.3 Photographs from the mission

Photos taken during the field trip mission to Chiclayo/Lambayeque on 26-28 March 2017 (photos: MHR)
Photos taken during the field trip mission to Chiclayo/Lambayeque on 26-28 March 2017 (photos: MHR)
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Photos taken during the field trip mission to Chiclayo/Lambayeque on 26-28 March 2017 (photos: MHR)
Photos above: UNDAC team offices at UN building in Lima and debriefings with the UNDAC team (MHR)

Left photo: Meeting at the UN Building in Lima on 29 March 2017 (ECHO-EUCP EU delegation) (MHR)
Right photo: Field trip mission to Chiclayo/Lambayeque on 26-28 March 2017 (JB)