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STUDENT RESEARCH

Project site Ouanaminthe – Haiti

Funded by:
Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

Imprint

Published by:
Deutsche Welthungerhilfe e. V.
Friedrich-Ebert-Straße 1
53173 Bonn
Germany
Tel. +49 (0)228 2288-0
Fax +49 (0)228 2288-333
info@welthungerhilfe.de
www.welthungerhilfe.de

In Cooperation with:
Dr. Simone Giertz
Department of Geography – University of Bonn
Meckenheimer Allee 166
53115 Bonn
Tel. +49 (0)228 735597
s.giertz@uni-bonn.de

Responsible Persons and Coordination:
Dr. Dirk E. Guenther, Eberhard Hauser, Tanja Heimann

Authors:
Alexia Mappes, Amrita Mondal, Ivo Thomas Pink,
Kristina Riesinger, Alexej Schmidt, Theo Schreck

Cover Photo:
Haiti, Nord-Ouest, Daniel Rosenthal/Welthungerhilfe

Production:
Carsten Blum

Visual Communication:
Anja Weingarten

Status:
November 2015

PDF-Download:
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Table of Contents

Foreword Welthungerhilfe

Welthungerhilfe has worked in Haiti for about 40 years, undertaking projects with national partner organisations for food and nutrition security, rural development and disaster risk reduction, as well as to deliver emergency aid. Even before the massive earthquake in January 2010, Haiti was a country facing huge development challenges, but receiving little attention on the global stage. This changed suddenly and, as a result, thanks to generous donations from the German public and grants from the German government, we were able to fund a six-year programme to support reconstruction and development projects all over the country.

In a highly vulnerable country that is regularly afflicted by disasters, we believe it is particularly important to integrate the delivery of essential emergency aid within a longer-term framework for development (known as the LRRD approach: Linking Relief with Rehabilitation and Development). Important preconditions to achieve this include strengthening Haitian civil society and cooperating well with the relevant government agencies. We believe that development cannot come from outside, but that a society can only develop itself from the inside out. On this point, we are self-critical and note that these aspects have been given too little consideration and have been inadequately supported in international cooperation with Haiti, including in our own work where we observe such weaknesses, time and again.

Apart from cooperation with civil society and decision-makers in the government, sensible cooperation with scientific and research institutions is very important for successful development activity. On the one hand, such cooperation helps develop specialist knowledge and supply technical information for the delivery of projects while, on the other hand, it can provide critical and independent analysis of the work undertaken. In the light of this, the research findings presented here should be understood as the work of independent students that do not necessarily reflect the institutional positions taken by Welthungerhilfe.

In addition, cooperation with researchers and teachers helps to ensure that those who will make decisions affecting these topics in the future have been equipped to deal with these issues critically through their studies. Welthungerhilfe therefore places particular importance on such joint working within its long-term strategy. In Haiti, as a result, we also work with several Haitian and German universities as well as other research institutions. Our cooperation with the University of Bonn in the north east of Haiti was especially intensive and we would like to particularly thank the University of Bonn and the students at its Geography and Sociology Department. Our thanks here also go to our local staff, who made it all possible. We would be delighted if this cooperation could continue in the future.

Source: Silverlab Solutions GmbH

Dr. Dirk E. Guenther
Regional Director for Caribbean, West and Central Africa,
Welthungerhilfe

Foreword University Bonn

Haiti is currently the poorest nation in the Western Hemisphere. The country is heavily dependent on development aid. As a consequence of the devastating earthquake in January 2010, which affected more than three million people, the situation in Haiti deteriorated further and its dependence on foreign humanitarian, financial and technical aid increased. In addition to the natural disasters that repeatedly strike the country, political instability and corruption are significant factors contributing to its continuing economic misery.

After the 2010 earthquake, the work of Welthungerhilfe's development programme initially concentrated on emergency aid and reconstruction. At the same time, important groundwork was done to promote the long-term development of the country, particularly in the fields of nutrition and agriculture. The priority for future programmes should, above all, be to strengthen local actors and structures so that the country can respond to future difficulties on its own more effectively, and so that a strong civil society emerges.

Similar questions and topics arise over and over again in Welthungerhilfe's local projects. Such topics can be addressed through detailed scientific analysis, for example through case studies. Some of these questions could be worked on in research undertaken for thesis papers produced in cooperation with the University of Bonn. These include papers related to managing emergencies, natural disasters, food security and soil erosion. The findings from such papers are summarised in this brochure.

Both sides benefit from this cooperation. For the students, it offers a unique opportunity to produce thesis papers which have concrete practical relevance. The unusual experience of visiting and staying in the project locations, supported both financially and organisationally by Welthungerhilfe, was also valuable for the students. As a result, the graduates have gained development policy experience overseas while working on their theses, which will be of importance to their continuing professional development and careers.

For Welthungerhilfe, the findings obtained in the thesis papers are of interest for the planning of further projects and activities. This means, for example, that the regionally differentiated results on the impact of deforestation on soil erosion can be utilised for land use planning. Papers on emergency management or resilience strategies in relation to responding to natural disasters can also provide valuable practical insights for development planning in Haiti.

The University of Bonn welcomes the successful collaboration between Welthungerhilfe and students from the Geography and Sociology Department working on their thesis papers, and it looks forward to many more jointly supervised papers in the context of development work.

Dr. Simone Giertz
Department of Geography, University of Bonn

Source: Dr. Simone Giertz

Chapter

1

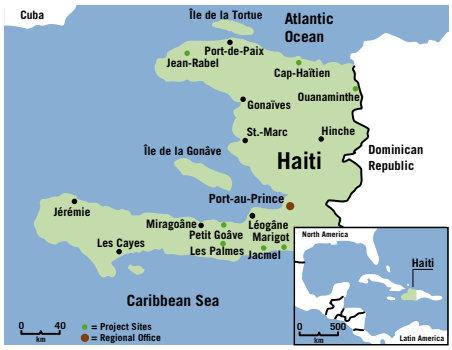
The role of civil society organisations in disaster management: Mapping vulnerability in Northeast Haiti

Amrita Mondal
University Bonn

Haiti – A fragile state

Haiti is one of the least developed countries in the world, ranking 168th out of 187 countries, according to the Human Development Report in 2014. In addition to having the lowest per capita income in Latin America, Haiti is a so-called "fragile state" characterised by political, social and environmental instability. This is manifested in issues such as poverty, corruption, homelessness, migration, food insecurity and resource degradation. The fragility is also reflected in a high level of dependence on humanitarian, financial and technical assistance from abroad.

The shortcomings of weak states often revolve around a lack of security, ineffective law and order institutions, the use of violence by the state as well as by non-state actors, a poor economic environment, and the inability or unwillingness to provide basic services to the population. A better understanding of the root causes of Haiti's fragility can contribute to building a better future by exploring the country's historical background, especially its political, economic and social inheritance, as well as Haiti's position in the current world order and significant environmental factors affecting its development.



Source: Welthungerhilfe

Haiti continues to be highly vulnerable. It urgently needs to carry out important reforms to enable social progress and long term economic development. At the same time, Haitian authorities and their development partners have a shared responsibility to create the conditions necessary for the country to keep improving. While the government of Haiti needs to take steps to unleash the country's economic potential and to improve governance, its partners should continue to support Haiti at appropriate levels, by providing international support for the government's plans and priorities and by strengthening civil society. Such cooperation between the state, civil society, and the international community should form the basis for negotiations.

The political legacy

Haiti is a classic example of a fragile state and is even sometimes described as a permanently failed state. According to the DAC Principles for Good International Engagement in Fragile States and Situations adopted in 2007, states are fragile "when state structures lack political will and/or capacity to provide the basic functions needed for poverty reduction, development and to safeguard the security and human rights of their populations". Even though Haiti's democratic transition began in 1986, after Jean-Claude Duvalier went into exile, democracy has still not been consolidated. State institutions were never designed to serve the people but rather aimed at serving the elite. The main contact between the

state and the public that existed during Duvalier's brutal dictatorship (1959–1986) was through the Tontons Macoutes, a special branch of the military forces, which was scattered around the country. They used very repressive methods to ensure law and order, acting as both police and judiciary. Today, Haitians still feel the effects of that regime's legacy: from social exclusion and the denial of their rights to a general distrust towards state institutions.

The economic framework

As Haiti's exports are limited to the garment industry and a few agricultural products, the economic sectors servicing foreign markets remain niche areas. The garment industry forms by far the most important sector of the export economy, representing more than two-thirds of all exports – all of which have a single destination market: the United States. The US is Haiti's biggest trade partner, accounting for more than 75 % of the country's trade, followed by the Dominican Republic and Canada. This high degree of specialisation, both in terms of its products and markets, is very problematic during economic downturns. Thus, Haiti's economy is largely shaped by outside forces, and it is dependent on strategic imports.

Haiti's imports are three times the size of its exports, resulting in a huge current account deficit. These imports are not inconsequential: they consist mostly of food and fuel. Haiti is therefore at the mercy of world market prices, changing supply conditions and other uncontrollable fluctuations, making the planning and control of government expenditure very difficult. The price of food increased by 83 % between 2005 and 2010, while the price of oil also tripled within just two years, peaking at $150 USD per barrel in June 2010.

Haiti's small and undiversified economy depends on a single export market and on the import of strategically important goods. This means the government lacks control over the domestic economy and possesses almost no resilience in times of crisis. In 2008, the external shock of soaring food prices had a dramatic impact on the lives of many Haitians. The causes were exogenous, such as the global financial crisis, and showed how economic or environmental events can often cause a great deal of social disturbance and even spark a complex political crisis. In an interdependent global system, weak states like Haiti are especially vulnerable to circumstances beyond their control.

National elites and the social context

The traditional role of a country's national elite is usually to invest in the country and generate economic activity, wealth and jobs as well as to influence the government to increase trade, promote productivity, ensure stability and protect investments. When public disorder erupts, the elite usually puts pressure on the government to respond by taking action to restore stability and minimise damage. However there are no incentives for the Haitian elite to reconstruct the country and take responsibility for development; so it is much more in their interests for the international community to shoulder this burden. This undoubtedly hinders the formation of a strong civil society in the country. Haiti's elite is a nebulous class consisting of traditional families, members of illegal trading networks, former supporters of Aristide, and former members of the military (people who are now part of the Haitian National Police). Many members of the elite speak French rather than Creole and have been educated abroad, which sets them apart from the vast majority of Haiti's population.

Chapter

1

Ecological legacies

Haiti is very vulnerable to natural disasters. The country has undergone a devastating process of deforestation as a result of which it has lost its defences against soil erosion. Deforestation has two distinct causes, one political and the other economic. The political component is the lack of a land law that confers clear, personal and transferable ownership. As a consequence, much of the tree stock has been common property, which gives no one much incentive to defend them as a public asset. On the contrary, there is a strong incentive to plunder it. The economic component is a result of population pressure. The number of people depending on the land to secure their livelihood has increased and, as a result of standard economic forces, the composition of agricultural activities has therefore changed. Specifically, the production of labour-intensive crops has increased while the production of land-intensive crops has been reduced.

Not all is lost

What Haiti has so far been lacking is an economic strategy that is simple and realistic as well as being effective. Public policy measures must show quick payoffs that are significant, visible and clearly attributable to the government of Haiti rather than to international donors alone. The main task is therefore to identify a few activities with such payoffs that the state can undertake and that taken together would help to build economic stability. Since success depends on inter-dependent decisions made by several actors, the government cannot determine the actions it should take without knowing what other key players are likely to do. In order to develop an economic strategy, all the key actors need to agree to follow it simultaneously. At this stage, there are as many encouraging signs as there are risks. As a starting point, Haiti's economy offers a huge market opportunity and it benefits from being relatively free of the structural problems that are typical for most other fragile states. Opportunities for political action therefore do exist, not only by taking advantage of the huge Haitian diaspora on its doorstep, but also thanks to the country's environmental and agricultural assets.

Haiti has a massive economic opportunity available through the "Hemispheric Opportunity through Partnership Encouragement" (HOPE II). This gives Haiti, uniquely in the world, duty-free and quota-free access to US markets guaranteed for almost a decade. HOPE II provides generous rules of origin that are especially beneficial to the garment industry. Of course, market access is not enough: costs of production must be globally competitive. But here again there are favourable conditions. The largest single cost in the garment sector is labour. Due to its poverty and relatively unregulated labour market, Haiti has labour costs that are fully competitive with those in China, which are considered the global benchmark. But Haitian labour is not only cheap – it is also of good quality. As the garment industry in Haiti used to be much bigger than it is today, there remains a substantial pool of experienced labour. Another important factor benefitting Haiti is the ease of transporting these products to foreign markets. Many fragile states are landlocked and therefore face prohibitive transport costs. Haiti, however, is located right on the doorstep of its market, the

USA. Since Haiti is the only low-wage economy in the region, it has a huge advantage over its competitors, such as China or Bangladesh, in terms of logistics.

Geopolitically, Haiti is advantageously located in a region where it is surrounded by prosperous and peaceful neighbours. The only regional problem of any significance is Haiti's status as a transit country for drug trafficking from South to North America. This kind of organised crime is usually coordinated at an international level, and is not the consequence of an indigenous Haitian political agenda. Haiti is used as a transit port because it is the only fragile state in the region. However, this provides a distinct and powerful reason for North America and the international community in general to invest in achieving significant changes in Haiti. On top of this – and despite all its difficulties – Haiti does not have the intractable structural socio-political problems that beset most other fragile states. It is not ethnically divided; it does not have a history of deep ideological cleavage; it does not have an armed and organised political group ready to launch rebellion; and it no longer has a military establishment with delusions about its political role. Although the political system of Haiti is fractious, and even though decision making can be quite difficult, its political leadership is relatively good compared with those in most post-conflict situations. Moreover, Haiti has a huge and very proximate diaspora: the Haitian community in North America, proportionately one of the largest in the world, provides Haiti with a massive flow of remittances, a reservoir of skills, and a powerful political lobby. The flow of remittances provides a vital resource for private households. The reservoir of skills is particularly important because the country is desperately short of staff at middle management level.

Haiti also has huge potential to improve its environmental situation. While the Dominican Republic managed to keep 47 % of its land area covered by trees and forests, the percentage of land that is forested in Haiti has decreased to just 3 %. While the scope for reforestation is enormous, there is no point in planting trees unless incentives are changed in order to protect them from being felled again. It is therefore of the utmost importance to both increase the stock of living trees, and at the same time reduce the number of trees that are cut down. The most straightforward way of increasing the numbers of trees in the ground is to encourage the planting of trees that produce valuable crops. The most promising one appears to be the mango tree. Mango trees are large enough to have a substantial root network, and they produce a high-value crop. Additionally, establishing clear and transferable property rights for the land on which such mango trees are planted is essential. The most effective intervention to reduce the loss of trees would be regulations limiting their felling coupled with the promotion of sustainable charcoal production. Currently most timber is used for charcoal, much of it consumed by a few commercial activities located in urban areas. These uses could initially be curtailed by regulation before being banned outright. However the regulatory approach would be inappropriate for reducing charcoal use by households in rural areas. A temporary subsidy on cooking gas could be used instead to promote the substitution of charcoal by gas in these cases.

Chapter

1

As productivity in the agricultural sector is very low, there is plenty of scope to increase food production. Agriculture in Haiti is not input-intensive, partly because of the country's inadequate infrastructure and poor transportation network. Infrastructural development in areas with potential for high productivity could improve access to important inputs such as know-how and material, as well as access to markets. The Haitian government has sufficient capacity in the field of agronomy, so it has little need for external advice on appropriate measures. Since the government has a substantial informational advantage over other actors in this domain, the agricultural sector would be a sensible priority area for the government to deploy its own financial and human resources, rather than attempting to coordinate measures with many other actors. Food distribution could be improved by developing a better transportation system to connect highly populated areas of the country. Improvements to the road infrastructure need to focus on increasing both the availability and accessibility of food, as a functioning nationwide domestic food market can provide greater security than regional markets, where shortages can develop more easily. Moreover, it is essential that a national policy should be implemented to raise food productivity in areas with high potential. Another important high priority issue for farmers is land ownership. Land usage rights, especially for women, have great potential for increasing productivity and improving nutrition. A clear system for conferring land ownership and licensing land-use would thus contribute significantly to overcoming poverty and malnutrition at the household level.

A look at the stakeholders

By focussing on issues such as human rights, development and the environment, non-governmental organisations and grassroots movements have added a new dimension to traditional politics and have helped humanity find new ways to address both global and regional problems. Unfortunately, civil society remains very weak in Haiti. It needs to be strengthened to improve resilience, especially in response to natural disasters. In spite of being a "donor darling" and the birthplace of several international organisations, they face low levels of approval. The prime source of social and moral support that people turn to following any natural disaster, as well as in their daily lives, is the church – which is by far the main social anchor for most Haitians. This has serious implications for achieving sustainable and efficient democratisation and governance. Both international actors and local civil society organisations need to become key pillars in the processes of collecting and disseminating information, as well as of developing and implementing policies. In addition, they should commit themselves more fully to the task of monitoring and evaluating social and natural risks, and advocate more actively for justice, especially environmental justice.

In Haiti, the state has a very limited presence, and most basic services are privately-run. As in many other fragile states, public institutions in Haiti fail to interact with civil society and barely recognise the social, political and economic contract between the state and society. Because the state is incapable of fulfilling its responsibilities towards its citizens, individuals are often reluctant to accept a common set of rules and often avoid fulfilling their own commitments to the rest of society. The Haitian government therefore functions

inefficiently and lacks legitimacy, which leads to a vicious circle where the government loses the structural authority and ability to govern. The state's inability and unwillingness to provide public services is most evident in the lack of investment in both education and employment – investments which could result in increased economic production and higher state revenues. Most schools are private, and the poorest families spend an estimated 40 % of their income on education. Since the state lacks sources of revenue, the level of social expenditure it can make is very low, and a social safety net cannot be developed. Massive emigration, corruption, and the establishment of informal and illegal economies are counter-reactions that have developed in the absence of a sense of citizenship.

The international community has been heavily involved in rebuilding Haiti after terrible disasters in the past few years. However the project-based approach of international organisations does not necessarily include the strengthening of state institutions and civil society. Even though efforts have been made to build institutional capacity through an ambitious development and security agenda, foreign involvement can damage the social contract in at least two ways: firstly, by undermining its legitimacy; and secondly, by threatening its long term efficiency. By trying to force rapid political and social development, international actors may inadvertently discourage national actors from taking responsibility for their own fate.

The need for a troika: civil society, the state and the international community

Mutual trust between the state and its citizens is a precondition for successful state formation – but the rift between Haitian society and the state has a long history and has become very deep. In times of crisis, the Haitian government has shown poor leadership, and it has missed several opportunities to build ties with its population. On the other hand, individual efforts are not sufficient to address the economic, political and environmental risks Haiti faces in today's globalised world. The idea that natural disasters can be prevented through civil society initiatives is as unrealistic as ever.

The absence of a genuine debate between national actors on forging a strategic vision for state-building and promoting national resilience is often seen as responsible for the Haitian government's apathy. Although it is unlikely in the present climate, what is needed is a nationwide dialogue that would commit Haitians – the state as well as civil society – to a common project based on mutual recognition and mediated by the international community. In a poor country with a fragile state like Haiti, the international community, government and local civil society organisations need to work together at a strategic level. The international community should therefore aim to strengthen connections between the state and civil society, rather than acting as a substitute for the official government, thereby undermining it. The future of Haiti will be largely determined by how these three important actors cooperate with one another.

Chapter

1

Further reading

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Expecting the unexpected: Exploring resilience strategies of socio-ecological systems to natural hazards in Northeast Haiti

Chapter

2

Kristina Riesinger
University Bonn

A country tormented by disasters

Haiti is considered to provide one of the world's most extreme examples of a man-made ecological disaster – one that is attributed to the country's social and economic problems. Haiti's environmental problems are embedded in a complex situation characterised by widespread poverty, weak governance structures, high levels of organised crime and sporadic outbreaks of violence. Local socio-ecological systems face constant change and are permanently exposed to risks such as flooding, drought, landslides, soil erosion, hurricanes and earthquakes. In the past 20 years Haiti has been affected by 65 natural disasters. Even worse, forecasts predict an increase in the intensity and frequency of tropical storms as well as a significant rise in average temperatures. This will affect people whose livelihoods depend heavily on natural resources particularly badly, including those working in the agricultural sector, such as the inhabitants of Acul Samedi, Acul des Pins and Haut Maribaroux.

These three villages are located in the watersheds of Jassa and Lamatry, parts of which are at a high altitude with mountainous terrain rising to almost 2,700 metres above sea-level. Steep slopes alternate with a few arable plains and valleys that are bordered by rivers. The topography forces the population to farm the hillsides and reside on plains below extensively deforested watersheds. Nearly every year the residents of Acul Samedi, Acul des Pins and Haut Maribaroux face adverse events, particularly floods, droughts and hurricanes, which raise several questions: How do local people perceive these challenges? How do they cope with and adapt to them? Are there any transformative strategies available?

Vulnerability and resilience

In this context, vulnerability describes the capacity of a community to anticipate, cope with, withstand and recover from the impact of a natural disaster. It involves a combination of factors that determine the degree to which a person's life and livelihood are put at risk by a discrete and identifiable natural event. Enhancing a community's resilience has been identified as a core component of disaster management, risk reduction and efforts to reduce vulnerability. Resilience is the capacity of a system, community or society to respond to disasters by maintaining or altering their structure and manner of functioning to reach an acceptable equilibrium level. This is determined by the degree to which the social system can organise itself to continually learn from past disasters to protect itself better in future and take measures to reduce risks. Investigating the resilience of a socio-ecological system aims at identifying local strengths, skills and resources to better anticipate, mitigate and cope with natural hazards. There are three different abilities a socio-ecological system can have to deal with uncertainties and shocks:

1. Coping Capacities
2. Adaptive Capacities and
3. Transformative Capacities.

Chapter

2

Resilient communities are therefore able to handle surprises (cope), learn from disturbances (adapt) and find opportunities for renewal (transform). The choices and decisions made by people facing disasters depend on their knowledge and experience. There is a clear relationship between awareness and adaptation: if a community is aware of the causes and effects of natural disasters on their socio-ecological system and of the effectiveness of certain adaptive strategies, they can develop a positive attitude towards the practices necessary for adaptation.

Local risk perceptions and attitudes towards risk

While the residents of Acul Samedi have experienced several natural disasters, they remember Hurricane Sandy particularly vividly as the worst calamity to have befallen the area. The entire region is prone to cyclones from June to November, and seasonal floods and droughts disrupt agricultural production. Due to their geographical isolation, the people of Acul Samedi feel vulnerable to natural disasters and they do not expect any assistance during emergencies because the region is too remote and the infrastructure can easily be destroyed. Access to hospitals and other health facilities is also very limited. The community of Acul des Pins is rarely affected by floods because there are no significant settlements close to the river. Instead, people consider drought to be the worst natural mishap affecting their area. In contrast to the people in Acul Samedi, the inhabitants of Acul des Pins consider themselves to live in a high risk area. They feel the lives of both people and livestock are threatened by natural disasters. Since Acul des Pins is vulnerable to landslides and cyclones, people consider the mountain slopes to be particularly hazardous. The third community, Haut Maribaroux, is located in the lower reaches of the watersheds. It has a higher risk of flooding due to riverbeds silting up, and residents identify the areas beside the riverbeds as high risk locations. Most people in Haut Maribaroux feel hamstrung by floods and landslides, and their homes are perceived to be located in a very risky environment.

Identifying community-based resilience capacities

The level of knowledge about natural hazards plays a crucial role in the resilience capacities of local communities. What kinds of coping, adaptive and transformative capacities can be found in the local communities of Acul Samedi, Acul des Pins and Haut Maribaroux? Which local strategies can be identified by examining responses to Hurricane Sandy (the last natural disaster to devastate the area through strong winds and heavy rain in November 2012)?

Dealing with naturals hazards: Coping Capacities

The coping capacities of communities and individuals refer to their abilities to deal with the effects of natural hazards. The shock is temporally limited and the situation will eventually "normalise" depending on their strategies for responding to the event. Coping capacities include prevention, preparedness, response and reconstruction. Prevention strategies help to minimise the effects of natural disasters in advance, especially through adapting land uses. To mitigate risks, a combination of roots and tubers (cassava, yams and sweet potatoes), grains (sorghum, maize and rice), fruits (bananas, plantains and citrus fruits among others), vegetables, and legumes (peas, peanuts and beans) are cultivated on very small plots by many farmers in northeast Haiti. This diversity can help to minimise the risk of crop failure. Further strategies include hillside stabilisation and soil conservation measures through ravine stabilisation, terracing, contour ridges with plants or trees on them, and irrigation systems. In the watersheds of Jassa and Lamatry, people also try to diversify their sources of income (such as providing services, trading, and receiving remittances), so that they do not rely solely on small-scale agricultural production.

Preparedness strategies include, among other measures, establishing early warning systems or temporary evacuation plans. Effective early warning systems enable individuals and communities to respond appropriately to and cope with an imminent threat. Most people in these three communities receive news of impending threats such as the arrival of Hurricane Sandy through a variety of communication channels ranging from mass media outlets to informal channels such as SMS, web communications and social networks. Local radio broadcasts are a particularly vital resource for most people as it provides the most detailed information on how people should respond in a crisis. Radios are also cheap, easily shared and not restricted to literate people as a source of information.

Response strategies refer to the actions which are actually taken when disaster strikes, such as temporary evacuation, the immediate repair of important facilities, or search and rescue actions. In traumatic or uncertain times it is very important to mobilise community-based support networks to provide shelter and food. Support from family members, neighbours and friends play a central role in deciding how to respond to the immediate situation. During Hurricane Sandy, however, most people stayed in their homes, listened to the radio and waited for the storm to pass. People in Acul Samedi, Acul des Pins and Haut Maribaroux tend to accept the risks they face fatalistically, relying mostly on their faith to get them through times of crisis.

Recovery strategies are carried out in the weeks and months following a shock. People cooperate to undertake activities like cleaning, repairing, rebuilding and replanting. During the reconstruction phase many people depend on their financial savings, and people with large losses are forced to rely not only on dissaving and borrowing, but also on selling their possessions and reducing their food consumption. For people with very restricted financial resources, external assistance from NGOs, governmental institutions or remittances from family members living abroad are often necessary.

Chapter

2

Adapting to recurring natural hazards: Adaptive Capacities

Compared with coping strategies, adaptation can be understood as a longer-term process of adjustment undertaken on a larger scale. Adaptive measures are responses to events that occur with increasing frequency. Learning to live with change and uncertainty is a necessity for the people living in the watersheds of Jassa and Lamatry, as they will have to continue to deal with shocks and vicissitudes of fortune into the future. Adaptation is no longer a question of "whether", but of "what", "when", "how", and "to what extent" it should be done. The communities of Acul Samedi, Acul des Pins and Haut Maribaroux have developed certain strategies to manage disturbances, such as planting trees sloped hillsides where erosion has taken place. But even though people have been learning from the events of the past, only a few farmers seem to embrace innovative and experimental strategies for adaptation – a fact that may be attributed to their limited resources.

On the other hand, nurturing diversity for reorganisation and renewal, for example by increasing local biodiversity, is a proven strategy for risk reduction in the region. Mono-cultures are more susceptible to changes and shocks, whilst diversified farming creates a buffer against abrupt shocks such as interruptions to the rhythm of the seasons.
Many farmers in the watersheds of Jassa and Lamatry combine land engineering techniques with resource conservation and agroforestry production.

The combination of different kinds of knowledge, both modern and traditional, also offers many opportunities. Traditional methods to conserve soil and water in northeast Haiti include hoeing weeds into contour ridges at certain intervals, gathering crop stubble along the line of elevation and supporting them with stakes, as well as placing assorted plant and soil material in ravines to retain soil and water. The people of Acul des Pins, Acul Samedi and Haut Maribaroux have also been growing early maturing and drought-resistant crops such as cassava, pumpkins, cocoyam, cowpeas and sorghum. Surplus crops are processed, preserved and stored so they can be used as a backup in times of famine. Modern technologies, especially mobile phones, also play an important role in allowing information to spread more easily. Another opportunity for increasing adaptive capacity would be to forgo modern building materials like cement, as traditional homes respond much better to telluric activity than modern houses.

Traditional practices and social structures have significant potential for creating opportunities for self-organisation. Many people in the watersheds of Jassa and Lamatry participate in traditional working groups like the "kombit". These traditional structures are the primary social institutions in which farmers organise production, marketing and discussions, as well as formulate responses to changing conditions affecting their lives. The extended family, called "lakou", is the primary unit of production and consumption, extending individual members' access to land, labour, tools, and credit. Together they share risks and help destitute individuals by sharing food and other necessities. In addition to these traditional forms of self-organisation, there are also a number of local committees,

Erosion control with gabion walls and retaining walls and natural precautionary measures.
Source: Michael Scheifler

women's groups and community-based organisations. In Acul des Pins, a committee for disaster risk management was founded in 2007 which tries to get local people to invest in preparedness measures, to monitor environmental changes and to implement disaster response actions. Unfortunately, most of these committees only exist on paper without being officially recognised in Haitian law and their work is widely considered to be inefficient. Many community-based organisations acknowledge that they do not have the technical knowledge to perform efficient disaster risk reduction. In practice they expect the government and NGOs to lead relief efforts and come up with solutions.

The will to transform: Transformative Capacities

Transformative capacities comprise all the strategies employed when both coping and adaptation strategies are insufficient. A transformation is a response that creates a new system when existing structures are no longer tenable for social, economic or ecological reasons. Any socio-ecological system has to be able to adapt in order to reduce its vulnerability to change, uncertainty and environmental shocks. Achieving long-term sustainability, however, also requires the ability to transform. A disaster can provide a "window of opportunity" for the socio-ecological system to try out new concepts, ideas and strategies. It is useful to see resilience as more than adjustment, recovery and return to a pre-disturbance state, and to encompass a capacity for renewal, regeneration, and reorganisation.

Chapter

2

A long way to go

In-depth knowledge of the causes and consequences of natural disasters can improve both the awareness and coping skills of affected social groups and individuals. Unfortunately, most people within the watersheds of Jassa and Lamatry have great difficulty in identifying the causes of natural disasters or recognising the signs that one is impending, and they have only a little knowledge about the environmental and man-made factors that contribute to them. In addition, most people have limited knowledge about how to prepare for future disasters. There is, however, a high level of awareness about the impacts of natural disasters on fragile livelihoods, although this does not always get translated into adaptive disaster management strategies. Local attitudes often take for granted that not much can be done to change or mitigate the course of natural events. Many in the community attribute natural disasters to acts of God, and thus see them as impossible to predict or prevent. The lack of income and opportunities available to people also restricts their ability to invest in long-term planning, as everyday life is a great struggle in itself. On top of that, the responsibility to deal with natural disasters is often assigned to external agencies like international NGOs or national institutions. At the same time, people argue that neither the state nor the community have the capacity to reduce the impacts of natural disasters effectively. Many people complain that they do not receive enough information on disaster preparedness strategies. The overall level of education about natural hazards therefore needs to be urgently improved.

On the other hand, the communities living in the watersheds of Jassa and Lamatry already apply a number of methods for dealing with natural hazards. These need to be integrated with local and national disaster risk reduction strategies. Existing coping techniques are based on soil and water conservation, resource management, social preparedness measures and awareness programmes. The adaptive strategies currently in place can be considered as a step in the right direction. In particular, all communities seem to have developed livelihood strategies of diversified production and sources of income to help them adapt to shocks. Building on these local strategies can be a good starting point for improving resilience. As people are more willing to apply resilience strategies that complement traditional practices and structures, work to promote social learning should be integrated with existing knowledge about natural hazards. Awareness-raising through environmental education programmes is also essential to sensitise local communities to the importance of disaster risk reduction. Existing community-based strategies for disaster risk management need to be improved; civil society in general must be strengthened as a high priority; effective links and partnerships should be forged between community members and emergency managers. In addition, networks, partnerships and collaborations between stakeholders and institutions operating at various levels can promote social learning, foster diversity and create opportunities for recovery, renewal and reorganisation.

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Chapter

3

Food security in the communities of Acul des Pins, Acul Samedi and Haut Maribaroux in Northeast Haiti

Alexia Mappes
University Bonn

The concept of food security

Access to food is a human right and achieving food security is one of the main priorities for alleviating poverty as a nutritionally-balanced diet is essential for health, well-being and prosperity. A widely-accepted definition of food security published by the FAO (The United Nations Food and Agriculture Organisation) in 1996, considers it to be "when all people, at all times, have access to sufficient, safe, nutritious food to maintain a healthy and active life". The concept of food security dates back to 1974 and is based on three pillars: "food availability", "access to food" and the "use and utilisation of food".

Food and nutrition security		
Food availibilty	**Access to food**	**Use and Utilisation (of food)**
■ crop production	■ income	■ food and nutrition knowledge
■ stock-seeking	■ prices	■ nutrition behaviour
■ trade	■ markets	■ health status
■ transfer	■ knowledge, norms	■ hygiene and sanitation
	■ infrastructure	■ care opportunities

The first pillar requires that enough food of a reasonable standard is available – either through growing one's own crops or through markets (that provide access to other people's production, stocks, food imports and food aid). Ideally, food availability should also rest on a basis of sustainable and diverse food production. However, most attention is focussed on the national or regional level while food availability at household and individual levels is ignored. The second pillar describes access to food as the consequence of ensuring all members of a household have rights to access productive resources and possess sufficient knowledge, capital, income and capacity to work to be able to produce, trade or otherwise acquire enough food to meet their nutritional needs. Access to food is closely tied to surrounding social, economic, political and environmental conditions. The third pillar of food security, the use and utilisation of food, is about ensuring the nutrition and health of an individual to be supported through access to a well-balanced diet, clean drinking water, health care, sanitation and care opportunities. This recognises that the body has to be able to absorb and process food to convert it into energy, which in turn affects the person's health.

The FAO added "stability" as a fourth dimension to consider. This refers to the steadiness and continuity of food security over time. Usually a distinction is made between chronic instability and temporary uncertainty. The latter occurs mainly in the context of short-term external shocks or recurring shortages, such as the period just before an upcoming harvest.

The current situation in northeast Haiti

Analysis of the three pillars can provide a complete picture of the food security situation in a region. We can use them to answer the following questions: What is the current food security situation in northeast Haiti in terms of the quantity, variety, price and transport of food? Are there differences in food security between the city of Ouanaminthe and the communities of Acul des Pins, Acul Samedi and Haut Maribaroux? And what kind of strategies and action plans could be developed to improve food provision in the watersheds of the Jassa and Lamatry rivers?

The city of Ouanaminthe is home to most of the more than 100,000 people living in the district of Ouanaminthe; and it is growing rapidly. Even before the devastating earthquake in 2010, urbanisation was increasing steadily: the proportion of urban residents within the district of Ouanaminthe tripled from 20 % in 1982, to over 60 % by 2009. As a result of the earthquake, approximately 850,000 people left the capital city of Port-au-Prince and mainly took refuge in provincial towns. An estimated 350,000 of them migrated to the north and northeast of Haiti, including several thousand who came to the commercial city of Ouanaminthe. However, outside the city, the region is still home to a rural population that predominantly depends on subsistence farming or selling small amounts of agricultural surplus to local markets. The plains of Haut Maribaroux are almost completely cultivated with rice and maize, and the communities of Acul des Pins and Acul Samedi, mainly practice a traditional Haitian horticultural system called "jadin" that is based on the extended family and remains an essential mechanism for providing food to all family members.

Ouanaminthe has a tropical savannah climate, which is characterised by dry winters. The rainy season lasts from May to October and average annual rainfall is 1100 mm. Food availability fluctuates throughout the year. The greatest availability is between June and October. Availability can be described as average in January, February and March. During April and May, however, food availability is very low, if not precarious. To generate income, farmers survive solely on the sale of cashew nuts. These "meagre" months cause difficulties not only for farmers but also for the urban population, as the prices of grains and legumes tend to rise. The cashew nut therefore has great earning potential and can be regarded as a strategic product because its sale helps farmers to purchase the new seeds they need for the subsequent agricultural cycle.

Chapter

3

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Maize												
Rice												
Manioc												
Cowpea												
Pigeon pea												
Mango												
Groundnut												
Cashew nut												

Under these circumstances, a well-balanced diet is hardly possible: the supply of food is simply too low. Additionally, the concept of a well-balanced diet is often unfamiliar to people. Harvests between March and June are always very poor and the availability of food is generally too low. At least one person suffers from malnutrition in every family – which constitutes a percentage of about 10 % of the local population. A farming family can only achieve an adequate food supply if some of its members are able to generate further income through trading or providing services in the city of Ouanaminthe. Families that live exclusively on subsistence farming often suffer from resource scarcity.

Another problem facing farmers is transporting their harvest due to the geographical remoteness of communities and their lack of access to major roads. Many roads and paths are in very poor condition, which constrains food supply right from the start. Sometimes up to seven waterways have to be crossed, and when it rains river crossings and paths become treacherous. The high cost of transportation also impedes access to markets for many farmers. Despite this, there are no local initiatives to improve access to markets through collective forms of transportation, partly due to fears about the potential for conflicts between various families.

Chapter

3

In the wake of the global food crisis in 2008, the so-called “hunger revolt” in Haiti laid bare the problem of food price volatility and its lethal effects. Price volatility describes how quickly or widely prices can fluctuate from its average level. Price fluctuations are not just determined by global conditions, but also by the availability of food locally, which is why prices reach their highest levels during the “meagre" months. Water scarcity, as well as the high cost of importing food from the Dominican Republic and the United States, further contributes to high prices. As the staple food in Haiti, rice can cost up to 25 gourdes per cup at times. Maize, the second most dominant food item, costs up to 15 gourdes a cup. The people living in the watersheds of Jassa and Lamatry in northeast Haiti often consider such prices too high and disapprove of price volatility in general.

Educating the populace plays a fundamental role in regional development and there is significant interest in workshops and knowledge transfer in the city of Ouanaminthe as well as in Acul des Pins, Acul Samedi and Haut Maribaroux. Although some local education initiatives do exist, not all residents are equally well-informed about them, and some even feel excluded from taking part. Knowledge about food and nutritional issues remains low, and there are few educational programmes that address how people can achieve a healthy, balanced diet. Even nursing stations lack adequate food, drinking water and dietary supplements. Water pumps are sometimes a 30-minute walk away, and it is the nursing staff who are responsible for purchasing drinking water.

The stakeholders

The population of northeast Haiti largely lack indigenous initiatives aimed at improving the existing situation “from within”, and many people in the region seem to have resigned themselves to the status quo and to living in poverty. At the same time, responsibility for making improvements is often assigned to other stakeholders, particularly to the state or to international organisations and NGOs. The level of expectation for receiving external support seems to be relatively high, and few farmers appear conscious of their own agency, or power to act. People complain about lack of support and the paucity of resources they receive, putting the blame primarily on the national government. Many farmers therefore feel compelled to ask NGOs for support. The districts often search actively for new funding opportunities available from various NGOs. The applications made to NGOs by local communities include requests for tangible assets and services as well as for knowledge transfer through educational programmes. They are quite explicit about what they need: seeds and materials for agricultural production, food, the means to achieve a healthy diet, and sanitation facilities in schools. Other demands made to NGOs include nature conservation measures and a general transfer of knowledge through training workshops.

Chapter

3

Reforestation. Source: Project Office Ouanaminthe

Civil society is very weak in the city of Ouanaminthe and in the communities of Acul des Pins, Acul Samedi and Haut Maribaroux, as it is in Haiti more generally. One of the traditional forms of organisation is called “kombit”, which is an exchange of labour according to established rules. The approach of offering cash for work commonly used by NGOs resembles the local custom of “taré”. In contrast to the kombit, this form of organisation is not only based on the exchange of labour, but also includes payment: the workers involved are paid about 100 to 150 gourdes per day. These social structures are forms of mutual aid, which are particularly important for organising everyday work in the fields in rural areas. Many grassroots organisations continue these traditional arrangements and integrate them into how they work. The civil society organisations that do exist, albeit at low levels, tend to congregate in urban areas. In Ouanaminthe, there are women's groups that dedicate themselves to assertively addressing cultural, social and urban issues such as gender equality or waste disposal. Although there is also a women’s group in Acul Samedi, members are afraid to take part in discussions at village level as they associate conflicts over collective issues with the potential for violence.

The strategy being pursued by many local groups to raise funds for new projects is to approach various NGOs depending on the particular needs they wish to meet (such as procuring seeds, technology, know-how, etc.). Unfortunately, the work of international NGOs in addressing food security is often evaluated negatively in the watersheds of the Jassa and Lamatry rivers. Their activities are perceived as piecemeal assistance and therefore only of short-term benefit. Local people believe that there remains a need for long-term and sustainable knowledge transfers and to establish mechanisms for ensuring food security.

The national government is also subject to serious criticism. It is generally perceived to be weak and unable to coordinate the various forms of assistance provided by different NGOs, and it is therefore blamed when measures that are taken do not respond to real needs on the ground. The government is partially involved in addressing issues of food security, for example, through providing temporary food aid, but it has not put in place a sustainable strategy. Representatives in local government offices barely cooperate with local people, and their requests are mostly left unanswered by politicians.

A look ahead

There is still a long way to go to achieve a stable level of food security in northeast Haiti. One in ten people suffer from malnutrition, and it is often children who suffer the most. Instead of being free to invest in educating the younger generation, many families depend on their children's labour to have enough food to go round. There are differences between the levels of food security available in the city of Ouanaminthe and the levels achieved in the rural communities of Acul des Pins, Acul Samedi and Haut Maribaroux. While the vast majority of the rural population survive through subsistence agriculture, urban people depend on the being able to purchase food. The prices for agricultural products are higher in the city than they are in the countryside due to the costs of transportation. On the other hand, the residents of the city of Ouanaminthe benefit from good access to markets as well as to educational and health facilities.

Action plans for improving the provision of food within the watersheds of the Jassa and Lamatry rivers are primarily based on mobilising the population and developing the capacity of the agricultural sector. However, civil society need to be strengthened before self-help organisations can effectively influence political decisions and campaign for the implementation of strategies as pro-active stakeholders in development. Local people's recognition of their own agency or power to act is a precondition for this, but this is still lacking in most of northeast Haiti. Due to the low status of agricultural work and due to the difficult living conditions in rural areas, many young people migrate to the urban area of Ouanaminthe to find work in the service sector. An improved food supply should therefore also find effective ways to involve young adults in the agricultural sector. Building a positive image of the farmer's lifestyle, activities and breadth of knowledge in the field of natural resource management can both raise their status and increase productivity. In addition, extending transport and counteracting the volatility of food prices requires policies that promote local food markets, while also exploiting the unique benefits available to Haiti through HOPE II.

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Chapter

4

The effects of deforestation on soil erosion in the watersheds of Jassa, Lamatry and Rio Massacre

Ivo Thomas Pink
University Bonn

A country without forests

In 2010 almost 40 % of the Haitian workforce was employed in agriculture. And even though only 20 % of the country's surface area is considered suitable for agriculture, crops are grown on more than half of Haiti's land. Slopes have been cleared in order to grow crops, and the wood and roots that remain on them are used to generate additional income through the production of charcoal, or as a source of energy, especially for cooking. This has contributed to wood and charcoal being the country's main sources of fuel providing almost 90 % of Haiti's energy, and wood consumption per capita is estimated to be 500 kg per year in rural areas. Both the expansion of agricultural land and the enormous demand for wood have led to a dramatic level of deforestation in Haiti.

Soil loss and soil erosion

When forests are cleared, the soil also loses some of its protection. Soils are protected by a cover of vegetation and other organic materials preventing soil loss caused by wind and rain. The removal of vegetation is therefore almost certainly followed by deterioration of the soil. Soil degradation can also be caused by other factors, both natural and anthropogenic, that result in changes to the structure of the soil and its mineral composition. Soil loss – the removal of soil particles and substances that are bound to these particles – is an important natural process which is influenced by natural physiogeographic characteristics and conditions. Whether soil loss takes place or not is largely dependent on the climatic conditions, the original material composition of the soil, the vegetation and the topography of the area. If such a process is reinforced or caused by human actions, it is called soil erosion. As soil erosion becomes more pronounced, the risk of soil degradation increases.

Working out the specific influence of deforestation on soil erosion in a particular location is essential in order to counteract soil degradation. Does deforestation cause soil erosion in the watersheds of the three rivers of Jassa, Lamatry and Rio Massacre in northeast Haiti? Or is soil loss there only due to natural physiogeographic characteristics and spatial conditions?

A comparison between the actual soil loss that occurs and the soil loss that would be expected under natural vegetation cover allows us to draw conclusions about the impact of deforestation on soil erosion in the area. Natural conditions in the watersheds of the three rivers, comprising a total of about 400 square kilometres, vary enormously. In terms of the factors influencing soil loss, differences in topographical relief are particularly significant, but there are also relevant differences in soil composition, rainfall patterns and vegetation cover.

The relief

Relief effects surface runoff and thereby influences the quantity of soil loss. It also determines where erosion of soil takes place and where such eroded material is deposited. The relief and the geology of northeast Haiti can be divided into two sections: the Plaine du Nord, a flat area heaped with sediments; and the Massif du Nord, a mountain range that rises to elevations of over 1000 metres above mean sea level (MSL) and that consists of the extrusive rocks andesite and rhydacite, as well as of the plutonic rocks diorite and tonalite further to the north. Rocks deposited from the mountains of the Massif du Nord form the original material for the sedimentary rocks and alluvial deposits that predominate both along the river valleys within the Massif du Nord and throughout the Plaine du Nord. This plain is located north of the mountains at an elevation of between 50 to 150 metres above MSL. The alluvial sedimentary rocks are separated between the "undissected alluvial plains" which are found in the area around Ouanaminthe and extends northwest to Cap Haitien, and the "dissected alluvial plains" consisting of quaternary gravels stretching northeast from Acul Samedi towards Ouanaminthe and that form a very poor starting material for fertile soils. To the north, the plain flattens slowly to a level of about 20 metres above MSL towards the coast. Along the coastline there is also an area of limestone created by an elevated coral reef. This limestone reaches almost four kilometres inland and extends for 15 kilometres from east to west.

The soils

The soils can be divided into mountain soils and the soils of the plains. Mountain soils are either red or black, the red soils being the most common soils in all of Haiti and are prevalent in the mountainous regions of the watersheds. The soils around Ouanaminthe, extending northwest to the area south of Ferrier, have the highest productivity. The form of agriculture practiced here is more intensive than anywhere else in the country. To the north and south of this area the agricultural potential of the soils decrease: the soils in the north are classified as well usable, the soils further south are moderately usable, and the soils at the southern border of the waterbeds are considered poorly usable. The soils of the plains are formed from deposits of material ablated from the mountains and their characteristics are thus dependent on the nature of this original material, as well as being influenced by the place of deposition and prevailing climatic conditions. To put it simply, the productivity of the soils in the Plaine du Nord is higher than of those in the Massif du Nord due to the alluvial soils. These soils are very young and still constantly rejuvenating by sedimentation. They are also slightly alkaline, rich in nitrogen and phosphorus and low in potassium. However, the soils in the Massif du Nord are also cultivated despite their low potential, not least because climatic conditions are much better there than in the area north of the watersheds. Along the rivers and in the lower areas of the plains, brown and humid clays which are suitable for agriculture predominate, and these are especially productive when they are irrigated. In dry and poorly drained areas, lime soils unsuitable for agricultural use predominate. Along the coast, there is a preponderance of saline soils which are suitable for the cultivation of cotton. However, where the salt content is excessive, the soils are no longer usable and cannot be regenerated

Chapter

4

Rainfall patterns

As a medium of transport, water is a decisive force determining patterns of erosion, so it is important to examine the influence of climate and rainfall. Along the coast average rainfall is less than 1,000 mm per year. Although this region experiences episodes of convective rain during the summer months, especially in June, it is characterised by an arid climate as air masses are not forced to rise by the presence of mountains and release their water vapour in the form of rain. Further south the amount of rainfall increases at higher altitudes and the climate becomes increasingly humid. At the southern border of the watersheds 1800 mm of rain falls annually, and the dry season is correspondingly shorter. Here only one month is defined as dry, in contrast to the three-month-long dry season experienced along the coast.

Vegetation

More than three centuries of logging and deforestation have led to the depletion, and even extinction, of plant species. Primary vegetation is now hard to find in Haiti, and most of what remains is secondary vegetation. In the mountainous regions to the south of the watersheds of Jassa, Lamatry and Rio Massacre, pine forests grow down to an altitude of about 100 metres above MSL. But even decades ago, the stock of trees was already described as decimated, and those pine trees that remain are confined to the areas low down within the canyons. To the north, where the Massif du Nord merges into the Plaine du Nord, there is a savannah belt 4 to 5 kilometres long, extending to the east as far as Ouanaminthe. The plain is mostly covered with grass. Further north the savannah turns into a lowland of xerophytes which covers almost the entire coastal plain with the exception of a few irrigated cultivated areas.

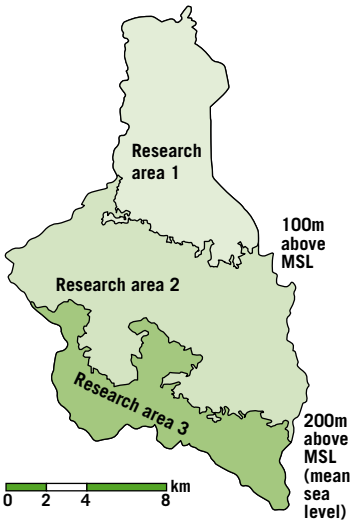
The area's vegetation shows a different picture where the numerous forms of human intervention are absent: the arid regions to the north of the watersheds – regions below 400 metres above MSL where rainfall is blocked by barriers – are home to dry subtropical forests. Trees and shrubs such as mesquite, acacia, guaiacum and white wood, along with cactuses and thorn bushes are considered characteristic to the area. Despite the lack of rainfall and the shallowness of the soil, many evergreen plant species manage to survive by obtaining water from the cracks within rocks. Due to the thinness of the soil, the area is not suitable for intensive farming. To the south of these dry forests are humid subtropical forests with vegetation including mahogany, oak, royal palm, or, on the borders with the dry forests, latanier palm. The low rainfall regions in the rain shadow of the Massif du Nord look similar to dry forests, but the presence of mango trees and royal palms indicates higher rainfall than in dry forest zones. Subtropical rainforests predominate in the high rainfall regions in the southern parts of the watersheds, where the transitions to humid forests are fluid. A higher density of vegetation consisting of shrubbery and vascular plants is considered characteristic to the area, but large parts of the original territory have suffered deforestation. At altitudes above 800 metres above MSL, humid lower mountain forests and very humid mountain forests can also be found with wild carrots, juniper trees, and many other species.

The spatial distribution of soil loss

Given the physical geography of northeast Haiti described above, it is possible to investigate the actual soil loss within the watersheds of the rivers Jassa, Lamatry and Rio Massacre. The average soil loss observed in the 400 square kilometres of the watersheds of these three rivers is close to 150 tons per hectare per year; although this varies a great deal and can even get as high as 12,770 tons. To gain a more nuanced understanding of the erosion potential within these watersheds, three separate areas can be differentiated based on the region's topography, with their boundaries defined along contour lines at 100 metres and 200 metres above MSL.

Area 1 is located in the north of the basin at an altitude of up to 100 metres above MSL. It covers 117 square kilometres and includes the two cities of Ouanaminthe and Ferrier as well as some lakes. The average potential soil loss in this area is 42 tons per hectare. Although it covers 28 % of the entire area of the watersheds, it only accounts for 8 % of the region's erosion. This relatively low erosion rate is due to the gentle topographic variation and low rainfall in the area. However, 94 % of the erosion potential is from agricultural land, which only makes up a little over half of the area.

Moving south, Area 1 meets Area 2 which has a surface area of over 192 square kilometres and covers 49 % of the entire area of the watersheds. The erosion potential here is about 185 tons per hectare and is thus significantly higher than in Area 1. Area 2 accounts for a relatively high proportion of the overall erosion potential in the watersheds at 60 %. The reasons for this are diverse: 67 % of the area is used for agriculture, and grazing land accounts for another 16 %.



Source: Map generated by author, based on Google maps.

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Chapter

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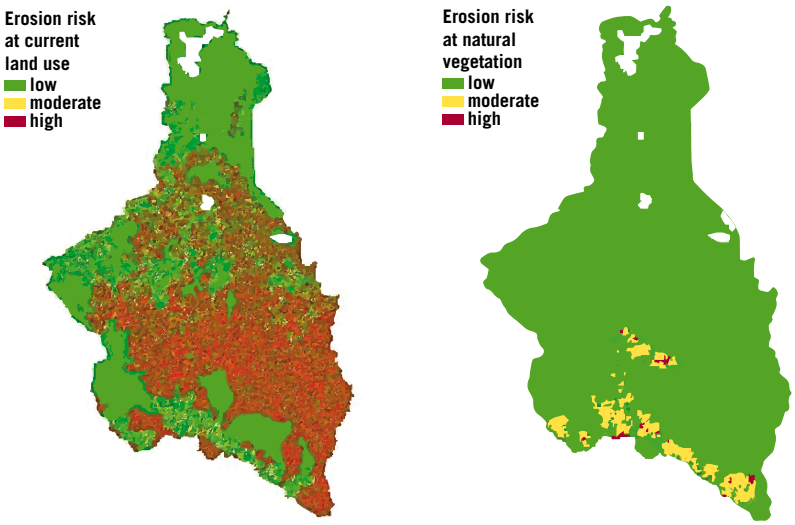
High risk of soil erosion in regions with high relief

As you go from north to south, the level of erosion potential increases dramatically. This is hardly surprising given the heavier rainfall and higher relief to the south. Moreover, it becomes clear how strongly the potential for soil loss is determined by the type of land use on it: There is a low erosion risk (less than 50 tons) on agroforestry land and unused savannahs within the watersheds of the three rivers. There is almost always a high erosion risk (more than 100 tons) in agricultural areas. There is great variation in the risks posed by savannahs that are being used (a predominantly low erosion risk in Areas 1 and 2, but classified as highly endangered by erosion in Area 3).

Only in Area 1 is the risk of erosion moderate or even low. 55 % of the surface of Area 1 is at low erosion risk, characterised by numerous unused savannahs and used agroforestry areas. In 45 % of Area 1, there is moderate erosion risk (between 50 and 100 tons) – mostly located on agricultural land. In Area 2, erosion risk as a whole increases, with agricultural land showing a high risk of erosion, although agroforestry areas here continue to show a low erosion risk. Due to the high proportion of agricultural land in Area 2, 68 % of its surface faces a high erosion risk. In Area 3, the risk of erosion decreases again, as larger areas of land there are given over to agroforestry and unused savannahs. These cover 57 % of the surface of Area 3 and at the same time present a low risk of erosion. But the remainder consists of agricultural land and used savannahs, which have a consistently high erosion risk.

Natural vegetation cover as a point of reference

The potential soil loss expected under a natural cover of vegetation is dramatically lower than the actual soil loss experienced under current land uses. The risk of erosion under natural vegetation would also be low for most of the watersheds if they were still covered by natural vegetation. The largest proportion of erosion potential would be from areas of savannah. Although representing only 19 % of the entire surface of the watersheds, savannahs would account for 77 % of the area's entire erosion potential. When comparing the share of erosion potential contributed by Areas 1, 2 and 3 with the total erosion potential in the



How land use influences erosion. Source: Thomas Pink

watersheds, the proportion attributed to Area 3 would be especially high at 77 % – even though Area 3 accounts for only 23 % of the surface of the watersheds. This is due not only to the heavy rainfall as well as to the high relief, but also because of the relatively high proportion of the area covered by savannahs. Although only 40 % of the surface of Area 3, they account for almost 90 % of its erosion potential. These savannahs would be exposed to a moderate risk of erosion, and north-east of Mont Organisé some regions would even be at high risk of erosion. The highest levels of erosion, at 380 tons, would still be found in Area 3, and the average potential soil loss here would be 13 tons. In Area 2 the potential soil loss would drop dramatically to fewer than two tons. The erosion would largely take place on the savannah as the erosion potential would be around 86 % higher for savannahs than for forested land. In Area 1, the average erosion potential would also drop noticeably to a mere 0.5 tons.

Forestry and its potentials

The type of soil also affects rates of erosion. Areas with a high erosion risk should ideally not be used for agriculture. This is particularly true where a moderate or high erosion risk would exist even under natural ground cover from vegetation. A locally-adapted system of forestry is urgently required in order to both reduce soil loss and, at the same time, to counteract the scarcity of wood as an energy resource and building material. Agroforestry offers enormous potential for protecting soils by being adapted for use on slopes. As long as the land on the lower slopes has to be used for agriculture, foresting land on the upper slopes is vital. In order to counteract soil degradation, individual fields could be separated by usable shrubs and trees such as mango, avocado, or coffee. The soil should be covered with vegetation all year long. In regions with lower risks of erosion however, agricultural productivity needs to be increased to relieve pressure on the areas of high relief in the southern part of the watersheds.

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Chapter

5

The use of water in the agricultural area of Haut Maribaroux

Theo Schreck
University Bonn

Achieving sustainable water use

Depending on how it is managed, water can be a giver of life or an agent of destruction. In Haiti, the amount of rainfall – which can sometimes be very high – varies widely both seasonally and between regions, and is heaviest in mountainous areas. When it rains in the mountains, heavy downpours release large amounts of water within a very short time, and the soil cannot absorb all of it. Instead the water is rapidly diverted into rivers and flows in an uncontrolled manner, down to the lowlands. There, the water still cannot seep evenly into the ground due to parched soils and instead forms individual pools of water unevenly distributed over agricultural land. A system for sustainable management of the available water resources is therefore essential.

Favourable circumstances in Haut Maribaroux

The agricultural area of Haut Maribaroux is located only about 4 kilometres west of Ouanaminthe. Here, in the Plaine du Nord, are some of the best soils in all of Haiti: mixtures of lime soils, clays and magmatic material form dark brown soils which are constantly rejuvenated by new sedimentary layers. They are enriched by chalky water from the mountains, making the soils slightly acidic. However, despite the fertility of the soil, problems related to land ownership, irrigation and salination pose challenges for agriculture in the northern plains.

Deforested hills around the town of Ouanaminthe.
Source: Project Office Ouanaminthe

This means the idea of expanding the existing irrigation system, beyond its current location in the farming area of Haut Maribaroux in Northeast Haiti and into neighbouring regions, should be evaluated in more detail. How can available water resources be used in an ordered way to ensure extending the existing irrigation systems use the region's water in a sustainable and economic manner? Developing a database to gather relevant information is a prerequisite for planning and implementing a system for water resource management. Small variations in climate and extreme irregularities in patterns of rainfall make forecasting complicated. Both the quantity and quality of hydrological data currently available are limited in terms of soil data, information on the hydrological balance within the watershed of the Jassa River, and measurements of groundwater. This means any assessments would be riddled with uncertainties. What we can currently analyse statistically to estimate the plant water demand for various crops is precipitation data. In Haut Maribaroux, the plant water demand the irrigation system has to meet depends on several factors – in particular on the various types of soil, and on the availability of water in the growing season.

The irrigation system in Haut Maribaroux

In 2010, the irrigation system of Haut Maribaroux was re-established. It is part of a system for surface irrigation that covers 328 hectares of fields. The channels have a total length of 8,478 metres and are in good working condition, with a high rate of efficiency of 70 %. They are divided into three categories and have controllable locks at two dams. The first two categories of channels are made of concrete and can be adjusted by further small locks. The third category of channels has only been dug out of the ground and not reinforced with concrete. These can be opened and closed manually by the farmers in the fields.

Irrigation weir at Ouanaminthe (Maribaroux). Source: Hauser

Since there are no water reserves in the form of reservoirs or irrigation wells, the irrigation system relies entirely on runoff from the Jassa River for its water supply. The Jassa watershed covers about 64 square kilometres before it merges with the Lamatry River. Overground, its catchment area is determined by natural watersheds which tend to follow along mountain crests and mountain ridges. Underground, the catchment follows the geological layers, faults, fissures or cavities which affect the amount of water flowing in or out of the area.

The cultivation conditions for maize, banana and rice in Haut Maribaroux

To enable the irrigation system to expand, the amount of water it receives in a dry year has to be sufficient for the existing area of production. An estimate of plant water demand for any crop is determined by the type of soil, how conditions vary between dry years and normal years, and by how much crop loss is acceptable. The crops selected for such calculations were maize, banana and rice. In order to run a simulation to assess minimal needs, the lowest level of water consumption is used for making calculations. The question to address is: how can the management of cultivation activity and the supply of water be optimised?

Mais

In Haiti, maize is grown to meet basic food needs. Maize is relatively resistant to water scarcity or surpluses, and it can generate up to three harvests a year. The growth period from sowing to harvest takes about four months. If maize is grown on sandy soils, additional irrigation is always required in order to avoid a lower harvest. Maize cultivation in clay or loam soils without additional irrigation is possible only for a period of one and a half months before the farmer would expect crops to fail. This period would extend to three months if the maize on clay soils is being cultivated in the second growing season. Compared with other soils, sandy soils require much more water. Both in a dry year and in a normal year, maize requires very little water in the second growing season, and the plant water demand of maize in the second growing season is always lower than in the first season, regardless of the type of soil.

Chapter

5

Banana

Banana plants thrive in tropical and subtropical climates, especially in sandy clay soils with good drainage. They are sensitive to a lack of water and therefore depend on irrigation to survive in areas where annual rainfall is less than 1,200 mm. Since their growth phase extends over almost the entire year, and as they can reach heights of more than three metres, banana plants are often exposed to and defenceless against strong winds, especially during the hurricane season. The planting of banana plants is carried out between March and May. In its first year, a banana plant requires 330 days to complete, its growth phase before being harvested, compared with 240 days in subsequent years. In addition, the banana plant has a much higher plant water demand in later years than it has in the first year. One of the reasons for this is that the shoots for the second year already start appearing during the final stage of the plant's growth in the first year. In its first year, the banana plant requires additional irrigation, even though for a short period of fewer than 14 days at the beginning of the year it is possible to cultivate them on clay soils without suffering any crop loss. In the second year, however, banana plants always need additional irrigation without exception, and crop failure is greater than for maize and or for banana in the first year. Furthermore, in the first year there is a clear difference between water demand on sandy soils and on other soil types. In the second year, however, the banana plant has higher water demand regardless of the type of soil, and it reacts particularly sensitively to dry conditions. This insensitivity to soil type remains regardless of rainfall patterns (whether it is a dry year or a normal year) in the second year.

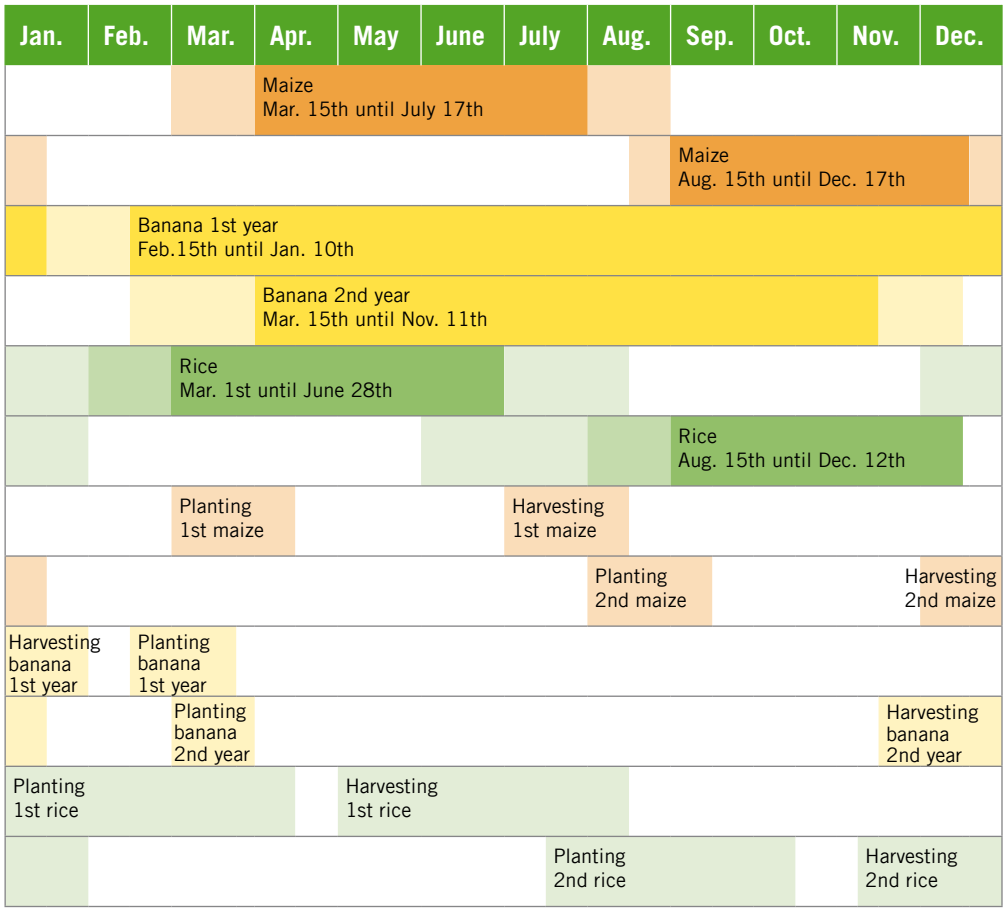
Rice

Since the amount of rainfall is insufficient for the period of field flooding required to cultivate rice, irrigation is necessary whatever the type of soil. Rice cultivation requires intensive preparation of the fields, and the growing period between sowing and harvesting is about 150 days. Seedlings are grown on a small area covering about 5 to 10 % of the arable area and takes 30 days. Another 20 days is spent tilling the soil through ploughing and irrigation and takes place while the seedlings mature before transplanting. The flooding of fields for wet rice cultivation takes five days, during which the seedlings are transplanted onto the fields. Although flooding is not strictly required for cultivating rice, it facilitates the work of the farmers when tilling the soil and so is preferred. Another advantage of flooding fields is that it provides better protection from pests – which makes wet rice cultivation very popular all over the world. However, this method also creates a huge additional demand for water that is difficult to meet even under normal rainfall conditions. If, however, a practice known as "deficit irrigation" is applied then water consumption can be significantly reduced in a dry year. This method uses a pattern of irrigation that deliberately keeps the volume of water used below the amount needed for optimal plant growth. The crop loss as a result is minimal at just 2.2 %, and this is compensated for by a significant saving of water. The amount of moisture required for irrigation-intensive wet rice cultivation can be lowered through adopting deficit irrigation instead, so that a good harvest is possible even in dry conditions. Even now, rice is grown both with and without irrigation in Haiti, showing that deficit irrigation is already being applied.

Irrigation canal at Maribaroux. Source: Hauser

A cultivation pattern for Haut Maribaroux

Optimising periods for cultivation is often considered to be the first step towards reducing water consumption. Another step is to switch to a plant which requires less water. In Haut Maribaroux this would mean replacing the banana plant with maize would be the right thing to do to take advantage of maize's lower plant water demand. In order to plan for a realistic level of demand for water that could meet the needs of the whole area being cultivated, a pattern of intercropping has to be established in farming areas. By estimating the plant water demand for the different crops (maize, banana and rice) it is possible to plan out when economically-viable growing seasons are possible.



Chapter

5

Rice cultivation in the irrigated area Maribaroux. Source: Project Office Ouanaminthe

It is possible to extend the irrigation system

By estimating the plant water demand that has to be met by the irrigation system of Haut Maribaroux, a database was created in order to be able to plan and implement a well-ordered use of water resources. Although an extension of the cultivation area is possible in principle, water reservoirs must also be established at the same time to minimise risk. Due to the unpredictability of rainfall patterns, a poor harvest remains a constant and recurring risk, which is why water reservoirs are essential for farmers, especially in dry months. Based on past years' experiences, the amount of water that can be saved should be around 235,000 cubic metres – which corresponds to a reservoir covering an area of 300 metres by 300 metres to a depth of 2.6 metres. In addition, reducing the amount of water used to irrigate rice by applying deficit irrigation is very important, especially during the dry season. At the very least, farmers should be familiar with this method of irrigation. It is also crucial for people living in the lower areas of the Jassa watershed to participate in planning, especially since they can suffer crop losses in dry seasons. A parallel plan to establish water reservoirs offers great potential to counteract this problem.

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Chapter

6

The use of Google Maps and Google Earth in development co-operation. Web-GIS applications in the work of Welthungerhilfe in Ouanaminthe, Haiti

Alexej Schmidt
University Bonn

The public image of project work in Ouanaminthe

Editing and presenting geospatial data to target audiences – showing geographic features, boundaries and characteristics using digital media – offers a host of opportunities for raising the profile and improving the image of development projects. Web-based Geographic Information Systems (GIS) are becoming increasingly important tools in this context, because WebGIS allows geographic objects to be linked clearly to data describing their attributes. This has meant that creating customised maps for specific target groups using Google Earth and Google Maps is of great relevance to the project site in Ouanaminthe. By using the "my maps" function in Google Maps and in Google Earth (a software application which has to be installed on a computer's hard drive), maps can be created and shared online as so-called "mashups", to present information about the project work of Welthungerhilfe. Such maps can be experienced as a virtual three-dimensional environment through Google Earth. As Web-GIS applications, Google Earth and Google Maps can therefore facilitate and simplify the transfer of knowledge between Welthungerhilfe's project delivery staff and interested third parties, as well as create a unique and interactive visual or audiovisual experience.

New possibilities through new technologies

Web 2.0 provides the basis for these new ways of making development projects visible. Unlike its predecessor, Web 2.0 is not primarily designed to disseminate information; instead it offers users various forms of interaction. Information can be created, shared, and commented on via wikis and blogs, and the use of interactive tools for undertaking searches for information and planning travel routes has now become routine. Numerous web-based services of these kinds have spread rapidly because they are easy to set up using shared and standardised programming languages and applications, and because such modules were mainly developed by the open-source community. The spectrum of Web 2.0 technologies also includes cloud computing, among many other tools, where documents in different formats can be saved centrally on web-based servers, so they are easily accessible instead of being saved on a local computer.

The Global Positioning System (GPS) is another important technology that has enabled lay participants to take part in "web mapping 2.0" and to generate spatial data. The GPS signal was made available for public use in 2001 and identifies positioning with a high degree of accuracy. In August 2004, a second version was released for the interchange of GPS data between applications and web services on the internet, which has been the standard data format for GPS data ever since. The central system, whose components make it possible to co-ordinate localised information, is the geographic information system. A geographic information system (GIS) is a computer-based system that consists of hardware, software and data. With GIS, spatial problems of various kinds can be modelled and revised.

Chapter

6

The required spatial data can be collected in digital form, reorganised and graphically presented. Geographic information systems that use web technologies for communication between components and that make geocoded information accessible on the internet are referred to as Web-GIS.

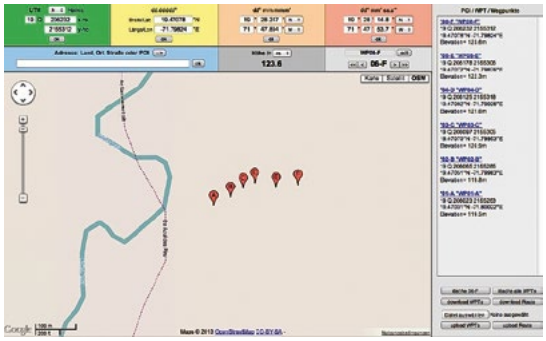
A new kind of geography: Neogeography

The combination of Web 2.0 technologies, GPS, Web-GIS and other application systems have created a "new kind of geography": neogeography. Neogeography is about people creating their own maps by collecting and combining information using existing applications, and using them to share spatial information with friends and other interested parties. In this way, neogeography has formed a new knowledge environment for understanding geographical areas better. This evolution of GIS into a new "GIS/2", which can be used by the populace, is also referred to as "Public Participation GIS", or PPGIS. The launch of Google Maps for Public Participation GIS and the democratisation of GIS technologies are of central importance because they facilitate active participation by the general public and provide a suitable global information platform. They enable GIS users from non-scientific backgrounds to read, write, edit and save information in an intuitive environment, as well as present it in the way they wish to. The main focus of neogeography is on non-professional users of a Web-GIS whose goal is to share their personal spatial knowledge with other interested parties. This type of production and dissemination of spatial knowledge by largely untrained volunteers is also called "Volunteered Geographic Information" or VGI. These are the users whose needs geographical software available on the World Wide Web is designed to meet.

The mapping process in practice

Due to both the popularity of the internet and its ever-increasing speed, it is delivering a more seamless and pleasant user experience. Although geographic data has a larger size and therefore requires a longer time to load, the speed of the internet is no longer a limiting factor, even in Haiti (where the average broadband speed is 1.5 Mbps, compared with 6.9 Mbps in Germany). The processing of spatial data, often collected with GPS devices, and the creation of digital maps more generally are subject to the same requirements in a Web-GIS as in traditional analogue cartographic formats. Legibility remains the top priority, supplemented by specific criteria such as the selection of the right cartographic labels or screen resolutions.

Map products and features in Google Maps and Google Earth provide numerous opportunities for presenting the project work of Welthungerhilfe in Ouanaminthe. The mapping process consists mainly of three separate steps: geotagging, processing in Google Earth, and editing in Google Maps. Geotagging – whether via the native interface or by using Geoplaner software (explained below) – occurs at the beginning of the mapping process, once the required data has been successfully acquired and processed. The interface between a GPS device and Google Earth is useful for directly importing coordinates from a GPS device or



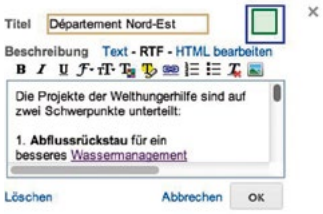
GIS-points mark the interventions points of the activities. Source: Alexej Schmidt

from an appropriately formatted table. If the GPS coordinates are available only in text documents or in other formats which cannot access the GPS tool through its own interface, a so-called geo data converter is used, such as that available from the Geoplaner website. This geo data converter allows the input and output of four different formats of GPS coordinates. In Geoplaner a GPX file containing GPS coordinates can be created, which can then be imported into Google Earth. Manual data entry of GPS coordinates should be carried out with due care.

After the GPS coordinates of a text file are tagged, the next step is importing the GPX data into Google Earth. At this point, the automatically created placemarks must be differentiated, because all the placemarks are initially shown as little flags without being distinguishable from one another. Using the function “Tools/GPS/Import from File”, tagged GPX files can be imported into Google Earth. These files appear as so-called “layers” in the left vertical toolbar, with all geotagged placemarks of a text file displayed in a single layer. The locations are saved in the user’s “Places” panel. By choosing “Properties/Get information”, the name, placemark symbol used in a layer, style, colour settings, and view can be processed along with hyperlinks and image links. Once a placemark is furnished with information, its label appears in the layers toolbar in blue letters and underlined in the same manner as a hyperlink. Because of its limited functionality for formatting text, Google Earth should only be used to insert graphics into a mashup, and further project information should be added and edited afterwards in Google Maps during the third step. The images and graphics that are used are either retrieved from a local computer or from a source on the internet. However, graphics that are saved only on a local computer cannot be displayed within a KML file in Google Maps or on another computer, because the path to a file on a local hard disk cannot be accessed by external users. For this reason, Google+ offers access to the “cloud” as a good alternative that allows permanent and universal access to the data, as long as the server is connected. When using this option, each placemark in Google Earth is provided with its own hyperlink to the specific storage location of a graphic in Google+, rendering access to a local hard disk is unnecessary. It is also advisable to set a uniform image size and make adjustments to images before saving them in Google+. At the end of this process, the “Places” are saved by right-clicking and selecting “Save Place As ...”. The resulting KML file then provides the raw material for the next step.

Chapter

6



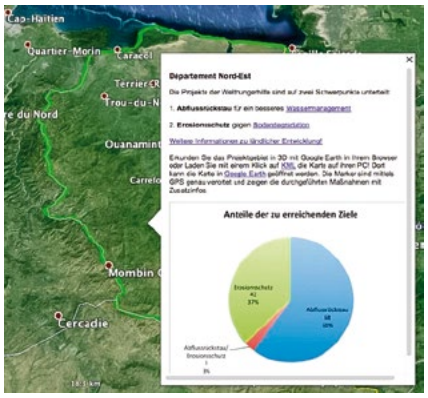
Pasting of text into the GIS-database. Source: Alexej Schmidt

To make further edits to the map such as formatting text, the next step is to import the KML file into Google Maps. In the Google Maps mashup, more content like simple text passages, images, videos, and links can be added into layers or in placemarks. Pictures and videos are embedded in the placemarks via hyperlinks to the relevant storage location in the cloud, and text can be typed in and formatted manually. RTF (Rich Text Format) offers a basic set of formatting options to edit text in Google Maps. In line with the philosophy of neogeography, no knowledge of HTML is required. A small selection of fonts, colours, and bullet points is available, and chain links to web pages and graphics can also be integrated. Hyperlinks to Wikipedia articles are particularly well-suited to offering easy access to additional information, for example, on "water resource management" or "soil retrogression and degradation".

After following these steps, the project area can then be explored in a web browser by using the Google Earth plug-in, or by downloading the KML layer that allows the map to be explored using Google Earth software. Clicking on "Google Earth" provides access to a link where the software can be downloaded, and "KML" is similarly linked to a direct download of the layer. The invitation to view the map in Google Earth enables interested parties to individually explore the project area and view its topography from a three-dimensional perspective. In this way, the mashup maps offer enormous potential for experiencing meaningful interaction through actively exploring the project area in what feels like a three-dimensional representation of the environment. This creates a special form of proximity to the project for the user – a proximity which cannot be achieved by conventional reports presented in a textual form. The placemarks contain the most important project information, providing a pleasant and user-friendly interface for the transfer of information through the maps. In order to facilitate a deeper exchange of knowledge related to project work, mashups can also be linked to thematically related documents such as studies, reports or brochures.

Ravine Dufoncelle – Situation before carrying out measures. Source: Alexej Schmidt

Situation after measures were implemented. Source: Alexej Schmidt



Display of statistics from the database.
Source: Alexej Schmidt

Distinguishing separate target groups

The methods of web mapping through neogeography foster knowledge transfer between Welthungerhilfe's project staff on one side, and interested third parties on the other. The spectrum of such interested parties includes other employees of Welthungerhilfe distributed across the globe, institutional donors, private donors, and large-scale donors. These groups are interested in different types of information and should be approached and addressed appropriately. An understanding of target groups when designing what information to include in a particular Google Maps mashup is a key task. At the same time, the designs should adhere to the general communication strategy of Welthungerhilfe as a whole. In order to achieve an adequate design for maps to meet the needs of specific audiences, three different target groups can be distinguished.

The first target group includes both institutional donors, or co-financiers, and employees of Welthungerhilfe in Germany and overseas. These people have technical knowledge and background information, and they are looking for factual information presented in an objective manner. This has meant that project information has mostly been presented and communicated to them in written form through reports or summaries. Detailed reports have also been used to provide as much information as possible. An emotional approach through images and personal stories has been avoided in order to focus on technical and organisational questions, such as the benefits of a particular seed.

Private donors that support the work of Welthungerhilfe at a level below 1,000 Euro, as well as funding partners, represent another target group. Unlike the first group, the appropriate primary focus should be to provide them with experiences of meaningful interaction. An emotional approach is the main priority and this can be pursued through an increased use of visual and audiovisual media such as photos and videos. This kind of communication is complemented by simple texts, such as personal stories from beneficiaries, illustrating how living conditions have improved following particular project activities. Before-and-after image comparisons are one of the best tools available because they show clearly the positive impacts that financial resources and donations have made.

Between these two target groups, companies and major donors (giving 1,000 Euro or more) represent a third audience. Many of the same criteria apply to them as to private donors and funding partners. In addition, however, this target group tends to be more interested in the distribution of funds than in its impacts. Technical background information through written text should ideally, therefore, be used to complement the emotional messages provided by visual and audiovisual materials.

Chapter

6

All of these different forms of presenting project work to others are based on information primarily found in existing reports. These reports contain general information about the project area (country, department, town, section, zone, GPS coordinates) as well as about the activities that are undertaken, the people responsible, the resources used and the hours worked. Almost all the activities at the project site of Ouanaminthe are also documented with photos, which sometimes allow a direct comparison to be made between the initial situation and the final outcome, providing a visual and interactive experience of both the project area and what the project involved. With the new possibilities made available through new technologies in the wake of Web 2.0, there is a huge, largely untapped potential for improving the presentation of projects to external audiences and raising the overall profile of Welthungerhilfe with opportunities which even go beyond the project site of Ouanaminthe.

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Welthungerhilfe, IBAN DE15 3705 0198 0000 0011 15, BIC COLSDE33

Deutsche Welthungerhilfe e. V., Friedrich-Ebert-Straße 1, 53173 Bonn, Germany, Tel. +49 (0)228 2288-0, Fax +49 (0)228 2288-333, www.welthungerhilfe.de