



Climate Challenges: Bridging the Knowledge Gap



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Finally, enormous thanks to Sloane Grogan who volunteered to coordinate students and Mercy Corps around the world in the course of this research partnership. Her organisational talents and dedication were key to its success.

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Introduction

Climate change cross-cuts all development challenges at a global scale. As an international humanitarian agency, Mercy Corps is profoundly aware of the hazard it poses to the communities we serve. It threatens to wipe out many achievements from previous development work and undermine the value and impact of current programmes.

According to current climate predictions, the most vulnerable communities today are likely to be the most severely impacted by changing climate patterns. Climate change will worsen an already unprecedented scarcity of resources including water and arable land in some of the world's most volatile and impoverished regions. Secondary effects include the driving of large numbers of people away from coastal areas where most of humanity lives, raising risks of conflicts and intensifying existing social and economic challenges across the world. Rising temperatures are already increasing the frequency and intensity of extreme weather patterns including storms, flooding and droughts. Over the long term, climate researchers anticipate the spreading of diseases such as dengue and malaria, and major shifts in agriculture. Unless we adapt to these changes, sickness, famine and forced migration will be the outcomes.

A principle obstacle that the humanitarian community faces is in knowing what climate impacts will occur where, and at what scale. This knowledge is needed to subsequently decide the most appropriate ways to assist communities adapt to, and reduce, climate change impact. Climate predictions tend to be too broad-scale to guide adaptation of the sorts of community led development projects humanitarian agencies implement. They are often highly technical and not always in agreement on timing and scale of impacts given different methods of calculation and assumptions over the amount of greenhouse gases emitted in the future. Making a start in grounding climate science in ways applicable to Mercy Corps' development efforts is a key objective of the content described here.

[Mercy Corps and The University of Edinburgh: A research alliance](#)

Recognising the need for an improved understanding of climate change impacts on Mercy Corps' programmes, the agency formed an alliance with Edinburgh University's M.Sc. Environment and Development programme. This is part of the Centre for the study of Environmental Change and Sustainability, which has a strong climate focus. Students agreed to formulate their theses around the impacts of climate change on particular issues from some of Mercy Corps country programmes. Most were able to visit the countries they were researching and consult face to face with Mercy Corps country programme staff, partners and communities. Each thesis is summarised briefly in this report. Together they clarify the urgency with which climate change impacts have to be addressed by Mercy Corps and similar agencies.

[Key findings](#)

Key findings from the theses were:

| Country | Topic | Key findings |
|---------------------|--|--|
| Afghanistan | Implications of climate change for water resources in the Kunduz River Basin | <ul style="list-style-type: none"> • The upper catchment of the Kunduz river basin has experienced a long term average rise in temperature that is double the average global temperature increase and consistent with temperature rises elsewhere in the Central Asian region. • The loss of snow cover feeding the river system will result in decreased water available to the region that will result in a smaller farming area for wheat planting downstream • Due to changing weather patterns there is a heightened risk of winter and spring floods, intensified summer droughts and deterioration in yearly water quality and quantity. |
| Ghana | Vulnerability of rainforest fringe communities to climate change – a case study on Ghana | <ul style="list-style-type: none"> • Previous climate research is not in sufficient agreement to make reliable predictions about climate impact on livelihoods in and around Ghana’s forest: Climate effects are likely to exacerbate problems already caused by human activity. Addressing poor natural resource practices is the most pressing issue. |
| Indonesia (Aceh) | As assessment of the effects of climate change on the sustainable livelihoods of forest dependent communities in the <i>Aceh Barat</i> district of Sumatra | <ul style="list-style-type: none"> • Previous climate research does not predict any major threat to community rubber development in Aceh if the surrounding environment remains stable. • Indirect, long term threats to forest may arise from communities living on the coast who face climatic disruption if sea levels rise as predicted. Moving inland and near forest areas has the potential to lead to unsustainable forest use for building and agricultural conversion, which in turn will affect those whose livelihoods are sustained by the presence of forests. |
| Indonesia (Jakarta) | Climate change and urban poverty in Jakarta | <ul style="list-style-type: none"> • By 2050, 160 km² of the city will be underwater. This will result in a catastrophic loss of infrastructure, population displacement and fresh drinking water contamination. • Flood events are predicted to increase in |

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| | | <p>frequency and severity. With no ready assistance and the pace of immigration continuing, desperation and frustration of Jakarta's vast population is likely to fuel social instability, especially among the young unemployed poor.</p> |
| Mongolia | Impacts of climate change and economic transition in Mongolia | <ul style="list-style-type: none"> • Mongolia is facing a drier future, particularly in the winter months, implying that severe droughts will occur more frequently, although there is also some possibility of localised increases in agricultural yield. • Higher temperatures coupled with less rain will lead to increased desertification: this will affect Mongolian livestock farming communities who rely on the land to produce fodder for their animals in a country where 90% of land is already vulnerable to desertification. |
| Niger | Implications of climate change on food security in Niger | <ul style="list-style-type: none"> • Uncertainty over rainfall trends makes further research a priority for different parts of Niger. Temperature increases will certainly impact food production. • Niger already suffers flood and drought periods and there remains a possibility that these will increase in frequency and severity which will threaten the production of major crops including millet, sorghum and cowpea, as well as livestock. • More research is needed before specific methods to reduce the effects of climate change can be implemented. |
| Nepal | Climate threats and vulnerability assessment of agricultural communities in Humla | <ul style="list-style-type: none"> • Food availability will be reduced and dependency on aid increased in Humla, one of the most remote and vulnerable parts of Nepal. • Recent increase in malnutrition in Humla is suspected to be largely due to a climate change-related increased level of drought. • Lack of infrastructure, finance, social networking and isolation leave the people of Humla particularly vulnerable to environmental shock: climate change will multiply the threat and impact from shocks arising from agricultural and environmental insecurity. |

Implications

The findings illustrate key issues humanitarian agencies need to address in assisting communities adapt to climate change impacts, and also highlight key questions that require further research.

Rising sea levels

The clearest threat comes from rising sea levels. Most of humanity lives along coastlines. As sea levels rise it is predicted that hundreds of millions of people will be forced to migrate from the most exposed areas. A high proportion of the displaced are likely to migrate to urban centres at a time when, for the first time in human history, more people are living in cities than rural areas. Yet as the Jakarta study shows, large coastal cities in developing countries will also be prone to catastrophic damage from rising seas. The combination of salt water inundation, mass influx of refugees, and increased pressure on indigenous urban poor is a humanitarian disaster likely to increase social tensions and potential for conflict.

Rural impacts

In rural areas, shifting weather patterns will have a largely negative affect on agriculture. Rains will become more unpredictable and cycles of flood and drought will increase in frequency and severity. Food availability will be threatened particularly in the most vulnerable countries such as Niger where sufficient rainfall for crops is already precarious. Livestock farming communities, like those in Mongolia, will face more droughts that will reduce fodder production. Mongolia has already been through a three year drought cycle that caused nearly 30% of the country's livestock to perish; these cycles threaten to become regular events.

Glaciers and mountain snow

The glaciers of Nepal are retreating and annual snow cover on mountains in Afghanistan is diminishing. These are responsible for regulating the water flows that feed downstream rivers vital for agriculture and everyday life. As winter temperatures increase, precipitation will fall as rain instead of snow, causing increased risk of flash flooding threatening life and agricultural infrastructure. During the later, warmer, seasons water is likely to become increasingly scarce. These types of flood and drought cycles have already been noted by many communities; the risk is a reality.

Positive opportunity

In those parts of the world where the environment is stable, like much of Indonesia's Aceh Province, natural buffers to environmental extremes such as good forest cover (protecting the ground from flood and erosion), will continue to provide ecological services in the face of more frequent, extreme, climatic events. For people fortunate enough to be away from the coast and in well maintained environments the course of action is clear – continue to practice sound natural resource management practices and avoid unsustainable environmental use.

Moving forward

Climate change challenges can be met by a united commitment to reduce their causes and anticipate their risks. Development agencies such as Mercy Corps are in a unique position to foster partnerships implementing climate change adaptation measures that work at local community levels. These partnerships include work with research departments to build up a useful and applicable body of knowledge, working with the private sector to utilise new technology relevant to community needs, and working alongside communities to involve local and national government to encourage and enable necessary changes to take place. Above all, the role of development agencies like Mercy Corps is to help inform communities and their governments of the risks facing them, mobilise people to help themselves and ensure that communities are seated at decision making tables.

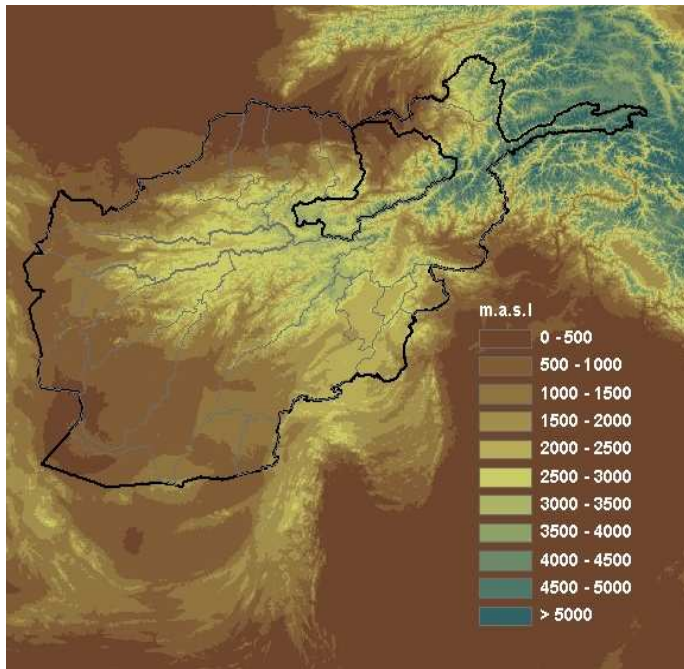
Through application of climate change science, Mercy Corps intends to focus climate adaptation programmes in four directions:

- Develop tailored programmes aiming to reduce the risk of climate change and anticipate climate change hazards with communities and local government.
- Helping governments to realise the likely scale of impacts and lobbying them to take meaningful steps to reduce the causes of climate change and provide resources for communities to adapt to impacts that cannot now be avoided.
- Create businesses that help address climate change causes while creating employment.
- Continue to partner with research institutions to be better informed on what climate change will mean to the communities the agency engages and what adaptation steps can be taken.

Afghanistan: Implications of climate change for water resources in the Kunduz River Basin

| | |
|------------------|---|
| Author | Joel Fiddes |
| Country | Afghanistan |
| Scale addressed | Water resources of the Kunduz basin |
| Issues addressed | <ul style="list-style-type: none">• Historical trends of snow cover in upper watershed areas that feed the major rivers of Afghanistan• Analysis of future climate projections for Afghanistan focussing on Kunduz river basin water resources and livelihoods |

Background



Topography of Afghanistan, Kunduz River Basin outlined in north-east

Throughout the world, mountains collect and distribute water into all of the major river systems. Afghanistan's Kunduz river basin is no different as its reliability depends on mountain snowmelt. About 90% of the country's rains fall from December to April, mostly in the northern mountains of the Hindu Kush. Throughout summer months, negligible rainfall means that the water necessary for everyday life and agriculture depends on the steady melting of the winter snows on the mountains to feed water-courses and groundwater.

The warming climate patterns are resulting in less snow on the mountains as rain falls instead of snow. This leads to early and large water runoff during the winter months. The reduced snowpack then produces less water in the dry season. The outcome is early flooding and later drought in yearly cycles that threaten to become increasingly severe as years progress.

Getting the data to analyse possible climate change impact is not easy. There is a lack of data on mountain climates across South Asia generally; in Afghanistan there is even less following years of wars and isolation. Adding further to the complexity, most mountain hydrology studies have focused on Himalayan mountain systems where glaciers feed into watersheds. Afghanistan is far less reliant on glaciers; winter snowpack and subsequent snowmelt are the key issues and going further, climate

change will not be the only factor causing environmental impact. It will likely multiply the threat arising from deforestation and over grazing on slopes already vulnerable to erosion of soil from wind and water through increased intensity of rain and drought cycles.

Predicting the impact of climate change on the Hindu Kush's snow cover is vitally important for anticipating the effects on the people of Afghanistan and on their livelihoods. These predictions can inform policies and programmes, helping Afghan communities to adapt to the changes coming their way, and hopefully reduce some of the risks facing them. The numbers of people who may be affected are large; the population of the basin is about 1,500,000 living mainly on the plains. Their survival relies on successful agriculture and their harvests form the breadbasket of Afghanistan.

Findings

- The upper catchment of the Kunduz river basin experienced a long term average rise in temperature of 1.32⁰C during the 20th Century between March and May, and 1.37⁰C between December and February: this is double the average global temperature increase and consistent with temperatures elsewhere in the Central Asian region.
- From 1998-2007 mountain snow cover has been constantly below the long-term average throughout the year: as spring progresses snow cover is increasingly marginal, exacerbating the impact of increasing temperature resulting in both less snow in winter and less melt in summer.
- Decreased water discharge from the mountains will result in a smaller farming area for wheat planting: irrigated wheat represents 87% of the total wheat grown in the Kunduz river basin; if this correlation holds true, then availability of food for communities living in the area will be under threat.
- Although peak water levels show little indication of change in the last generation, there is still a high likelihood that a shorter snow season will shift the timing of peak snow melt. This will need careful monitoring because the ability of cropping patterns to adapt to seasonal change will be critical for retaining a sustainable agricultural base.
- With a higher proportion of precipitation falling as rain and earlier snowmelt, there is a heightened risk of winter and spring floods, intensified summer droughts and deterioration in yearly water quality and quantity. These shocks can represent a slow-onset disaster for populations who do not have the capacity to adapt to changing circumstance.

Development action points

Mercy Corps and sister agencies working in the Kunduz river basin, and downstream in irrigated agricultural landscapes, need to take into account the findings of this research to ensure the communities we engage with have time to adapt to the climate challenges they are facing.

Areas for immediate consideration are:

- *Adaptation*: there are short and long term threats ranging from flash flooding to a reduction in food production. The full implications need to be broadcast to communities, local and national government and donors, with an agenda

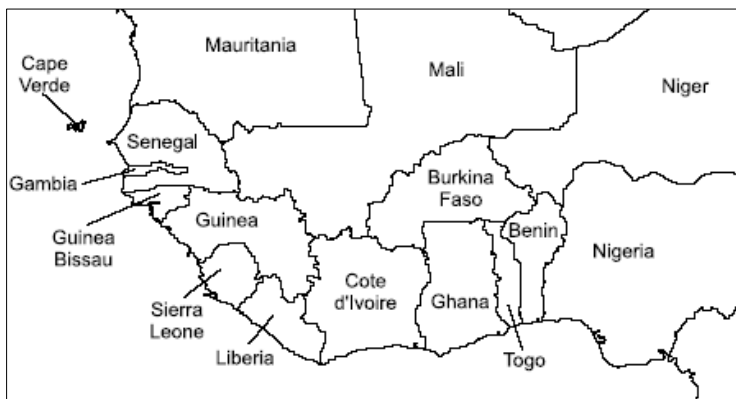
for building community and national resilience. Given the security situation in Afghanistan it will be difficult to get the climate message treated with the urgency it deserves, yet this should not dissuade the development community from moving forward. If steps are taken too late to prepare for, and reduce the risks of, a disaster, further instability is likely to arise as agricultural production reduces and fresh water becomes an increasingly limited resource.

- *Mitigation:* Many of the anticipated climate change impacts will exacerbate recent environmental damage. Loss of forest cover through over-exploitation and over-grazing have reduced natural buffers to flooding and soil erosion, and these issues will continue to multiply with the effects of climate change. Current projects aimed at better natural resource management for a sustainable environment need to be amplified and replicated, including restoration of forest on degraded slopes and promotion of agricultural practices that conserve watersheds.
- *Monitoring:* Accurate data from the Kunduz river basin is sparse yet is needed to accurately predict the impact of climate change and create ways to adapt and reduce the damage caused. To enable accurate assessments of water resources the Kunduz river basin desperately requires the meteorological observation stations and hydrological gauging stations to be reconstructed. While satellite data can provide a good amount of information, on the ground observations are also needed to validate data and ensure reliability of early warning systems. River discharge data is badly needed to allow for accurate monitoring of shifts in quantity or seasonality of snowmelt water levels while groundwater reserves and predicted future water use need accurate analysis.

Ghana: Vulnerability of rainforest fringe communities to climate change – a case study on Ghana

| | |
|---------------------|---|
| Author | Mohamed El Mongy |
| Country | Ghana |
| Scale addressed | Atewa |
| Issues and approach | <ul style="list-style-type: none"> Climate change projections for forest zones in Ghana and vulnerability of livelihoods |

Background



Map of West Africa (Dow 2005)

Ghana is located within West Africa's Upper Guinea rain forest, which is one of the world's biodiversity rich areas. The country's rain forest is under tremendous pressure from deforestation attributed to an export driven economy that leads to loss of forest from

conversion for agriculture, and forest degradation from unsustainable timber extraction, mining and illegal logging. Ghana's increasing population adds pressure on forests due to increasing demand on food and forest products.

The forest of Atewa, the site of field research for this study, exemplifies many of the challenges Ghana's forest faces. Communities surrounding the forest remain dependent upon it to sustain their livelihoods. However, this resource is under threat. Forest loss through conversion and degradation is caused by trees being cut down to make farmland; unsustainable timber extraction; illegal logging; unsustainable wildlife hunting; mining; and population growth.

Climate change is predicted to worsen these threats to forests, particularly when increased temperature and drought raise the risk of fire. A challenge for Ghana is that different climate predictions vary in impact when translated to national level. Some make future predictions up to 2050 or later, making them of limited use for recommending immediate practical action to reduce the threat and adapt to climate change. However, there is consensus that the current basis for negative environmental impacts on forests are mainly induced by poorly managed human activity and that climate change is likely to amplify these negative effects.

Findings

- The previous climate research carried out is too varied in its findings to make reliable predictions about the impact of climate on livelihoods in and around Ghana's forest: Climate effects are likely to worsen forestry problems already caused by human activity. Addressing poor natural resource practices is the most pressing issue in research areas.

Development action points

Climate change poses no obvious, immediate threat to forest-dependent communities in Ghana. The development challenge will be to introduce sustainable methods of using forest and forest resources, and by doing this avoid current problems becoming worse through climate change impacts.

Areas for immediate consideration are:

- *Advocacy and Governance*: Campaign for community leaders and local government to encourage the use of sustainable resources.
- *Research*: Uncertainty in climate predictions make it difficult for risk reduction measures to be formulated on a firm scientific footing: *More research is needed before site specific climate change mitigation measures can be taken.*

Aceh: As assessment of the effects of climate change on the sustainable livelihoods of forest-dependent communities in the Aceh Barat district of Sumatra

| | |
|---------------------|--|
| Author | Jeremy Stone |
| Country | Indonesia |
| Scale addressed | Aceh |
| Issues and approach | <ul style="list-style-type: none"> Use climate change predictions to assist determination of factors having the greatest impact on livelihoods of communities in West Aceh based on rubber and other tree crops |

Background



Map of Aceh (Mercy Corps)

Deforestation and massive forest fires are regularly reported from Indonesia, especially the large western island of Sumatra.

Climate change multiplies risks to forests already posed by human intervention. Forest loss through overlogging results in the drying-out of soils since the moisture that would have been retained under closed tree canopies is lost. Abandoned wood and tree waste accumulates and becomes kindling for fire. When the trees catch fire they can cause vast forest fires, especially when the soil is flammable peat. These fires are currently being reported on an almost annual basis from SE Asia. They can rage through thousands of hectares of plantations and form hazes that spread to other countries, threatening health and

causing financial disruption. Indonesian forest fires have taught society that there is a wide definition of “forest dependency”, often assumed to refer only to indigenous tribes roaming intact forests. Forests protect watersheds, flammable substrates from burning, and downstream cities from flash flooding. In short, forests protect vast swathes of humanity.

Thankfully, large areas of forest still remain in the northern province of Aceh. During a 28-year separatist conflict, loggers were unable to clear the land as they had in much of the south. The conflict waned after the devastating tsunami of December, 2004 and since then a peace accord has been signed and adhered to. There is now intense interest in retaining the forest cover of Aceh while simultaneously protecting and promoting livelihoods that are recovering from natural disaster and war. Among these are community-based plantations of tree crops such as rubber and oil palm that many communities in Aceh increasingly

depend on. For Aceh to meet its commitment to sustainable development it will have to continue to protect its forest while simultaneously promoting forest and plantation-based economic development.

Findings

- Climate research does not predict any major threat to community rubber development in Aceh if the surrounding environment remains stable: Aceh's existing forests are not subject to the massive fires found further south on Sumatra. Heavily degraded forest is susceptible to increased fire risk through climate impact including drying of flammable substrates, whereas undisturbed old forest growth, like that in Aceh, is far less vulnerable. Its presence, in turn, protects surrounding communities and is crucial for their livelihoods if sustainable practises are put in place.
- Indirect, long term threats to forests may arise from communities who live on the coast and are facing climatic disruption if sea levels rise, as anticipated, in the predicted range of 7 – 38 cm by 2020 and an additional 19 – 104 cm by 2080 across the country. Most of Aceh's communities live on the coast. If climate-related rises in sea levels displace Aceh's population they will have to migrate inland and rebuild their supporting infrastructure. This has the potential to lead to unsustainable forest use (as was highlighted by local demand for timber during the tsunami response, which in turn will affect those whose livelihoods are sustained by the presence of forests).

Development action points

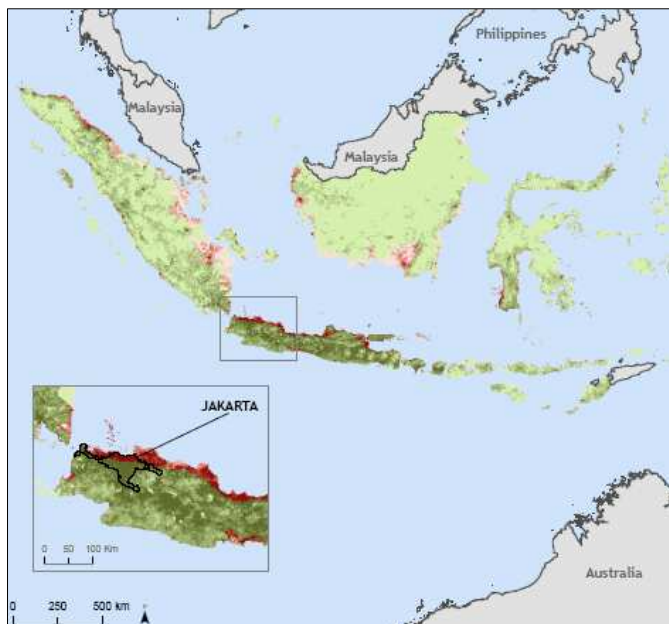
Areas for immediate consideration are:

- *Mitigation*: Implement plans for reducing the risk of climate disasters by researching the potential scale of future migration due to rising sea levels along the coast and plan to accommodate population resettlement in ways that leave Aceh's forest resource intact.
- *Advocacy and Governance*: Assist current efforts by local government to retain their forest resource base while developing the sustainability of local economy sustainably.

Jakarta: Climate change and urban poverty in Indonesia: Assessing climate change impacts on poor communities in Jakarta

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|---------------------|--|
| Author | Claire Langley |
| Country | Indonesia |
| Scale addressed | Jakarta |
| Issues and approach | <ul style="list-style-type: none">• Climate change scenarios for Jakarta• Likely Impact of climate change scenarios on urban slums and livelihoods of the poor in those areas |

Background



CIESIN, Colombia University 2007

With 13,000 islands hosting more than 210,000,000 people, many of whom live by the 81,000 km of coastline, Indonesia is particularly vulnerable to the impact of rising sea levels caused by climate change. Increasing influx of sea water will force millions of people from their homes in low lying coastlines and will present a serious security and development challenge in the future. At particular risk are massive coastal urban locations and nowhere more so than Indonesia's capital, Jakarta. Among the 100 fastest growing cities, Jakarta

holds 9th position. It hosts a central population of more than 12,000,000; most live in poverty and are poorly served by the city's infrastructure.

The climate change data available for Indonesia provide a basic foundation for predicting future scenarios. Consistent among the data are three particular areas of concern: changes in rainfall patterns (with potentially serious agricultural impact), sea level rise and regular extreme weather events including severe storms triggering more frequent and serious urban flooding and landslides in rural areas. Jakarta is particularly vulnerable to rising sea level which increases in flood frequency and severity. These floods will worsen human-made problems arising from forest clearance in upstream areas and city subsidence into the swamp it developed from, which has affected the city since the 1960's. The water levels are currently increasing

by 6 cm per year, inundating the fresh water table with saline water up to 15 km inland.

Also of concern for Jakarta are extreme weather events such as prolonged heavy rains that increase direct risk to the city and also cause salt water to pollute underground fresh water resources. Direct impacts are likely to be most severe among north Jakarta communities which are only elevated by 0 – 2 m above sea level, and where nine of the city's 13 rivers and two flood canals pass through.

Whereas the direct threats to Jakarta are serious, secondary impacts are equally as concerning. Recent attention has focused on the fact that most of humanity now lives in cities, many of which are underserved by infrastructure and governance, and that urban centres are likely to be the areas climate-refugees go to when their coastal lands are flooded by sea level rise. This increases the risk of insecurity, crime and squalor in ever more densely packed urban areas. This secondary threat of climate change significantly increases the probability of related civil disturbance and insecurity in massive urban cities like Jakarta.

Findings

- Indonesia is anticipated to experience a temperature increase of up to 2.8°C across the country by the year 2100. In Jakarta, predicted impacts include an increase in heat related diseases such as malaria and dengue combined with seasonal drought restricting access to clean water.
- Sea levels are anticipated to rise between 7 – 38 cm by 2020 and an additional 19 – 104 cm by 2080 across the country: localised predictions for Jakarta Bay show annual increases in sea level of 5.7 cm, meaning that by 2050 160 km² of land will be underwater. This would result in a catastrophic loss of infrastructure, population displacement and further fresh drinking water contamination (these figures combine sea level rise with subsidence).
- Access to basic services will be further restricted. The areas most threatened by climate change are already those with the poorest housing, transportation links, flood defences, emergency responses and employment opportunities: the poorest and most vulnerable already have experienced massive floods. City government support has so far not succeeded in addressing flood prevention and assisting those in need. Flood events are predicted to



Jakarta floods (Mercy Corps digital library)

increase in frequency and severity. With no ready assistance and the pace of in-migration continuing the desperation and frustration felt by Jakarta's vast population is likely to fuel social instability, especially among young, unemployed poor.

Development action points

Development activity in Indonesia has increased its focus on the growing urbanisation and climate-related challenges, with direct impacts, such as flooding, and secondary impacts including the increased risk of conflict and social instability in the capital. Jakarta is a melting pot for all these concerns.

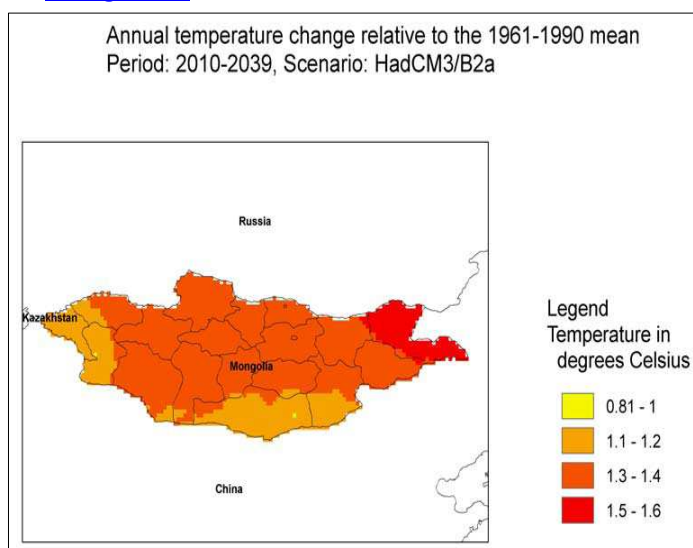
Areas for immediate consideration are:

- *Adaptation:* Development activity needs to reduce the risk of disasters by addressing the hazards likely to worsen through climate change. At the core should be activities that reduce flooding risk while generating employment through tasks such as clearing drainage canals of garbage and recycling. The calculation and awareness of the benefits to the city and its population need to be highlighted through successful, community led, activities that educate the population on how they can together prevent disasters occurring.
- *Mitigation:* Even in urban environments, climate change impacts will worsen environmental degradation. The Jakarta government has often been advised to work with upstream government to reforest watersheds to reduce flash flooding that occurs due to rapid water runoff across degraded slopes as far away as 80 km north of the city.
- *Advocacy and Governance:* Campaign to raise awareness of climate change and the predicted climate change impacts are essential to motivate organisations and communities to react and embrace policies that adapt and reduce the threat of climate change. The plight of the urban poor must be made particularly clear to actors in Government and in the environment and development communities, with appropriate action taken. Government, international development organisations and communities need to work together to address development strategies to improve housing regulations, transportation, flood defence, emergency response and employment that are especially lacking in slum and low income communities in Jakarta.

Mongolia: Impacts of climate change on economic transition - application of sustainable livelihoods framework in designing development projects

| | |
|---------------------|---|
| Author | Gao Shan |
| Country | Mongolia |
| Scale addressed | Mongolia |
| Issues and approach | <ul style="list-style-type: none"> • Future climate impacts on Mongolian agriculture |

Background



Mongolia has a varied landscape with desert in the south and grassland and forests to the north. As climate change impacts the globe, a large land mass such as Mongolia could face a far more severe temperature increase than other countries, given a lack of oceanic cooling. The country's diverse landscapes will be affected differently. Some climate predictions even

suggest that a modest degree of warming might benefit agriculture in some regions.

Mongolia has been characterised by the population's nomadic history. The country is now writing a new chapter for itself with hopes of prosperity brought about through economic development. In 1990, the country moved from a centrally planned economy to a market economy. The government is committed to reducing poverty through economic growth, and one of the most important policies concerning the livestock business is land privatisation. It has a direct impact on thousands of Mongolians' livelihoods and indirect effects on the environment and future land use. A large number of Mongolians are still living a nomadic life and their only income is generated from their livestock, so they are in a vulnerable position when faced with extreme, unpredictable weather patterns caused by climate change.

In the past, natural disasters related to extreme weather have caused large-scale migration to urban areas. For example, severe drought in 1999-2000 killed many rural Mongolians' livestock and forced them to relocate to the capital and other provincial centres. The total herd of 33.6 million heads of livestock in 1999 was reduced to 26.1 million in 2001, and 23.9 million by 2002; almost a 30% loss. As a result, agricultural production fell, economic growth slowed and many thousands of

herders were left without any sources of income. At present, 33% of the country's population lives in the capital city, Ulaanbaatar, and population growth exceeds employment opportunity. Many people have fallen into poverty, which has triggered a series of other issues: growing social insecurity from weakened community networks, increases in alcohol abuse, domestic violence and marital breakdown. The full socioeconomic effects of climate change in Mongolia will surface in the future, and government policy will play a vital role in offsetting these effects. It is crucial for policy makers to take the full climate change picture into consideration so that policies can be developed to reduce unfavourable effects now rather than facing their consequences in the future.

Findings

- Overall, climate scenarios for Mongolia suggest temperatures will increase from 2010 – 2069 by up to 4.7°C, especially in the desert regions of the south. Rain will decrease throughout the country in general, yet with localised increases in the southern and eastern regions in summer: Overall, Mongolia is facing a drier future, particularly in the winter months, implying that severe droughts will occur more frequently, although there is some possibility of localised increases in agricultural yield.
- Higher temperatures coupled with less rain will lead to increased desertification: this will affect Mongolian livelihoods relying on fodder production for livestock in a country where 90% of land is already vulnerable to desertification.

Development action points

Mongolia is already vulnerable to climate extremes that have caused mass migration to urban areas, which were unprepared for the influx, leading to social decay and disorder. Climate change will increase desertification risk and, unless prepared for, will compound these environmental and social challenges already threatening the country's new road to development.

Uncertainty among climate predictions for Mongolia's different regions prevents informed decision-making on the best way to avoid climate-related risk. There is a need to become better aware of the range of climate-related threats and possible benefits (such as increased crop yield if temperature increases and rainfall does not become limiting for crop growth), that climate change will bring to Mongolia.

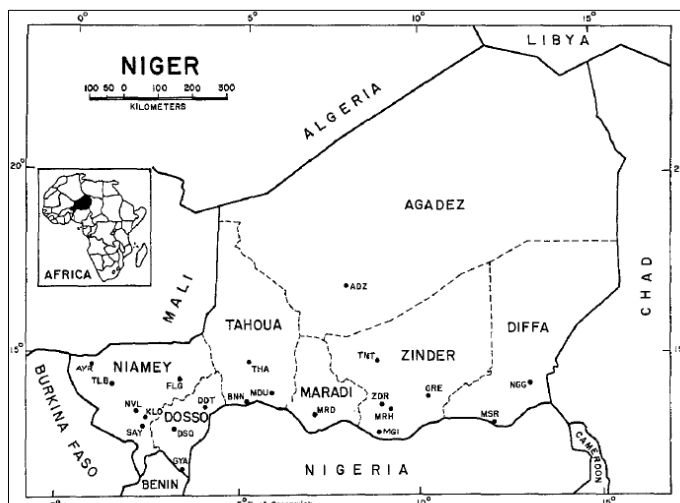
Areas for immediate consideration are:

- *Research*: Improve scientific understanding of the long and short-term impacts of climate change specific to Mongolia.
- *Adaptation & Mitigation*: Prepare a range of ways to reduce vulnerability of the poor and climate-displaced and build adequate social safety nets for people having to migrate to urban areas.
- *Advocacy and Governance*: Campaign for the development of adaptation mechanisms for the current challenges Mongolia faces from its physical environment and climate and prepare for the additional impacts of climate change.

Niger: Implications of climate change on food security in Niger

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| Author | Gabrielle K. S. Chan |
| Country | Niger |
| Scale addressed | Niger |
| Issues and approach | <ul style="list-style-type: none"> Impact of climate change on future food production |

Background



Niger (source Sivakumar 1992)

Human health issues are among the most serious in development. Some are related to disease, such as HIV/AIDS or malaria, others to issues like malnutrition. Climate change can affect health directly, for example by heat stress or injury from severe conditions, or indirectly through changes in distribution of disease carriers like mosquitoes, the availability of food and environmental hazards including prolonged flooding. However, it is

malnutrition that is considered the single most important factor threatening global health. Malnutrition is responsible for 15% of total disease worldwide and is closely related to climate.

Niger is the world's poorest country and ranks last in the United Nations Development Programme's Human Development Index. With 251 child deaths per 1000, it has the highest infant mortality rate in Africa. 80% of Niger's population lives in a southern strip of land where rainfall is usually sufficient for agriculture and 90% of the labour force in Niger works in farming. Niger's agriculture is rain-fed but periodic intense weather events such as droughts and floods increase risk of food shortages. Agricultural security is also impacted by wind erosion; huge quantities of sand are carried from bare soils and can destroy young crops when deposited in large quantities. Livestock are as vulnerable as crops since their health is dependent on forage that, in turn, depends on rainfall. It is estimated that droughts in the 1960's and 1980's caused the deaths of approximately 50% of livestock throughout Niger, although how many livestock deaths were specifically related to drought rather than to communities who panic-slaughtered their livestock when the droughts took hold is open to question.

There is consensus that an increase in frequency and severity of these types of climate change-related events could threaten food availability and livelihoods for

most of the population. If timely adaptations are not prepared in time, communities living in and around parched lands could be forced to leave their homes. But there is no obvious place for people to move to in Niger and cross-national migration has the potential to raise tensions in an already unstable region.

Formulating ways to adapt to climate change while taking into consideration the more immediate development needs in Niger will be a major challenge. Current priorities are to deal with water shortages due to a lack of rainfall, addressing governance-related issues over fair distribution of available water and reducing food shortages during bad agricultural years when too much food is exported from Niger into neighbouring countries that are experiencing the same food shortage problems.

Findings

- Different climate predictions have led to varying opinions about whether Niger will have more or less rainfall because of climate change. This is partly due to complex weather patterns within the Sahel, where Niger is located, and also because the Sahara is the world's largest source of airborne dust which further complicates climate models. However, climate predictions agree that temperatures will increase between 1 – 6°C in the future, particularly in the south where most agriculture is located. Uncertainty over rainfall trends makes further research a priority for different parts of Niger. Temperature increases will certainly impact food production.
- If rainfall does increase this could remove a major agricultural problem; the current lack of available moisture. However, the benefits will be offset against the challenges that increased temperatures present. Increased rainfall will be an advantageous side effect of climate change in Niger if intensity and timing are agricultural-friendly. However, the likelihood of this is uncertain. Niger already suffers flood and drought periods and there remains a possibility that these will increase in frequency and severity and threaten the production of major crops including millet, sorghum and cowpea, as well as affecting the health of the country's livestock.
- Uncertainty in climate predictions make it difficult for risk reduction measures to be formulated on a firm scientific footing. More research is needed before practical methods of reducing the effects of climate can be carried out.

Development action points

Uncertainty among climate predictions prevents informed decision-making on the best way to avoid climate-related risk. There is a need to increase awareness of the range of climate related threats, and potential benefits, that might arise in Niger.

Areas for immediate consideration are:

- *Research*: Encourage climate scientists to pay particular attention to a country as vulnerable as Niger with such complex climatic patterns. Agricultural policies and programmes should, until more data becomes available, focus on building resilience to a range of potential climate threats.
- *Adaptation*: Formulate a range of recommendations to government that can be adapted to the uncertain climate change predictions currently available

for Niger. These should include anticipation of increased desertification from the north and too little water for current agriculture in the south.

- *Advocacy and Governance:* Food shortages are common in Niger and impacts including poor child health and export of food to neighbouring countries in times of crisis are priority issues, particularly because communities with little capacity or resilience are unable to deal these types of shock. Yet policy makers should be made more aware that climate change-related temperature increases will likely negatively impact agriculture and risk the worsening of already severe developmental challenges.

Nepal: Climate threats and vulnerability assessment of agricultural communities in Humla

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| Author | Adam Liddle |
| Country | Nepal |
| Scale addressed | Humla |
| Issues and approach | <ul style="list-style-type: none"> Identify threats and vulnerabilities posed by climate change in the Humla district of Nepal Gain clear knowledge of how these threats affect livelihoods in Humla and suggest future avenues of research and adaptation strategies |

Background



District map of Nepal (Humla the further NW)

The most vulnerable communities in the world are often those who depend solely on their surrounding natural resources. The Nepalese district of Humla is a prime example of this fragility. Its population of 40,000 people are spread across communities living on barely habitable lands and suffer from high rates of poverty. The people of

Humla have to survive through subsistence agriculture and due to climate change this population is likely to face a much harder task of producing sufficient food in the future.

The Humla region lacks basic infrastructure, which restricts development of supportive social networks between communities and access to government. The population of Humla are therefore extremely vulnerable to the effects of already widespread environmental degradation and fragility, the impacts of which are anticipated to worsen through climate change.

Historically, summer temperatures in Nepal have remained relatively constant, however, winter temperatures over the period 1901-2000 have increased annually by 0.6°C; a statistic which reflects the global average increase. The majority of warming trends are due to sudden increases in the latter part of the last century, a pattern which is mirrored and exaggerated in Humla. Even with the restricted quantity of data available, it is still possible to isolate trends and climate shifts specific to the district. This confirms an alarming rise in winter temperatures, which could have a serious impact on irrigation and winter crop planting.

Across Nepal, although fortunately not in Humla, there is rising concern over climate change related to Glacier Lake Outburst Floods (where ice dams suddenly give way releasing large bodies of water) and other flash flooding events, which threaten the lives of downstream communities and agricultural infrastructure by shifting rainfall patterns that affect traditional crop growing seasons and harvests and incrementally reducing annual water availability as the glaciers retreat. Yet climate change awareness in Nepal remains patchy. Whereas some development agencies and government departments note that climate change represents an immense, burgeoning hazard to livelihoods and food availability in Nepal, the government overall is still operating against a backdrop of potential renewed conflict. There is currently no mechanism for raising awareness of pending chronic emergencies or for developing resilience against them. As some in Nepalese government have noted, 'Day to day issues like conflict have attention, the catastrophe that waits is rarely on the main policy agenda'. This needs to be changed.

Findings

- Rising winter temperatures, decreasing rainfall and recurring drought in recent years have contributed to a reduction in food production: food availability is reduced and dependency on aid is increasing in Humla, one of the most remote and vulnerable parts of Nepal.
- Reduction in the availability of food is affecting child health: Malnutrition is common in Humla. The last survey carried out in 2006 illustrated that 12.3% of all children under 5 were malnourished with 3.3% severely so, and 25.9% of all children between 18 – 29 months show moderate to severe wasting. This is a significant increase in malnutrition figures since a 2001 survey, whose basis is suspected to be at least partly due to climate change-related increased levels of drought.
- Lack of infrastructure, finance, social networking and isolation leave the people of Humla particularly vulnerable to environmental shock: climate change will multiply the threat and impact from shocks arising from agricultural and environmental insecurity.

Development action points




In isolated areas like Humla populations are vulnerable but there is a lack of assistance to help them overcome the challenges they face. In areas such as these across the world, their poverty goes unvoiced. The impact of climate change will apply further pressure on these communities who are already unable to deal with present challenges. Humla highlights these current problems and the actions that need to be taken.


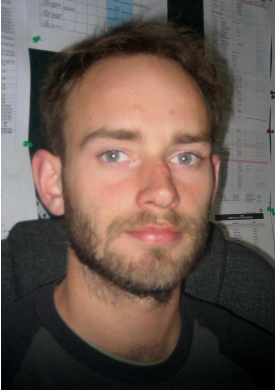


Areas for immediate consideration are:

- *Adaptation*: Help communities adapt to shifts in climate which will have an impact on agriculture. This should include the introduction of new varieties of current crops better able to cope with changing seasons and water availability.
- *Mitigation*: Supporting the improvement of degraded and bare lands will provide buffers against some effects of climate change to the environment such as flash floods, drought and flood cycles.

- *Advocacy and Governance:* Create a coordinating and advisory hub linking groups wanting to tackle climate change across Nepal. Focussing on threats to life, livelihoods and food availability, these groups would help strengthen appropriate responses through working together. Such a consortium of groups could:
 - Map out climate change hazards across the country with a particular focus on the most remote and vulnerable communities.
 - Develop a series of lobbying messages to increase awareness of the climate risks to wider areas of government and encourage action surrounding adaptation at community levels, especially in the more remote areas of the country.
 - Promote more direct involvement among consortium members in communities that encourages further action in reducing the risk of climate disaster.
 - Start a series of lobbying campaigns to educate communities on the practical actions they can take to prepare and plan for disasters. These should be replicated across the country through potential partners like local NGOs.

Biographies of Students

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|  | <p>Claire Langley Email: marie_claire6@hotmail.com</p> <p>Claire was born in Halifax, Nova Scotia and completed an undergraduate degree in History at Acadia University in Canada. After travelling and working for several years in different countries, Claire became interested in issues of international development and poverty reduction. In 2006 she enrolled in the University of Edinburgh's postgraduate degree Environment and Development, and completed a dissertation on the impact of climate change on urban communities in Indonesia. Claire is currently living in London, pursuing a career in International Development.</p> |
|  | <p>Shan Gao Email: gsjess@yahoo.com</p> <p>Shan's first degree was environmental engineering. Following this degree, she embarked on a project management career on a 12km² resort project in Hainan Island, China which provided her with project management skills and development expertise. In 2006, Shan was awarded the Chevening scholarship by the UK Foreign and Commonwealth Office which allowed her to complete a Master's degree in Environment and Development. Shan is interested in exploring the interlinked relations between environmental issues, policies and governance.</p> |
|  | <p>Jez Stone Email: jez_stone@hotmail.com</p> <p>Travel in developing countries encouraged Jez's interest in environmental issues which led to his first degree in Geography from the University of Plymouth. His undergraduate dissertation, on ecotourism and sustainable development in Nepal highlighted how the environment can be utilised to relieve poverty and create livelihoods. This resulted in his desire to undertake an MSc in Environment and Development at the University of Edinburgh. Jez hopes to find a career in development that works towards solutions that alleviate poverty and complement environmental conservation.</p> |

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|  | <p>Gabby Chan Email: chan.gabby@gmail.com Gabby was born in Hong Kong and studied in the UK from the age of 15. After completing a BA Biological Sciences at University of Oxford in 2006, Gabby enrolled in the MSc course in Environment and Development at the University of Edinburgh. Gabby is especially interested in health issues in developing countries and therefore researched climate change, food security and nutrition with Mercy Corps which she found to be a valuable experience. Gabby also enjoys travelling, various sports activities and playing musical instruments.</p> |
|  | <p>Joel Fiddes Email: joelfiddes@yahoo.co.uk Joel's interest in mountain regions, natural resource management and impacts of climate change came together in his dissertation on water resources in Afghanistan. He is currently based in the North East of Afghanistan and working for a development consultancy that is providing technical assistance to the government in the implementation of a River Basin Management programme which is proving to be a fascinating project.</p> |
|  | <p>Mohamed El Mongy Email: mmongislav@yahoo.com Mohamed conducted his masters in Environment and Development with a focus on Africa. He has worked as project manager and consultant for several sustainable development consultancies in the fields of Ecotourism, Fair Trade and natural resources management in several African countries.</p> |
|  | <p>Adam Liddle Email: adam.liddle@gmail.com Adam began his academic pursuits at Heriot-Watt University, achieving a BSc (Hons) in Chemistry. After a period of self-employment and a year working for a global environmental company Adam undertook an MSc in Environment & Development at Edinburgh University. His dissertation focused on the potential impacts of climate change on agricultural communities in north-west Nepal. Adam is currently working in central Scotland, actively seeking a career in climate change and development.</p> |

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