



Utrecht  
University

---

# FIGHTING THE SAND: THE ROLE OF EDUCATION IN COMBATING DESERTIFICATION

---

A CASE STUDY OF M'HAMID EL  
GHIZLANE, MOROCCO

---

**BO MAEIJER**

Date: September 13, 2022

Student number: 7345232

Supervisor: Dr. Kei Otsuki

# Acknowledgement

First, I would like to thank my supervisor Dr. Kei Otsuki, for helping me finding my way through the research proposal and for guiding me through the whole process of conducting research and writing a master thesis. By answering all my questions she helped me finalizing this paper. Also, I would like to thank Wanda Hebly for introducing me to the Sahara Roots Foundation and Joudour Sahara, and Maryem and Halim of Joudour Sahara for helping me collecting my data in the field and introducing me to everyone in M'hamid el Ghizlane. Last but not least, I would like to thank Nawfal Serhir for translating my interviews from Darija to English and from French to English.

Without your help my research would not have been the same.

Bo Maeijer

# Table of Contents

Acknowledgement.....	1
Table of Contents.....	2
Abstract.....	3
List of Abbreviations.....	3
Introduction.....	4
Scientific Relevance.....	5
Societal Relevance.....	6
Theoretical Framework.....	8
Desertification & Land Degradation.....	8
Quality Education to Combat Desertification.....	9
Decision to Migrate.....	10
Methodology.....	12
Document Analysis.....	12
Case Study Area – M’hamid el Ghizlane.....	13
Data Collection.....	15
Ethics.....	17
A New Learning Experience – Limitations to this Methodology.....	17
Findings.....	17
Daily Life in the Desert – Experience from a Western Point of View.....	17
International Anti-Desertification Efforts.....	20
Anti-Desertification Efforts in Morocco.....	20
La Ceinture Verte (The Green Belt).....	22
Case Study – Desertification in M’hamid el Ghizlane.....	24
Anti-Desertification Efforts in M’hamid el Ghizlane.....	26
Education in M’hamid el Ghizlane.....	29
Environmental Education Initiatives.....	30
Regular Education in M’hamdi el Ghizlane.....	32
Migration & Displacement.....	34
Discussion.....	36
Limitations.....	37
Suggestions for Further Research.....	38
Conclusion.....	38
Policy Recommendations.....	39

References .....	41
APPENDIX A .....	45
APPENDIX B .....	47

## Abstract

Over 40% of the world's land surface is covered by semi-arid and arid environments, which are home to over one billion people. These semi-arid and arid environments are subject to desertification. Africa is a heavily degraded continent, with desertification affecting over 46% of the continent's surface. In the case of Morocco, approximately 90% of the land is classified as desert. The documentary 'Oasis in de Orient' is what started the interest in desertification for this thesis. M'hamid el Ghizlane is an example of a town that is threatened by desertification, causing land degradation, a change in livelihood and the displacement of people. Here, migration is seen as the best adaptation strategy to the change in environment and livelihood. Internationally as well as in Morocco there are initiatives that focus on fighting desertification using projects and plans to protect heavily degraded areas. However, the environment keeps deteriorating and the threat by desertification has gotten worse over the years. Education is seen as a good tool to shape behaviour and attitude into an environmentally positive way and to provide people with technical knowledge to prevent disasters from happening. Therefore, this research focusses on the role of education in the fight against desertification. Document analysis and a case study using interviews and observations have been used to gather data on this subject and to add to the literature on the relationship between education and desertification.

Key words: desertification, education, land degradation, migration, displacement

## List of Abbreviations

ESA: Environmentally Sensitive Area  
 ESAI: Environmentally Sensitive Area Index  
 GIS: Geographic Information System  
 IPCC: Intergovernmental Panel on Climate Change  
 MDV: Middle Draa Valley  
 NGO: Non-Governmental Organization  
 PAN-LCD: Programme d'Action National de Lutte Contre la Désertification  
 PSEAU: Programme Solidarité Eau  
 SDG: Sustainable Development Goal  
 SRF: Sahara Roots Foundation  
 UN: United Nations  
 UNESCO: United Nations Educational, Scientific and Cultural Organisation  
 UNCCD: United Nations Convention to Combat Desertification  
 VVOB: Vereniging van OnderwijsBestuurders

*Front page picture: Joudour Sahara future cultural centre grounds, May 10, 2022.*

# Introduction

Over 40% of the world's land surface is covered by semi-arid and arid environments. These areas are home to over one billion people whose livelihoods depend on the available natural resources in these environments. These semi-arid and arid environments are subject to desertification (Image 1) (Veron, Paruelo & Oesterheld, 2006). In Agenda 21 by the United Nations Convention to Combat Desertification (UNCCD) of 1992, desertification is explained as “..land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities” – UNCCD Agenda 21 chapter 12; paragraph 12.2 (1992). However, what is important to note here, is what is meant with land degradation. According to Kassas (1995) land degradation does not refer to ecological deterioration but more so refers to economic loss, as degradation of land is seen as the loss or reduction of the capacity of land to produce what is expected by the human society that is associated with the land. Desertification is thus seen as a process that affects human society in, among others, an economical way.

Africa is a heavily degraded continent, with desertification affecting over 46% of the continent's surface. In the case of Morocco, approximately 90% of the land is classified as desert (Ait Lamqadem et al., 2018). The documentary called 'Oasis in de Orient' by Kefah Allush (2020) caught my attention towards the problem of desertification in Morocco and gave the concept of desertification a 'face'. Small oasis towns are being abandoned due to the increasing presence of and threat of sand, people migrating to bigger cities to make a living and the nomadic and desert traditions disappearing. According to Karmaraoui (2019), a move is happening of young people leaving the desert region in Morocco to bigger cities to provide for their families who are left behind. Right now, this lifestyle is necessary as life at the border of the desert becomes more and more challenging. This challenge becomes very clear in the documentary mentioned above. The most ironic but also very worrying image that was shown by this particular documentary was the door of the agency for combating desertification being blocked by Sahara sand. How can they combat desertification if they cannot even keep the sand away from their own door?



**Image 1: Severity of desertification on world stage - The European Space Agency 15/06/2007**  
[https://www.esa.int/Applications/Observing\\_the\\_Earth/Severity\\_of\\_desertification\\_on\\_world\\_stage](https://www.esa.int/Applications/Observing_the_Earth/Severity_of_desertification_on_world_stage)

This image shows that desertification is impacting parts of Morocco, and while the international community puts effort to address the problem, it is important for researchers to explore ways to help people cope with or adapt to their environmental situation. According to Anderson (2010) education is important to mitigate and adapt to climate change as it provides knowledge and skills and has the ability to change behaviour into taking action for sustainable development. To raise public awareness and to shape attitudes in a positive way towards the environment, education is an important and efficient tool (Karatas & Karata, 2016; Anderson 2010). This is mainly important for the areas of the world that accelerated climate change with their unsustainable practices to mitigate their actions and move towards a more sustainable development. As educators have the expertise to use knowledge and skills to shape social change, Anderson (2010) states that they can also bring positive impacts on the environment and for example help reduce greenhouse gas emissions. Schmitz & Rocha (2018) demonstrate these statements in their study saying that attitudes towards sustainable development and pro-environmental behaviours can be

improved by environmental education. Adding to this, all around the world, countries have shown that education reduces disaster risk and provides long-term benefits. In the areas where people are directly affected by natural hazards like desertification, it is important to provide education for adaptation. Being the next generation to make decisions and to take action, children are in particular important in combating climate change. Teaching them about disasters has shown to reduce the vulnerability to risk of their own and their communities (Anderson, 2010). With desertification being a natural hazard, educating children to adapt and act timely on this hazard, could lead to less harmful impacts. Even more so, it is important to educate girls. Studies by the Centre for Global Development and the World Bank show that the best way to ensure that communities adapt and are less vulnerable to climate change and extreme weather conditions, is by providing education to girls and women (Blankespoor et al., 2010; Blankespoor et al., 2010b). Existing data shows that the vulnerability of women decreases when they receive education which could lead to a reduction in the families' vulnerability to natural disasters and disasters that are weather-related. According to these reports, many weather related disasters, both acute and slower processes, could have been prevented if developing countries would have focused more on education for women (Anderson, 2010). This is also the case for desertification as it is an extreme weather related natural hazard. Anderson (2010) even states that when education for sustainable development gets ignored, this can lead to negative consequences for combating climate change.

So far, the role of education in bringing positive change to behaviour and thus to the environment has been made clear in the literature, however, it is not much implemented and to some extent even overlooked by the climate change arena and the international community. Also, there is no clear leading actor in this field, but there are multiple actors working in education internationally like non-formal education programs, but also NGOs, agencies by the United Nations and educational ministries. Even further, the linkage between the role of education and the process of desertification is missing.

## Scientific Relevance

The continuing climate change will have a detrimental effect on dryland areas as they become more vulnerable to desertification. As a result of lower amounts of precipitation, it is expected that Morocco will have to cope with a higher sediment load with a higher risk of drylands suffering desertification leaving a threat on the food security (Mirzabaev et al., 2019). Even though it is stated that limiting global warming to 1.5°C instead of 2°C would be beneficial to avoid more desertification, the European Commission Joint Research Centre (2018) claims that even though land degradation is a global problem, it should be tackled on a local level with local solutions as the process of desertification takes place on the local level. In order to stop biodiversity loss and further degradation of land, more effective cooperation and greater commitment are necessary at the local level. On a global level we see initiatives like the United Nations Convention to Combat Desertification in which countries pledge to fight desertification. On a more local level in Morocco we see organizations like the Sahara Roots Foundation using education, the Groasis Waterboxx and planting trees to fight desertification at the border of the Sahara desert (Sahara Roots Foundation, 2021). Unlike these organizations, the education sector has not been fully engaged by policymakers, even though they could use education as an adaptation and mitigation strategy in combating climate change (Anderson, 2010).

Now, SDG 4 'Quality Education' states as the 7<sup>th</sup> agenda point: *"4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to*

*sustainable development.*” – United Nations (2022) Goal 4 targets. However, in combination with the fact that it is the seventh agenda point and not one of the first, when looking at the Sustainable Development Goals report of 2022 it appears that education for sustainable development is not high on the agenda as the focus is more on accessibility and facilities of schools and equality between boys and girls (United Nations, 2022b). Also, concepts like desertification and displacement have not been mentioned in this report. Thus, main focus of this agenda point is on sustainable development as a whole, but a focus on more detailed environmental and social problems like desertification and displacement are lacking in the SDG agenda. In the case of Morocco, there is a diversity of actors active in the field of environmental education, constituting a great asset and wealth for the kingdom. According to the research by Riouch & Benamar (2018), The Ministry of National Education is the most active environmental education player, supervising a large number of schools with a focus on environmental education. The next biggest players are the NGOs who have an important role in engaging the local communities and sensitizing for environmental protection. This shows that Morocco has made great steps towards protecting its environment through environmental education, however, despite these efforts and diversity in actors, the environment continues to deteriorate. According to Riouch & Benamar (2018), this is due to the limits of the tools and approaches used by the active players in the field of environmental education. As most approaches are focused on only transmitting knowledge, values and behaviours that respect the environment are not touched upon.

Looking specifically at the topic of desertification and how education can add to combating this problem, there is less literature available than on combating climate change in general. Also, looking specifically at countries, there are a few studies on the role of education on desertification in, for instance, Algeria by le Roux & Bouazid (2009) and Ghana (Amankwah, 2012). However, these studies are all rather outdated and recent literature on Morocco specifically is lacking.

## Societal Relevance

Globally, the number of people directly affected by desertification is according to Reynolds et al., (2007) 250 million people and looking at current developments in climate change and population growth, this number is only expected to increase. Between the 1980s and 2000s people living in drylands experienced high loss of biomass productivity. As their livelihoods are mostly dependent on agriculture, dryland populations are extremely vulnerable to desertification. Loss of biodiversity, reduced incomes and agricultural productivity are all caused by desertification and due to over-extraction the groundwater is depleting. Human well-being is endangered because of, for instance, dust-storm activity due to unsustainable land management (Mirzabaev et al., 2019). Poverty in these drylands is limiting the opportunities to invest in sustainable land management. In Morocco, according to Mirzabaev et al., (2019) the costs of soil degradations were estimated to be 0.5% of the Gross Domestic Product each year. The amount of palm trees in the Middle Draa Valley (MDV) has decreased from 4575km<sup>2</sup> to 1342km<sup>2</sup> over time and due to overuse of water by humans, wetlands are changing into deserts (Karmaraoui, 2019). The loss of income and financial insecurity has led young people to leave their families in the MDV and migrate to big cities. Now, this move of young people for employment and livelihood is crucial for families to adapt to the impacts of desertification by transferring money to those who stayed in the valley (Karmaraoui, 2019).

According to United Nations Department of Economic and Social Affairs (April 22, 2021), over the last decade, displacement triggered by weather-related crises have been twice as high as displacement due to conflict and violence. The inability of land to regrow plants or retain water and soil erosion are affecting the billions of people living in the areas that are

vulnerable to desertification. It is estimated that by the year of 2030 about 50 million people could be displaced as desert lands do not have the ability to support the populations of people and animals living in drylands. The inability of growing food and the unavailability of clean drinking water produce health problems to humans like malnutrition, respiratory disease due to dust and other diseases (Nunez, 2021 3 May). As many of the factors mentioned above are consequences of human actions and unsustainable practices, environmental education could be an efficient tool to bring positive change to society. As said, environmental education can improve the attitudes of people towards pro-environmental behaviour and sustainable development, reducing the vulnerability to natural disasters and increasing the resilience of communities. Globally, stakeholders like the United Nations and Save the Children are trying to incorporate parts of the climate change agenda into education and learning communities to adapt to climate change by adding the integration of risk reduction strategies into curricula. Save the Children mainly focuses on the climate crisis as a whole in their education and provide first aid help in countries that are in need, but also offers children education that have been displaced by drought (Save the Children, 2022). UNESCO, has created an educational kit on combating desertification for primary school children. In this kit, the whole topic of desertification, its causes, consequences, case studies and class activities are present. As one of the biggest socio-economic consequences of desertification they mention migration and displacement causing friction between societies and political- and environmental instability. While these educational initiatives seem promising for the future, in the past decades, the climate change community has not recognized nor integrated the education work intensively as these works remain ad hoc (Anderson, 2010).

The goal of this paper is to add to the literature on the topic of combating environmental problems like desertification by using education as an efficient tool to share, generate and distribute knowledge and raise awareness. Furthermore, this paper will add to the literature on desertification in Morocco. To do this, the following central research question and sub questions are formulated:

Central research question: *What role do educational initiatives play in generating, implementing and distributing knowledge to combat desertification in Morocco?*

Sub questions:

1. What types of environmental education with a focus on desertification are available in M'hamid el Ghizlane?
2. To what extent does education affect people's decision to migrate?



# Theoretical Framework

This paper builds on and will test the idea that education is a great tool for combating climate change and digs deeper into the theory to see if this also accounts for specific natural hazards like desertification. A statement related to this theory is by Schmitz & Rocha (2018) saying that participation in environmental educational programs can influence the students' behaviour towards the environment in a positive way, meaning becoming aware of the value of the fragility of the environment and wanting to take care of it.

To test this theory, it is necessary to elaborate on the most important concepts and what their relations are with each other. Starting with desertification and land degradation.

## Desertification & Land Degradation

The UNCCD (2022) describes desertification as land degradation in dry regions due to various factors like human actions. Nunez, (2021, 31 May) defines desertification as the permanent degradation of land that once used to be cultivable. Land degradation can be defined as a decrease in land condition caused by mainly human-induced processes either directly or indirectly. For example, anthropogenic climate change, which is the long-term loss or reduction of ecological value to humans or biological productivity (Mirzabaev, et al., 2019). Desertification and land degradation do not differ in means of process, their difference is more geographically based. Where land degradation can happen anywhere in the world, it is only called desertification when it occurs in drylands. Desertification is not only about permanent damage to land or the change of lands into desert, it is representing all types of land degradation that occurs in dryland areas (Mirzabaev, et al., 2019).

Land degradation is not a new phenomenon. However, the pace at which land degrades now has accelerated to 30 to 35 times the historical rate (Nunez, 2021, 31 May). According to the European Commission Joint Research Centre. (2018, 21 June), more than 75% of all of Earths' land is already degraded, which can worsen to over 90% by the year of 2050. Yearly, about 4.18 million km<sup>2</sup>, which is half of the size of the European Union, degrades globally, affecting mostly Africa and Asia (European Commission Joint Research Centre, 2018, 21 June).

Early-to-mid 20<sup>th</sup> century it was thought that human actions were the only cause of desertification (Mirzabaev, et al., 2019). What we see is that desertification caused by human actions is mainly through the expansion of croplands, unsustainable land management practices like overgrazing (Image 2) and the pressure on land that is increasing due to population growth (Mirzabaev, et al., 2019). Vegetation is cleared away to give space to farming and urbanization and livestock and crops deplete and destroy the soil and vegetation (Nunez, May 31, 2021).

However, according to the IPCC report by Mirzabaev, et al., (2019), blaming desertification only on human actions is not completely fair. In Chapter 4 of the IPCC report, a full table is given



**Image 2: Goats in Desert Espace in southern Morocco / Local travel, Morocco, Travel agency (2008)**  
<https://nl.pinterest.com/pin/738942251344424320/>

showing drivers of desertification and their connections to climate change. One naturally occurring driver of land degradation and desertification in arid and semi-arid regions is the increase of soil salinisation, which can be defined as the process of soluble salts accumulating in the soil up to the point where the fertility of the soil gets severely harmed (Gkioungkis et al., 2015). By increasing the mineralised groundwater level, climate change can increase the salinisation of the present saline soil in these areas. However, even though soil salinisation is a natural process, it can be intensified by anthropogenic processes like poor irrigation activities. Also, differences in sea surface temperature can cause changes in rainfall and can thus influence desertification processes. In the last century, invasive plants have caused loss of ecosystem services in arid areas and have contributed to desertification. Last but not least, another example of a driver of desertification are wildfires, destroying the fertile soil and vegetation cover (Mirzabaev, et al., 2019). Although this shows that desertification can also be seen as a natural process, it is argued that the main cause of the intensification and acceleration of desertification is due to human actions (Nunez, May 31, 2021).

## Quality Education to Combat Desertification

Another important concept for this research is quality (environmental) education. Environmental education “... *has the potential to strengthen people’s capacity to acquire and develop knowledge, values, attitudes, skills, decision-making ability and ethical behaviours that contribute towards and are beneficial for the environment; to address environmental and development risks and issues; and to be more aware of and better understand environmental complexities.*” – le Roux & Bouazid (2009) p. 135. Thus the role of environmental education is to ensure a world that is liveable for future generations, by increasing the ability of humans to adapt, mitigate and transform the environment to their own and their community’s needs and protecting it from exhaustion (le Roux & Bouazid, 2009). When speaking of ‘quality education’, there is not one specific definition. However, according to Unterhalter (2019), quality can be connected to certain values and equalities. These values can be global citizenship, sustainable development and learning skills for decent work. The United Nations states that “*quality education specifically entails issues such as appropriate skills development, gender parity, provision of relevant school infrastructure, equipment, educational materials and resources, scholarships or teaching force.*” – UNESCO (November 21, 2018) SDG Resources for Educators – Quality Education. VVOB adds learning skills for a sustainable livelihood to this as they state that “*A good quality education is one that provides learners with capabilities they require to become economically productive, develop sustainable livelihoods, contribute to peaceful and democratic societies and enhance individual well-being.*”- VVOB (2022) Our Vision on Quality Education.

According to Action Education, an association that provides access to quality education for populations that are the most vulnerable in the world (Action Education, July 4, 2022) “*Giving everyone access to quality education, is to enable each individual to have a job, to support his or her family, to be in good health, and to become an enlightened citizen and actor in a sustainable development at the service of all.*”- Action Education, SDGs: Education for all by 2030; July 7, 2022.

Action Education emphasizes the relationship between quality education and adapting to climate change. As it has the ability to change behaviour and attitude, education is essential in raising awareness and adapting to climate change (Action Education, July 8, 2022). Not only is it an essential tool in raising awareness, it improves the lives of especially the vulnerable people and strengthens the resilience of communities in conflict and crisis situations (Action Education, July 6, 2022). As every process of migration starts with a ‘push’ and ‘pull’ factor, push meaning the factors disturbing one’s livelihood, and pull meaning the attracting factors for one’s livelihood at the destination, the decision to migrate can be

influenced by the susceptibility to being resilient to an unexpected happening within the normal livelihood. Meaning, improved resilience could influence the decision to migrate or not (Mallick, 2019), and according to Action Education (July 6, 2022) education helps strengthen communities' resilience.

In a monthly report, the president of Action Education, Jean-Pierrre Pichaut emphasizes that *"Education is the most effective tool to prevent and adapt to the consequences of climate change."* – Action Education president Jean-Pierre Pichaut, June 2022. P. 3. Provided that this offered education is accessible to all and of high quality, education is a tool that helps especially the vulnerable populations with adapting to and preventing the consequences of climate change (Action Education, June 2022). However, to reach this level of adaptation and prevention, it is fundamental that there is access to lifelong training and education. This is to be able to solve sustainable development related complex issues. As Action Education states it: *"Education can promote the emergence of a new form of citizenship and of entrepreneurship guided by the present and future wellbeing of humanity and the planet."* – Action Education, June 2022; p.13.

***"In the face of the climate crisis,  
education is our greatest strength!"***  
- Action Education, June 2022; p.14.

For this research, the term education contains both formal and informal types of education and is mainly focussed on early childhood until high school. This is to limit the broadness of the scope of the research, but not forget about informal institutions providing education or education through upbringing.

## Decision to Migrate

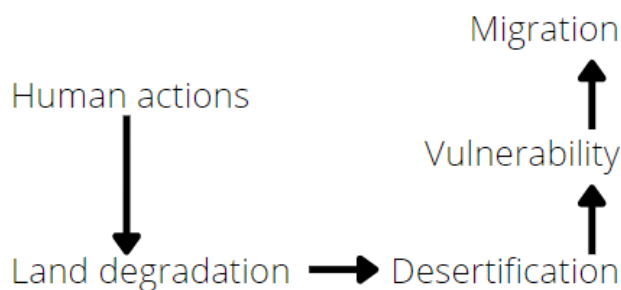
Humans are creatures of movement. Some choose to move looking for a job or income, others to escape from violence or violation of their human rights and others move as a response to changing livelihoods due to climatic changes (United Nations, 2020). In the late 1800s, there was thought to be a connection between people being on the move and climatic changes. However, not until the 1970s or 1980s this connection between migration and environmental change was investigated by researchers (McLeman & Gemenne, 2018). In their handbook of environmental displacement and migration, environmental migrants are defined as: *"... persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their homes or choose to do so, either temporarily or permanently, and who move either within their country or abroad."* – McLeman & Gemenne, 2018., p. 4. This research will base the concept of migration on this definition.

Choosing to migrate is a livelihood decision. The decision of one individual can influence the decision making process of others within the community. However, this is not always the case, and sometimes the choice for migration is not voluntarily made. Still, it can be said that every migration process starts with a 'push' factor coming from where the person lives, and ends with a 'pull' factor that is coming from the destination (Mallick, 2019). Push meaning the factors that are disturbing the persons' normal livelihood and pull meaning the factors that attract the person to make the decision to migrate. This means that being vulnerable in one place, and being more resilient in another can influence why people choose to migrate (Mallick, 2019).

In fact, vulnerability due to climate stress has caused communities to choose migration as an adaptation strategy. Vulnerability is commonly defined as; people or communities that do not have the ability to adjust to or deal with negative effects of, for instance, climate change (Fahad et al., 2022). People or places that are resilient are able to cope with- or recover from

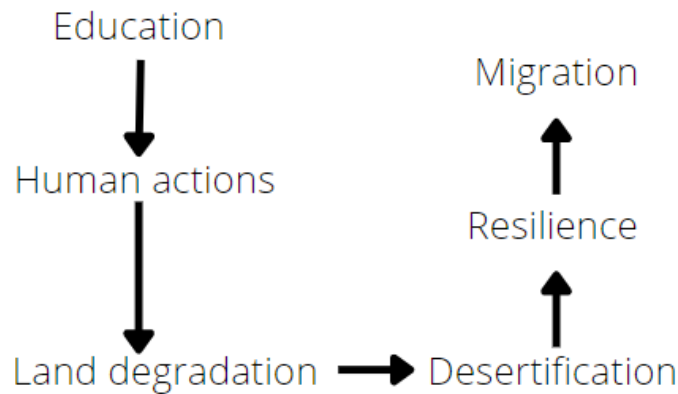
external disturbances or stresses that are the result of environmental, social and political change (Deshingkar, 2012). According to Deshingkar (2012), with more stresses coming from slow climatic changes and impacts, this could mean that more people are going to rely on migration in order to cope with and adapt to (climate) change. According to the booklet by UNESCO (2003), desertification can push entire communities to migrate to regions or cities where conditions for survival are looking more promising, but turn out to be very difficult as often cultural identity and social stability are threatened at the place of destination. Desertification also gets accelerated as displacement and migration have disastrous impacts on the environment due to, for example, the overexploitation of natural resources. Therefore, long term migration is not desirable for sustainable development. Instead, it is stressed that the promotion and implementation of development programmes that are supported by local people is more important for sustainable development (Mallick, 2019).

The above mentioned concepts and their linkages are visualized below from which a hypothesis is derived that is tested in this research. According to Mirzabaev et al., (2019) human actions like unsustainable land management practices are causing land degradation. Land degradation can lead to desertification which causes loss of soil fertility and can cause food insecurity. These factors add to the vulnerability of people in a community which can influence the decision to migrate. People leave the villages to, for example, bigger cities for opportunities and income. However, migration is not desirable for sustainable development (Mallick, 2019; UNESCO, 2003).



**Conceptual framework derived from Mirzabaev et al., 2019; & Mallick, 2019.**

Based on this framework the following hypothesis is derived: *“If people from areas that are threatened by natural hazards like desertification receive quality education, then changes in behaviour and action will help combat desertification and make people opting less for migration as the resilience of the community increases.”* To explain, when education gets added to the equation, the negative impact of human actions on the environment can be decreased or even transformed into a positive impact through protection and mitigation projects, due to a change in behaviour and awareness. Also, communities will learn how to better adapt to, for instance, climatic stresses. This increases the resilience of the community as they know how to adapt to and fight processes like desertification and thus might lead to people opting not to migrate. This might especially be the case when the education is focused on children as they have their future ahead of them and can decide to leave or stay and create a livelihood for themselves. Visualizing the new hypothesis would look like the framework below:



**Conceptual framework following the hypothesis following up on the theory by Mirzabaev et al., 2019; & Mallick, 2019.**

The framework states that education decreases the negative effects of human actions on the land, which then decreases the amount of land degradation, which decreases the threat of desertification. This, and the availability of education cause an increase in the resilience of the community, which decreases the choices for migration. This research uses the first situation that has been proven by literature as a starting point to see if the hypothesis, visualized in the second framework, can be approved or falsified using the data collected during the research.

## Methodology

For this thesis two main methods of data collection have been used: document analysis and fieldwork. The combination of these two gave the opportunity to research desertification and the role of education both at a local and a wider scale. This provided insights on how factors on a countrywide scale influenced life on a local scale. The use of more than one main method helps to confluence evidence and to create credibility. Also, the use of multiple methods can help reduce potential bias's impact.

### Document Analysis

To substantiate the data that has been collected in the field and to provide an overview of the situation regarding desertification and education, I used available online literature and reports. These public records are legal reports from the Moroccan government about desertification in the country and their efforts to fight this environmental process. Also, documents published by NGOs were used like Action Education. Many reports were French and thus had to be translated into English. As documents are practical and manageable resources, document analysis is an effective and efficient method for data collection. Also, as documents come in different forms and are commonplace, they are seen as reliable and accessible sources of data. Being non-reactive, stable data sources, documents are unchangeable by the influence of the researcher or the research process. Documents can be reviewed and read multiple times over the course of the research period and still remain the same (Triad 3., March 9, 2016).

Document analysis can be used for a variety of reasons, it can be used as a primary data collection method, or as complimentary to other methods. It is often used to strengthen or support the research. As they provide a broad amount of data, documents are often useful for background information and contextualizing a research (Triad 3., March 9, 2016). In the

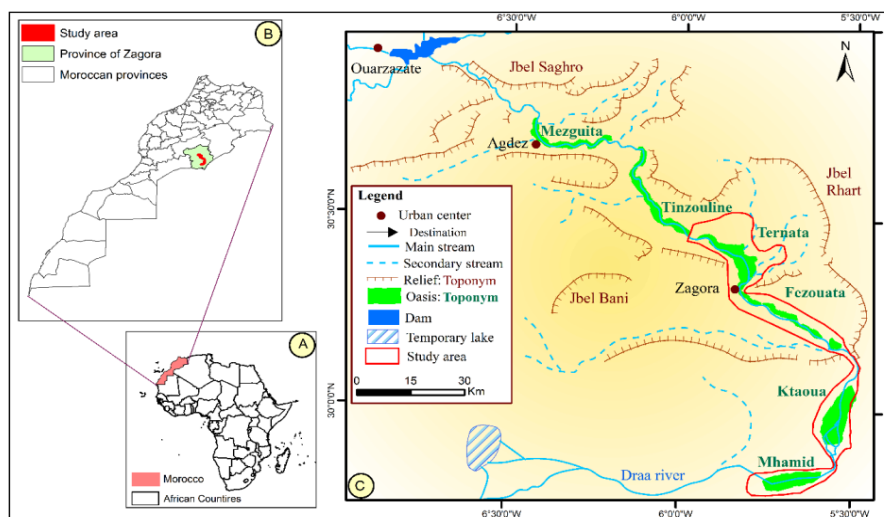
case of this thesis, public records are used to provide that background information and give a broad overview of the situation in Morocco regarding combating desertification and the usefulness of education in this matter. Also, academic literature is used as complimentary data to support claims made by interviewees during the case study.

## Case Study Area – M’hamid el Ghizlane

For this research, a case study has been done as this gave the opportunity to see how desertification works on a local scale and what role education can play or plays in combating this process. The case study chosen for this research is a small oasis town located in the Middle Draa Valley in the Southeast of Morocco, called M’hamid el Ghizlane (Figure 1). With desertification taking place in this area, the inhabitants have to deal with a threat to food security due to loss of soil fertility. Affected crop yields impact incomes and cause economic losses, forcing local people to migrate to big cities for their livelihood, income and to support their families who stayed behind (Karmaoui, 2019).



**Figure 1: Location of M’hamid el Ghizlane in Morocco**  
<http://riadzany.blogspot.com/2017/02/international-festival-of-nomads-16th.html>



**Figure 2: (A) Location of Morocco in Africa. (B,C) Zagora Province and Middle Draa Valley location; Ait Lamqadem et al., (2018).**

The Middle Draa Valley (MDV) is part of the Zagora Province, which is an area characterized by an arid climate meaning low rainfall and high temperatures, shortage of water and erosion by wind. Inadequate agricultural practices and erosion by wind and water are causing a severe environmental pressure on the area. The Draa River flows through the MDV with its six oases: Mezguita, Tinzouline, Ternata, Fezouata, Ktaoua and M’hamid (see Figure 2.) (Ait Lamqadem et al., 2018).

The MDV is at the border of the arid Sahara desert. Located between the hyper-arid desert and the more humid parts of Morocco, these oases are functioning as a buffer zone. High salt concentrations, low precipitation and a weak formation rate of organic matter are, according to Karmaoui (2019), characteristics of an oasis-desert ecosystem like the MDV in Morocco. This buffer zone is working as a barrier to stop the Sahara from advancing and taking over more land. Due to harsh climate conditions, scarcity of water and overgrazing of natural vegetation, the valley and its oases are threatened by siltation and salinity (Karmaoui, 2019). As arid areas are dependent on water for the control of vegetation and soil, the impact of droughts are detrimental. According to Karmaoui (2019), due to the combination of droughts and the dam storage upstream, half of the palm trees in the MDV are already gone.

The Mediterranean Desertification and Land Use method is used to identify Environmentally Sensitive Areas (ESAs). Using different variables like vegetation, soil, climate, landforms, geology and human actions, different types of ESAs to desertification can be analysed. Grouping these variables and setting a certain weight to these groups helps to evaluate the four different layers: management, soil, vegetation and climate quality. The MEDALUS method and the developed GIS model may be used to understand and distinguish the threat of desertification to certain areas (Sepehr et al., 2007; Ait Lamqadem et al., 2018). In Figure 3, the Environmentally Sensitive Area Index (ESAI) of the MDV is given after putting it in a Geographic Information System (GIS). With dark red being very high sensitivity to desertification and green being low sensitivity to desertification. Looking at the location of M'hamid el Ghizlane in the figure, a dark red and red colour can be identified, meaning a high to very high sensitivity to desertification. This high sensitivity to desertification is what makes this area interesting for research.

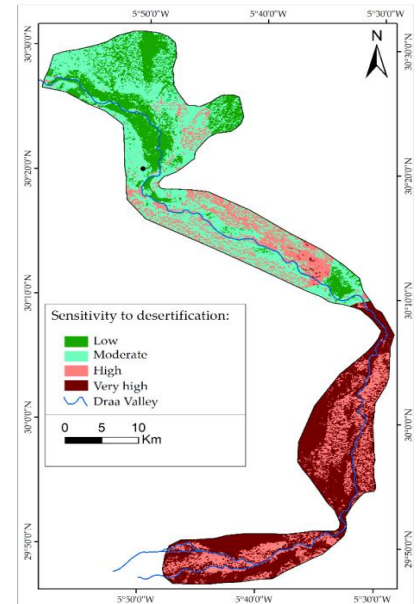
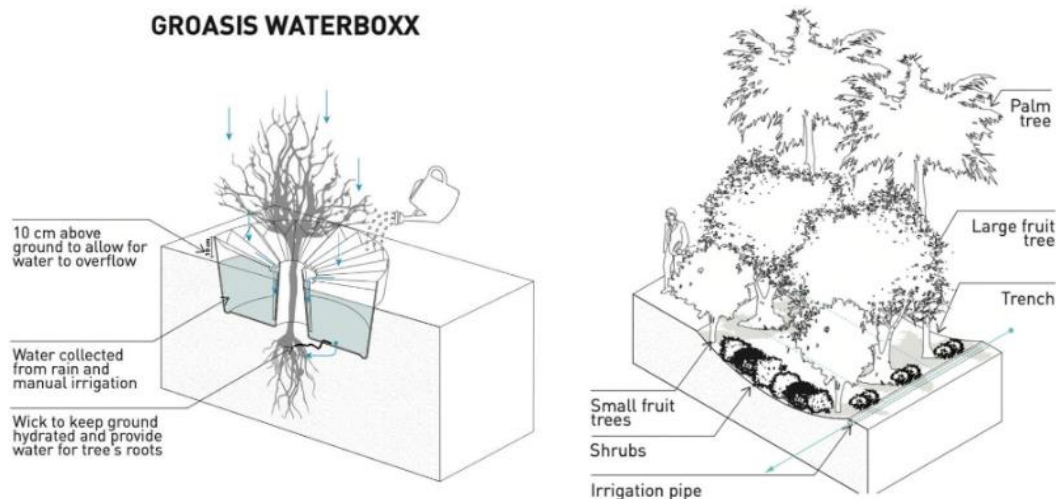


Figure 3: ESAI Map. Ait Lamqadem et al., (2018).

## Sahara Roots Foundation & Joudour Sahara

The choice for M'hamid el Ghizlane as the case study area was also based on the presence of initiatives focusing on education and desertification. During the entire stay in M'hamid el Ghizlane there was contact between me and these organizations. They provided me with information, helped me conduct interviews and introduced me to the right people and experts.

The Sahara Roots Foundation (SRF) presents itself as '*a grassroots approach to reduce desertification in the Moroccan Sahara*' – Sahara-roots.org. Founded in 2008, the SRF wants to raise awareness amongst the local community about maintaining their own natural environment. Their efforts are put in planting trees to fight desertification, assisting in clean-ups of the desert area and distributing a booklet called 'Me and my Sahara' amongst local children to teach them about the place where they live and the importance of maintaining it (Sahara Roots Foundation » About Us, 2021). For their tree planting, the Sahara Roots Foundation uses a planting tool called Groasis Waterboxx that maximizes the use of water and increases the survival rate of the trees from 20% to 80% (Figure 4). The goal is to revitalize the oasis by using a pilot farm to test a permaculture-based wadi system for a thriving oasis by re-establishing a three tire structure: canopy level palm trees, fruit trees and ground vegetation (Figure 5) (Joudour Sahara., April 17, 2022).



**Figure 4: Groasis Waterboxx tree growing system & Figure 5: Three tires of vegetation for a thriving oasis. <https://joudoursahara.org/the-music-school/> (2022).**

Founded in 2016 and working together with the Sahara Roots Foundation, Joudour Sahara is an Eco and Cultural centre in M'hamid el Ghizlane. It comprises a visitors centre, a music school, an exhibition centre for cultural heritage, a botanical garden showing the local flowers, trees and plants of this desert which at the same time works as a learning ground for nature conservation, a restaurant serving local food, an eco-lodge showing how to live in the local environment and last but not least a centre for hiring local guides for desert trips with camels and tents. Providing a musical program to youth, Joudour Sahara works on enriching their lives and promoting and preserving the rich heritage of the Middle Draa Valley (Sahara Roots Foundation » Joudour Sahara Culture Center, 2021). Right now, the centre engages about 100 children with more than 100 musicians in the valley, with students coming from M'hamid el Ghizlane and Tagounite making it an unique initiative for the region of south-eastern Morocco. Joudour Sahara also works hard on realizing a significant amount of female students at the school, breaking the taboo of girls playing music and dancing. Joudour Sahara has become a leader in tackling gender inequality by providing education to girls and by attracting more and more girls to participate in the program. In partnership with the Playing for Change foundation, the children learn to play traditional music styles and together with Aziza Chaouni Projects they are realizing a sustainable construction for their new cultural centre in the middle of the oasis. Joudour Sahara and the Sahara Roots Foundation believe that environmental conservation and cultural preservation are intertwined as environmental (land) degradation leads economic loss as agriculture is no longer the economic driver that it used to be, leading to a great rural-to-urban move. This migration to bigger cities takes the indigenous knowledge out of the MDV region, causing a disappearance of the traditional music, culture and way of life in the desert (Joudour Sahara., April 17, 2022).

## Data Collection

In order to formulate an answer to my main research question and the sub questions, I did qualitative data collection. First, informal conversations were held with a local guide in Zagora, Halim Sbaï, president of Joudour Sahara, Maryem, employee at Joudour Sahara, Nour, English teacher, Anas, cafe employee, and other local people and children to touch upon the characteristics of life in M'hamid el Ghizlane, the state of desertification in the area and its impact on the lives of the local people. These people were chosen as they all had a different position in the community and could thus give insights from different perspectives. They all voluntarily participated in these conversations and were found through meetups at



the local cultural centre and through invitations to join a visit or a field day. The main question asked here was to what extent the environment in M'hamid el Ghizlane affected their daily activities and what they think is needed to make life easier in this town. Aside from these informal conversations, in-depth interviews were conducted to gather expert knowledge on the matter of education and desertification in Morocco. These interviews were done with local school teachers Nezaha & Elmouiaouaki Abderrahman, teachers from the music school Naji & Brahim, Habib, tree caretaker for the Sahara Roots Foundation, Siham a local girl from Bounou, a town where the effects of desertification are clear, Maryem of Joudour Sahara, Nour, English teacher, NGO from the region called Maroc Jeune and the CEO of NGO Climate Refugees Amali Tower. These experts, some experts by experience, others by qualification, were asked questions about the types of education, the quality and importance of the education, the focus on the environment, desertification in M'hamid el Ghizlane and measures to fight this process, life with the threat of displacement, opportunities in M'hamid el Ghizlane, other projects on desertification and the concept of climate migration. Examples of interview questions and a data collection table can be found in appendix A & B.

These in-depth interviews were semi-structured with probes. This means that a set of questions were prepared in advance and probes were added to steer the interview in a way that all important questions were answered. This gives the researcher structure and guidance and makes sure that no questions will be skipped. Though, there is the freedom to dive into certain topics that have not been addressed in the questions beforehand and to elaborate on interesting and important topics. Using the method of 'snowballing' the interviewee was asked if he/she knows an interesting person or organization that can be contacted for further interviews or insights. This helped broaden my reach and helped to plan interviews with people that might have not been on my list from the start like Siham and Amali Tower.

As most of the interviewees were the most comfortable in their own language, most of the interviews were done either in French or Darija and thus had to be translated into English. This translation was done by Maryem from Joudour Sahara and Nawfal Serhir from Orion Trek Voyages Agadir, they are both born in Morocco and master Darija, French and the English language.

After the data collection, the interviews with an audio were transcribed, summarized and coded into recurring themes. And the interviews without audio were summarized from the notes that were taken and added to the themes. Examples of those themes are: 'living situation in M'hamid el Ghizlane', 'external factors', 'environmental education', 'migration choice' and 'government involvement'. These themes relate to the sub questions of this research as they all touch upon the different aspects that in the end answer the main research question. Using these themes, it helped structure the available data into findings that together add to the answer of the sub and main research question.

Another method of data collection that was used was participant observation using field-notes, photography and video recordings. This is mainly used to get a clear view on the current situation at the case study area and the problems and initiatives present and to substantiate the claims coming from the interviews. Participant observation is a method to try to understand people or communities by spending time being with them and experiencing their way of life (Laurier, 2010). This method focuses on being as close to the subject as possible whereas other methods are more distant. However, the researcher does not want to intervene and the presence of the researcher should not change the way people behave (Laurier, 2010). Also, participant observation is a great method when youth are part of the research as it decreases the power imbalance between the researcher and the young people (Langevang, 2007).

## Ethics

While doing the research, especially fieldwork in a topic of development, it was important that it was always carried out in a way that is ethical, even more so when young people are involved. It is important to protect someone's privacy, dignity and safety at all times. Also, as briefly mentioned before, the researcher should take into account the power relations between actors and between actor and researcher (Langevang, 2007). Through informed consent, participants were told about the purpose of the research, the fact that they have the right to deny participation and how the information provided will be used. This consent was done verbally and anonymity was guaranteed at all times when necessary or asked for. At any time, my identity as a researcher was known and clear and the final thesis will be shared with those who are interested.

## A New Learning Experience – Limitations to this Methodology

As a student educated through the Western school system, I learned certain academic ways of conducting data. However, arriving in the case study area of M'hamid el Ghizlane, I soon noticed that my planned methods were not going to work as much during the fieldwork. This is mainly due to a difference in how we learn things at school theoretically and real life situations on the ground. These situations required a high amount of flexibility and improvising as interviews or other data collection opportunities could appear at moments when not expected. Therefore I always kept my notebook close to me and wrote as many general and more in depth questions down to be as prepared as possible for any data collection opportunity. The moment you step foot on soil that is completely different from what you are used to, it is crucial to try and go with the flow of that local community and adapt to their way of life. In my case, this resulted in being ready to interview someone with a five minute notice and rescheduling appointments as people turned out to not be available or present in the area anymore. What made the data collection even harder was the present language barrier. As Morocco's main languages are Arabic, Berber and French it is sometimes difficult to communicate as the level of English is not always high. Getting help from local people and friends to translate interviews and conversations for me, valuable information still might have gotten lost in translation. Also, many (governmental) documents were only written in French, causing the same problem of possible valuable information getting lost in translation. Even though the language barrier made it more difficult to collect data, I managed to collect data and built an analysis and conclusion from it.

## Findings

### Daily Life in the Desert – Experience from a Western Point of View

Growing up in the Netherlands, I never really had to experience or 'deal with' extreme heat. I knew that going to the Sahara desert in Morocco would be a big difference for me, requiring a certain amount of flexibility and adaptability, however, I was intrigued to see and experience this type of lifestyle myself. After arriving in Marrakech, taking a five hour bus to the city of Ouarzazate, which is seen as the gateway to the desert, and another 5 hour bus to finally end up at M'hamid el Ghizlane makes it quite the road trip. Passing a few other oasis towns, M'hamid el Ghizlane is the last town at the far end of the national road. Where busses leave and arrive in Marrakech at every hour of the day, there is only one bus going to M'hamid el Ghizlane arriving at 9:30 pm. and only one leaving the next day at 6 am. The only other means of transportation are shared taxis, if you are lucky as their presence and availability is not promised and they often wait until they are full, and tourist coaches that

often only stop in the town for a quick cold drink before going into the Erg Chegaga dunes or on their way out. These factors and the fact that everywhere you look there is nothing but sand and dust, makes it very much feel like an isolated location.

As the only foreign looking person in town, I got a lot of eyes at me with friendly smiles and offers to help. Just like in many other small towns, everyone in M'hamid el Ghizlane seems to know each other and after a few days even I got more used to seeing the same faces around town and people also got more used to me. Small conversations in my poor Arabic helped the people to open up more to me and already on the first day an invitation for a tea at a local home was offered to me. As I was already in contact with a local organisation there before I arrived also helped with getting in touch with the local people and feeling more comfortable in a completely new community to me. Just like in many other parts in Morocco, the moment you leave the real tourist areas like the souk in Marrakech, people are genuine and eager to help a person out expecting nothing in return.

As temperatures in M'hamid el Ghizlane in May already rise to a good 40 degrees, life is adapted to this extreme heat. People only come out early in the morning and late in the afternoon / evening around 8pm. During the day the sun is burning on the pavement and you need to fully cover your head in order to protect yourself. However, you can leave your hat at home as strong winds easily blow them off your head. The only way to properly protect yourself and be comfortable at the same time, is wearing a 'Chachia' or better known as a Sahara Nomad scarf, wrapped around your head and neck. Once the sun is down, the town comes to life and the three cafés that are open are filled with people.

On Saturdays and Sundays the local music school organizes music classes for the local children of all ages. Around 6 or 7pm the children arrive and start socializing. What surprised me was the kindness of all the kids, all greeting and shaking hands with each other and me. Despite an unfamiliar face of a foreign person, the children get to work and sing songs and play instruments together with the teachers of the school. During my time in M'hamid el Ghizlane, I had the privilege to join the school on a trip to the oasis where the Sahara Roots foundation is creating a green wall of trees and the location of the future Joudour Sahara culture centre. Together with all the kids in a trailer connected to a tractor we made our way over the dusty paths, crossing the dried up Draa river and through the oasis passing countless date palms. Spotting some grazing dromedaries in the dried up river bed and listening to the music made by the children in the trailer, was a truly unforgettable experience. Arriving at our destination, everyone got to work to create a 'stage' made by Moroccan rugs that were placed in a square on the sand so that the musicians could sit down in a half circle. Listening to the traditional Moroccan music, we could see the moon rise above the dunes and palms (Image 3).



**Image 3: Children and teacher performing in the Oasis of M'hamid el Ghizlane at the grounds of the future Joudour Sahara culture centre. May 15, 2022.**

Another class that I got to participate in was an English class given by Palestinian-American Nour Houssein. On the top floor of the music school, Nour practiced basic words and sentences with the children from different ages (Image 4). In the days before the class, the children from the village came to speak with her and asked when the English class would finally take place. Many children in town are eager to learn English as, to them, it is the first step in getting out of M'hamid el Ghizlane and getting a good job. As I was sitting in the back of the class, listening to the children practicing the English, I suddenly got all eyes on me and I had to do the same sentence, but: in Arabic.



*Image 4: Classroom at the top floor of the Joudour Sahara centre in M'hamid el Ghizlane, May 17, 2022.*

The people of M'hamid el Ghizlane feel a little forgotten by the Moroccan government as basic facilities are lacking in the town. There is no hospital and for treatments for, for instance, scorpion bites, people rely on traditional medication as there are no anti serums available. With this knowledge in the back of my head, I made sure to take my distance when I had an encounter with one of those little creatures myself.

Even though some might say that life in the desert is slow, I do not think this life is made for everyone. I have great admiration for this community that shows great resilience, continuing to live in extreme heat with strong dusty winds and a lacking amount of facilities that we, as people who grew up in Western countries, probably take for granted. Despite the harsh circumstances under which these people live, the one thing that I remember the most from this experience is the kindness of the people. This especially became clear when I visited a neighbouring village called 'Bounou' together with Joudour Sahara president Halim Sbaï and Climate Refugees CEO Amali Tower. While Halim, Amali and a film crew from the UK were busy recording a documentary in the village, I had the honour to drink tea in a local home with Siham, a local girl who experienced displacement due to the effects of desertification herself. Of course, communication was not easy again. Using our hands and feet and the little French we knew we were able to talk about our lives and it became clear to me how completely different they were even though we had the same age. The house that she lived in got destroyed by sand and so she had to move into a house of a family friend. The house consists of one room with an open roof and some rugs on the ground. Using a portable gas tank she made me a delicious cup of Moroccan tea. Afterwards, Halim, Amali and the film crew returned and we were able to have a detailed and in-depth conversation with Siham as now translators were present. The willingness to share the little these people have, amazed me every day.

For a large part, the struggles of the people of M'hamid el Ghizlane are caused by the harsh climate that they live in. Despite being an isolated town at the end of a national road, the living conditions do not differ much from the hardships of other towns in the world that have to deal with desertification. Therefore, the situation of M'hamid el Ghizlane is being addressed, to some extent, within the efforts of the international and national anti-desertification plans.

## International Anti-Desertification Efforts

Adopted in 1994 in Paris, France, the United Nations Convention to Combat Desertification (UNCCD) is an international agreement to combat desertification in countries, in particular in Africa, that are seriously affected by desertification and/or drought. The convention, ratified by countries all over the world showed an increasing awareness of the importance of acknowledging and combating the problems of desertification (UNESCO, 2003). The objectives of the convention to combat desertification are to improve the livelihoods of the populations affected by desertification and drought, to improve the productivity, restore and preserve land, to introduce, in the affected areas, sustainable development and create more efficient water usage. Indirectly, the convention also stresses the importance of the adoption of National Action Plans by every country in order to combat desertification. All members of a society should join forces supported by the government in order to solve and prevent the problems created by desertification (UNESCO, 2003).

The action plans that resulted from the UNCCD to combat desertification require long term and regular monitoring. For these measurements, observatories have been created to collect the data. The Sahara and Sahel Observatory (OSS) is an example of a monitoring organisation and measures the drylands around the Sahara and its biological potential. The main objective of the OSS is to promote the optimization and development of data that can be used for desertification control. The actions done by the OSS are mainly focused on the sub-humid, semi-arid and arid areas of Africa. Amongst the 33 member countries of this observatory is Morocco (UNESCO, 2003; Sahara and Sahel Observatory, 2022).

## Anti-Desertification Efforts in Morocco

Following up on the Rio convention in 1992 and the United Nations Convention to Combat Desertification (UNCCD) in 1994, which Morocco signed on the 11<sup>th</sup> of December, 1996, the Moroccan government has put in place the National Action Program to Combat Desertification (PAN-LCD).

The focus of this program is: 1. To contribute to the ongoing fight against desertification by providing resources; 2. Fight the root of the problem of desertification by providing attention to socio-economic factors; 3. By reforming new long-term policies and action programs (l'Agence Nationale des Eaux et Forêts, June 2013).

In the report by the Moroccan Government published in June 2013 about the National Action Program to Combat Desertification there are a number of national strategies and plans listed with their link to fighting desertification in the country. The first strategy listed is called the 'National Watershed Management Plan'. The objective of this plan is to develop sustainably and conserve the natural resources upstream of dams, protect the hydraulic infrastructures downstream and to promote an integrated and participatory development process. This gets done by classifying the watersheds according to their degree of severity of erosion. The National Watershed Management Plan is an example of a national strategy that links to desertification as it addresses a main problem of desertification, namely: soil erosion (Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, 2013, June; p. 17.)

Another example of a national strategy implemented by the Moroccan government that helps combat desertification in the country is the 'National Plan for the Restructuring and Development of the Palm Grove (NPRDPG)'. This plan is to reconstruct and renew palm groves for the long-term by planting noble varieties. Also, to safeguard the growth of these renewed palm groves, the research and advisory services also need to be strengthened. This plan helps to combat desertification as restoring and protecting the oasis environment

can help to gradually recover the land (Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, 2013, June; p. 18.)

The National Strategy for the Conservation and Sustainable use of Biodiversity aims at defining a national strategy for biodiversity and developing a national action plan to protect biodiversity. This plan is linked to desertification as the sustainable management of biodiversity allows the maintenance of genetic heritage of varieties that are adapted to local climatic conditions (Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, 2013, June; p. 18.). So maintaining species that are adapted to the conditions of oasis and desert environments can increase the resilience of an area. These strategies and plans are examples of the first and third objective of the PAN-LCD to contribute to the fight of desertification by providing resources in the shape of projects and action programs that are funded by the Moroccan government.

The Green Morocco Plan (Plan Maroc Vert) (Image 5) is focused on the social and economic side of sustainability and desertification. It supports agricultural practices that are small-scale by improving the incomes of the farmers that are the most fragile. By supporting the farmers with a higher income, the need to migrate due to loss of income and job opportunities caused by extreme heat, lack of water and desertification might become less pressing (Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, 2013, June; p. 18.). The focus of the Green Morocco Plan is in line with the second objective of the PAN-LCD as it provides attention to the socio-economic problems that are seen as the root of the problem of desertification.

The third objective of the PAN-LCD also mentions the reformation of long-term policies. Table 1 on the next page, is a list of Moroccan laws and policies related to the environment. It also shows what their connection to the anti-desertification efforts entails. These policies are all very promising and help tackle the problem of desertification from different perspectives. There is a focus on water, renewable energies, reforestation and protection of forests and the protection of the environment in general.



**Image 5: Logo Green Morocco Plan (Le Maroc Vert)**  
<https://www.agriculture.gov.ma/fr/data-agri/plan-maroc-vert>

Legislative and regulatory texts	Content	Relation to the PANLCD
Law n°11-03 on the protection and enhancement of the environment	Sets the general framework for environmental protection and the main principles (polluter-pays, establishment of discharge standards, etc.).	<ul style="list-style-type: none"> <li>- <b>Article 18: Special protection measures are enacted to combat desertification, flooding, the disappearance of forests, erosion, loss of arable land ... The said measures may be declared of public utility and be imposed on any operator or beneficiary.</b></li> <li>- <b>The respect of the provisions of the law contributes to the improvement of the quality of the environment and subsequently to the effective implementation of the of the PANLCD.</b></li> </ul>
Law 12-03 on environmental impact studies and its application texts	Defines the conducting procedure, the content of an environmental impact study and the types of projects subject to it.	<ul style="list-style-type: none"> <li>- Complying with environmental impact studies recommendations helps combat desertification.</li> <li>- The regionalization process of environmental impact studies will support the implementation of the adaptation of the PANLCD to zonal specificities.</li> <li>- Mitigation measures could include actions of reforestation.</li> </ul>
Law 10-95 on water	Sets the framework for the proper management of water resources and the generalization of access to water (water use, quantitative and qualitative management of the resource).	<p>Rational water management will allow :</p> <ul style="list-style-type: none"> <li>- greater mobilization and availability of water</li> <li>- a reduction of crises and a better use of water,</li> <li>- Improved monitoring of alerts,</li> <li>- a reduction in the vulnerability of populations.</li> </ul>
Law n°13-09 on renewable energies	Is part of the national energy policy whose goal is to promote the development of renewable energy sources.	The use of renewable energy reduces the pressure on forest resources, in particular the consumption of firewood
Dahir of October 1917 on the conservation and exploitation of forests.	Defines the forest estate and regulates its use	Establishes the conditions of use, exploitation, protection and conservation of forest resources, so as to ensure the sustainability of the forest heritage.
Law n°22-07 on Protected Areas	Protects the natural heritage by defining the different Protected Areas and the process of their creation.	The development and management plans of the Protected Areas are a tool for conservation and development of natural resources.

**Table 1: Review of the main legal texts related to the PANLCD. Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification. (2013, June). Translated from French to English.**

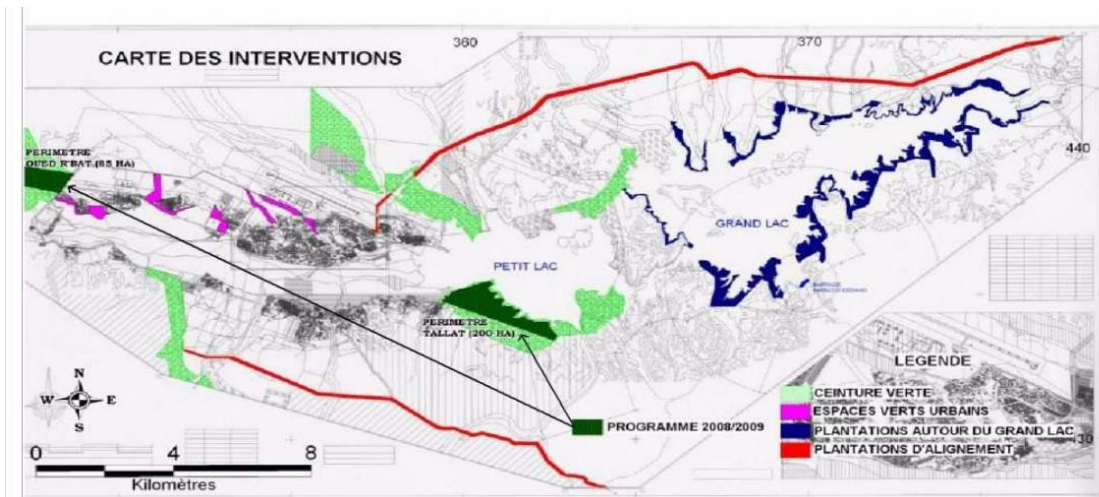
## La Ceinture Verte (The Green Belt)

An example of a project initiated and funded by the Moroccan government to combat desertification and part of the PAN-LCD, is the Green Belt Project (La Ceinture Verte) in the city of Ouarzazate. According to Maroc Jeune president Mohamed Ben Issa *“The Green Belt Program is a program launched by the Moroccan government, more specifically, the ministry of agriculture with a partnership with the high commissariat of water and forest in Morocco.”* – Interview; Mohamed Ben Issa, June 18, 2022. The main objectives of this project were:

1. Protecting the city of Ouarzazate from desertification and pollution;
2. Protecting the city of Ouarzazate from the effects of strong Chergui wind, which is the strong continental wind coming from the Sahara from the East or Southeast of the country (Jourjon, April 22, 2013);
3. The creation of green spaces in the city for recreational purposes (Pseau.org, December, 2016; Association Interdisciplinaire pour le Développement et l’Environnement December 21, 2017).

Ouarzazate is seen as the gateway to the desert, and is coping with the threat of desertification. Even though it is tricky to plant trees in drylands, this city has accepted the challenge and started using wastewater from the city itself to water the newly planted trees and by doing so decrease the impact of so-called dust storms and combat desertification (United Nations Environment Programme, August 8, 2017). With the city already depending on the El Mansour Eddahbi dam for its water, cooling of the solar power plant ‘Noor’ that is

located near Ouarzazate and irrigation for agriculture, the dam cannot also provide irrigation water for the Green Belt project (United Nations Environment Programme, August 8, 2017).



**Figure 6: Location of the project, with in green being the green belt. *Projet de ceinture verte autour de Ouarzazate et réutilisation des eaux usées; December 2016. Pseau.org.***

The project was put in place, as a green belt made from trees is necessary for the protection of the city from dust, land degradation and desertification (Figure 6). In order to be able to water the trees that form a protective buffer between the desert and the city, Ouarzazate started recycling its wastewater. Using solar power, the water gets pumped to the plantation site to water the trees, however, before that happens, the wastewater gets collected from households and in a number of lagoons the water gets filtered (United Nations Environment Programme, August 8, 2017).

The project ran for 5 years from 2012 till the end of 2017 and is called a ‘success’ by the involved parties and local people. According to the article by the United Nations Environment Programme (October 23, 2015), the project created opportunities to use indigenous knowledge and experience and through the years it has created employment opportunities providing a stable income to people from the local community. Because of the high involvement of the local community by creating jobs and using local knowledge, the project received a high level of engagement from the community and support resulting in caring for and looking after the trees (United Nations Environment Programme, October 23, 2015).

Not only did the project provide benefits to the people directly involved in the project, the green belt itself also started functioning as a recreational space for the people living in the city. At the same time, this project has been used as a way of sensibilization and raising awareness about the benefits of a green belt and taking care of the environment for the livelihood of the local communities (United Nations Environment Programme, October 23, 2015). Now there is hope for the project to become a model in the fight against desertification worldwide. *“The next step is to officially move the project in Ouarzazate to other regions. We will bring the local representatives to Ouarzazate, to locally observe our example, how we worked on it, use it as an example and to apply it in their region. We can also bring our expertise to them by local visits to the lands and share as much input as we can to help make other projects successful as well.”* – Interview; Mohamed Ben Issa, president Maroc Jeune, June 18, 2022.

The success of the Green Belt project in Ouarzazate gives a feeling of hope that the country of Morocco can combat the threat of desertification. And by combating desertification, there is hope that the value of places gets acknowledged and people actually decide to stay instead of leaving their homes to other cities/places for a better chance in life. *“If we can fight*



*desertification, then we are part of reviving that region. We help give back the historical importance of our Southeast regions in Morocco and we can reassure people that their region is valuable. We have our expertise to help make it work, so that we can stop local migration.*” – Interview; Mohamed Ben Issa, president Maroc Jeune, June 18, 2022. The next step of this project was supposed to be to move the work to other regions and start the same process. However, due to the pandemic that started in 2019 and a change in government made the project go into stand-by. The moment the opportunity arises, *“we will bring the local representatives to Ouarzazate, to locally observe our example, how we worked on it, so that they can use it as an example and apply it to their region. We can also bring our expertise to them by local visits to the lands and share as much input as we can to help make other projects successful as well.”* – Interview; Mohamed Ben Issa, president Maroc Jeune, June 18, 2022.

According to the article by the United Nations Environment Programme, (August 8, 2017) there are multiple reasons why the project was a success, with government involvement being one of them. Despite the efforts made by the Moroccan government, supported by the United Nations and other international initiatives, the educational initiatives remain relatively small in scale and the environment keeps deteriorating Riouch & Benamar (2018). However, zooming in on a local scale, there are some effects of education that I have observed during the case study in M’hamid el Ghizlane.

## Case Study – Desertification in M’hamid el Ghizlane

According to UNESCO (2003), in the past, attempts to combat desertification have not been concentrating on the causes of the natural hazard but on its symptoms. Instead of addressing underlying economic and social pressures, these attempts only focused on tackling problems caused by human activities like overgrazing, over-cultivation, unsustainable irrigation practices and deforestation. *“This often resulted in blaming the victims of desertification for the damage caused without making a serious attempt to understand the forces outside their control driving them to over-exploit their land.”* – UNESCO (2003). p. 69. Before going into the details of the case study area M’hamid el Ghizlane, it is therefore important to note the external factors that somehow ignored M’hamid el Ghizlane with their actions, impacting the livelihood in the oasis town.

The town and the oasis of M’hamid el Ghizlane are threatened by desertification. Sand gets closer and closer to the doorsteps of the houses (Observations, May 13, 2022) and the extreme heat and increasing amounts of sandstorms are making life more difficult (Interview Siham, May 15, 2022). To measure the importance of education in combating natural hazards like desertification, it is important to take into account external factors as well. In the case of M’hamid el Ghizlane, unsustainable irrigation practices and agriculture, and climate adaptation and mitigation not being high on the agenda, have led to a decrease in livelihood. However, what is important to note here is that the town and its environment is also subject to actions done in other parts of Morocco and the world.

Talking to the local people Zagora, M’hamid el Ghizlane and Bounou it became clear that one of the most damaging businesses for the environment and especially the water supply has been the watermelon industry. According to a local guide in Zagora (May 9, 2022), most people used to work in the palmeries growing the popular dates. However, due to a lack of water it is difficult to keep the palms alive and a lot of plantations have been abandoned. People left Zagora for the bigger cities hoping to find work elsewhere.

A new crop was becoming more popular: the watermelon (Image 6). The main benefit for farmers growing and harvesting watermelons is that it is a quick way of making money in a short period of time, compared to, for example, date palms that take a couple of years to grow. However, the watermelon industry uses high amounts of water and has caused groundwater depletion in the areas where the industry was active. The moment there is no water left in the ground, farmers move to another spot and start their industry again, depleting more and more of the groundwater in the Southeast of Morocco (Informal conversation; Mohammed guide of film crew, May 15, 2022; Interview; Maryem, Joudour Sahara, May 10, 2022).



**Image 6. Truck with watermelons, Zagora, May 8, 2022.**

These statements can be substantiated by the article by Karmaoui et al, (2014) & Karmaoui et al., (2016). Farmers choose to cultivate crops that are more profitable in the short run, but more harmful in the long run. Before the appearance of the watermelon culture in the last decade, the total irrigated area in the Middle Draa Valley was dominated by palm trees, alfalfa and wheat. With the introduction of the watermelons, the total irrigated area almost doubled between the years of 2012 and 2013 and now has a total area of about 26 000 hectares. This increase in watermelon cultivation has a dramatic impact on the water demands (Karmaoui et al, 2016). Of all the water resources available, according to Karmaoui et al., (2016), 96.66% is used for agriculture. The remaining 3.34% are spread over domestic use (2.70%), tourism (0.28%) and economic activities (0.36%), meaning that by far the biggest consumer of water resources in the Middle Draa Valley is the agricultural sector.

The impact of tourism is not high in numbers, but still important for the area of M'hamid el Ghizlane as for many people tourism is their source of income. Being the gateway to the Sahara desert (Erg Chegaga), many tours stop here to enter the dunes. With high temperatures year round, tourists like their dip in the swimming pools and fresh water to cool off. The pressure of the tourism industry on the water resources is alarming. Even more so, due to the increasing tourism activities in the area, the pressure on water resources is only increasing. According to Karmaoui et al., (2014), the water consumption by the tourism industry “.. increased from 15.967 m<sup>3</sup> in 1982 to 89 575 m<sup>3</sup> in 2000, an increase of 461%.” - Karmaoui et al., 2014 p. 4. Children acknowledge the opportunities of the tourism industry and are interested in learning English, however, unfortunately due to these pressures on the environment and natural resources, environmental vulnerability is accelerated by social vulnerability. Communities in the Middle Draa Valley are often at the periphery of society with high rates of poverty and illiteracy (Karmaoui, et al., 2014).

Another external factor impacting the livelihood in the oasis of M'hamid el Ghizlane is the El Mansour Eddahbi dam that was built upstream near the bigger city of Ouarzazate (Figure 7). Joudour Sahara co-founder Halim Sbai (May 9, 2022) questions during an informal conversation whether it is up to the local people of M'hamid el Ghizlane to work towards a sustainable way of living to prevent climate change from getting worse, or that it is more up to the decision makers who decided to build a dam upstream causing the Draa river, that used to provide fresh water to the oasis, to turn into a seasonal river with, most of the time, being fully dried up. Also, Maryem of Joudour Sahara (May 10, 2022) mentions in the interview that the oasis of M'hamid el Ghizlane used to be green, but ever since the dam was built, there was no water left in the river to provide the oasis with fresh water. Mohammed, who is a local guide and at that time guided an international film crew (May 15,

2022), substantiates these claims and states that the existence of this dam is one of the main factors for causing problems for the towns located downstream of the river Draa. According to Mohammed (May 15, 2022), the dam is used to provide local cities like Ouarzazate and Zagora with fresh water and for cooling solar panels that are located near Ouarzazate.



Figure 7: El Mansour Eddahbi reservoir, satellite view, Google Maps, 2022.

After the construction in 1972, the Mansour Eddahbi dam controls the release of water in the Draa River. By releasing water periodically from the reservoir, the dam and reservoir were built to ensure the availability of water for irrigation for the oases during seasons of drought (Moumane et al., 2022). This is done by collecting inflows from the Atlas Mountains and the volume of the stored water in the reservoir decides the number and volume of the releases each year (Moumane et al., 2022). Yet, the irrigation needs and thus the demand of water by farmers downstream are higher than what they receive. In order to maintain their oasis, the farmers rely on groundwater in between the releases by the dam. A major drought occurred in the valley in 2021 caused by a lack of surface water and rainfall in summertime. This drought resulted in the inability to water their palms (Moumane et al., 2022). Next to the impact of droughts, the Mansour Eddahbi dam is subject to siltation. This phenomenon causes the capacity of the dam to decrease. Already by the year of 1998 the dam has experienced a reduction of capacity of approximately 25% and this reduction is expected to continue (Karmaoui et al., 2016).

## Anti-Desertification Efforts in M'hamid el Ghizlane

Because of these external factors and despite the projects and the involvement of the Moroccan government and (inter)national organisations in the fight against desertification, the social services and basic facilities in M'hamid el Ghizlane are lacking, impacting the livelihood in the village. The involvement of the government in fighting desertification is less present in M'hamid el Ghizlane, this involvement goes as far as: *“Once a year the government sends trucks to M'hamid to help the local people by pushing away the sand from the houses.”* – Interview; Habib, tree caretaker, May 10, 2022. Other than this yearly

clearance, the government does not provide the initiatives in M'hamid el Ghizlane with financial resources. For instance, the active NGO, the Sahara Roots Foundation, in M'hamid el Ghizlane is mainly dependent on external donations (Sahara Roots Foundation >> About us, Financials, 2021).

In M'hamid el Ghizlane, the threat of the sand is visible, sand builds up high on walls of buildings (Image 7) and people have to sweep away the sand from their doorstep every morning (Observations, May 13, 2022). In the neighbouring village Bounou sweeping is necessary multiple times a day. The lack of water available in the area for irrigation is visible in the countless date palm trees that are turning brown and dying and the dried up Draa riverbed (Image 8 & 11) Also, in many places the soil is cracked and only small plants tend to survive the extreme heat (Image 9 & 10).



**Image 7: Sand reaching high on walls in the town of M'hamid el Ghizlane, May 13, 2022; Image 8: Dried up riverbed of river Draa, May 10, 2022; Image 9 & 10: Cracked soil oasis of M'hamid el Ghizlane, May 10, 2022; Image 11: Palm oasis with a lot of dead palms, M'hamid el Ghizlane, May 10, 2022.**

The increasing lack of water is not only a problem for the town of M'hamid el Ghizlane, other towns and cities in the Middle Draa Valley are coping with the same problem.

Talking to Siham in the neighbouring village Bounou (May 15, 2022), the concept of climate change and desertification are new to her. However, when asking her what the factors are that restrain her from doing her normal daily activities like going grocery shopping and going to school, she mentions the extreme heat and sandstorms. In M'hamid el Ghizlane, the people are familiar with the concept of climate change, but it is never high on their agenda. Surviving in the heat and taking care of family is the top priority for most people.

Images 12 and 13 below show traditional measures against desertification. Using branches of palm trees to create small walls that are located criss-cross to stop the sand from coming closer to where the people live (Interview; Maryem, Joudour Sahara, May 10, 2022). These traditional measures have been used for years and are still being used by the local people of M'hamid el Ghizlane and the surrounding oasis villages. However, with the growing threat of desertification and the increase in the number of sandstorms, these measures alone are not enough anymore to keep the sand out. Thanks to the Sahara Roots Foundation, these traditional measures are now getting accompanied by a new technological tree growing system: Groasis Waterboxx.



**Image 12. & 13: Traditional anti-desertification measures in Ouled Mhia, May 10, 2022.**

The Sahara Roots Foundation was created to help the town of M'hamid el Ghizlane fight against desertification (Sahara Roots Foundation » About Us, 2021). Using a new technological growing system called the Groasis Waterboxx, planted seeds can survive the extreme heat and grow into larger trees. The goal of this project is to plant enough trees to create a green wall to protect the oasis and the towns of M'hamid el Ghizlane and surroundings against desertification. Talking to local people of M'hamid el Ghizlane, it became clear that in the past there have already been tree planting initiatives to protect the town. However, these efforts turned out not to be a success as the trees were not enough taken care of, giving room to vandalism by children and other local people destroying the grounds, small plants and irrigation systems (Interview, Maryem, May 10, 2022). Now, the Sahara Roots Foundation has a tree caretaker on the grounds full time who protects the trees from vandalism and makes sure that the trees get enough water and care. So far, the oldest trees alive that are planted by the foundation are 5 years old and are now able to keep growing without the Groasis Waterboxx system (Images 14,15,16,17). The future for these growing grounds is a cultural centre by Joudour Sahara to bring the community, economy (tourism) and environment together and to improve the living conditions in M'hamid el Ghizlane.



***Image 14: Tree planting grounds of Sahara Roots Foundation using the Groasis Waterboxx irrigation system, May 10, 2022; Image 15: Groasis Waterboxx system with newly planted tree, May 10, 2022; Image 16: Groasis Waterboxx system with a tree of a few years old, May 10, 2022; Image 17: Water pump for irrigation on the grounds of the Sahara Roots Foundation, May 10, 2022.***

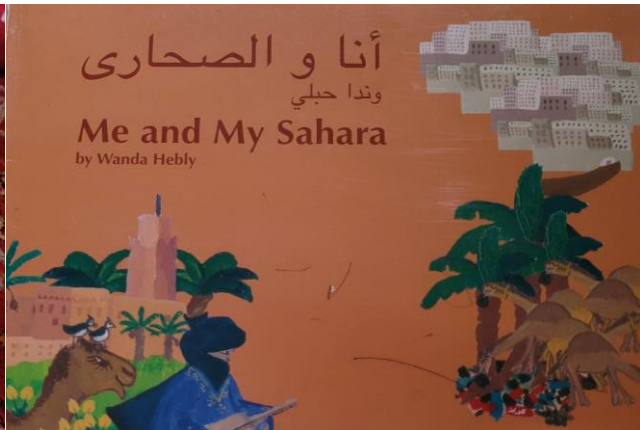
## Education in M'hamid el Ghizlane

The first step towards combating desertification is learning how to read, add and write through basic education. Being an important means in diffusing and transferring information, school enables communication between people affected by desertification (UNESCO, 2003). Basic education enables people to understand information communicated by literature and the media and helps them to set up and understand projects against desertification. Moving further than the basic education, school can help develop techniques and skills to combat the natural hazard and this information should be shared via the children and teachers to the rest of the community including parents and people outside the schools. Sharing knowledge and managing available resources are important skills in the battle against desertification (UNESCO, 2003). It is therefore important to take into account the educational initiatives in

M'hamid el Ghizlane and what they offer in the field of sustainable development and to what extent they focus on desertification.

## Environmental Education Initiatives

Together with Joudour Sahara, Sahara roots offers some environmental education to the children of M'hamid el Ghizlane, but most of the education comes from the regular primary and high school in M'hamid el Ghizlane. Around the year of 2016 the Sahara Roots Foundation distributed a booklet called “Me and my Sahara” written in 2007 by the founder of SRF Wanda Hebly about the importance of preserving the oasis of M'hamid el Ghizlane (Image 19). Apart from distributing the booklets to the children of M'hamid el Ghizlane during a yearly festival, there has been no teaching from the book in classes. Even more so, when asking about the booklet to people, only a few were actually aware of that particular booklet.



**Image 18: Traditional music instrument at the Joudour music school, May 10, 2022; Image 19: Me and My Sahara booklet cover by Wanda Hebly, May 15, 2022.**

Together with Playing for Change, Joudour Sahara has created a music school for local children during the weekends (Image 20) . Here, the students learn about traditional music styles and learn how to use old and modern musical instruments (Image 18). While most of the songs are about love or religion, the Sahari people often sing about their environment (Interviews music teachers, Naji & Brahim, May 10, 2022). Nowadays, children who go to the music school in M'hamid el Ghizlane embrace these old music styles and lyrics and create their own songs while being influenced and inspired by their traditions. The music school is a way to keep the children off the street during the weekends and to increase their self-confidence. Especially for girls, this music school has helped to encourage them to come to class, to work on their future and to break the taboo on girls stepping into the spotlight. The classes that I attended in May were quite evenly distributed between boys and girls. However, of the 80 children who participate in the classes according to the website of Playing for Change and according to the teachers, there were only about 20 children present. One of the reasons given to me was the extreme heat during these months that keeps the children away from school (Interview Maryem, May 10, 2022). This is similar to the situation of Siham in the neighboring village of Bounou where the



**Image 20: Cultural center of Joudour Sahara, May 10, 2022;**

heat keeps her from attending school and even dropping out of school as she is not able to walk all the way to M'hamid el Ghizlane to attend education. According to Action Education (June, 2022), the countries that are exposed the most to the consequences of climate change, are the ones with the highest rates of school dropouts. Affected children are likely to never return to school as the climatic disaster, in this case extreme heat, often interrupts a long period of time. Missing out on school due to climatic events, prevents children from receiving quality education, which can lead to less job opportunities in the future and they will continue suffering from the disasters made by the climate without the possibility to adapt to them (Action Education, June 2022). As Action Education states it: *"Faced with extreme heat and a lack of resources, populations are forced to migrate to major urban centres to find work. These migration processes are complex, dangerous and cause children to drop out of school."* - Action Education, June 2022; p. 11.



**Image 21: Children visiting the grounds of Sahara Roots Foundation and discussing environmental terms, May 15, 2022; Image 22: Garden next to the music school using the Groasis Waterboxx system, May 15, 2022.**

Joudour Sahara organizes together with the Sahara Roots Foundation trips to the tree plantation grounds, to teach the children about their own environment and the threat of desertification (Interview Maryem, May 10, 2022). By letting the children plant the trees they become more aware of the vulnerability of nature and the impact of sand (Interview Habib, tree caretaker, May 10, 2022). Besides the visits to the tree plantation grounds at the future cultural centre, Joudour Sahara also keeps a small garden next to the music school (Image 22). According to Action Education (June, 2022), participating in gardening programs at school makes students more concerned about the conservation of nature and resources and makes them more interested in gardening, nature and environmental issues. Image 21, shows the students of the music school sitting near the plantation site. Here they talk about the name of the region, what migration means and what it means when people are climate refugees. They also touched upon topics like the changing weather, M'hamid el Ghizlane getting more hot and the importance of planting trees (Observations, May 15, 2022). Another recent activity by Joudour Sahara was in cooperation with a sound artist called Susie Ibarra. Together with the children of the music school they went into the oasis to record the sounds of nature and the changing desert climate (@susie.ibarra, May 23, 2022) (Image23).



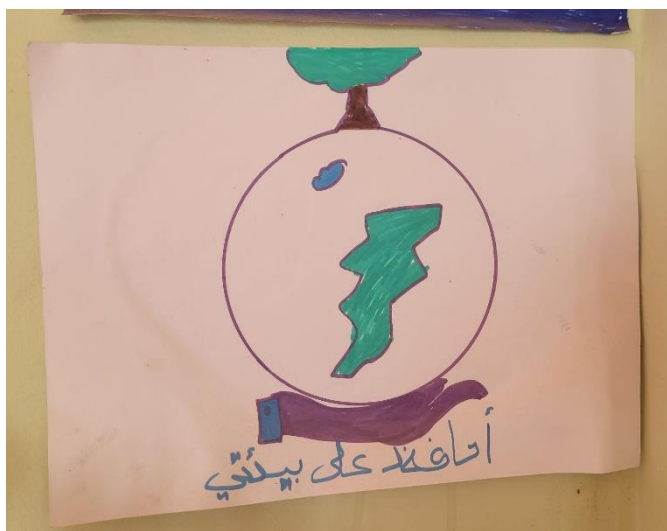


**Image 23: Instagram post of May 23<sup>rd</sup> @susie.ibarra; listening and recording the sounds of the environment. Ibarra, S. [@susie.ibarra]. (May 23, 2022)**

## Regular Education in M'hamdi el Ghizlane

Apart from previously mentioned educational initiatives that can be seen as 'informal' education, M'hamid el Ghizlane accommodates a kindergarten, primary and high school that are following the French school system. Children from surrounding villages need to come to M'hamid el Ghizlane for education. However, after high school, there are no universities or follow up educational facilities, so students who have the money and ability to go to university need to go to cities like Marrakech and Agadir (Maryem, May 20, 2022). Pre elementary teacher Nezaha provides education for the children of M'hamid el Ghizlane up to the age of four. Considering their age, she tries to focus her education on making them excited about going to school and building their self-esteem. According to Action Education (July 7, 2022b), early education is extremely important. A rich period of brain development is when a child is in its first (0 - 8) years. Quality education is essential for the development of a child both physically and mentally (Action Education, July 7, 2022b). Regarding environmental education, the children make drawings of the earth and they learn about the weather, but climate change is not a top priority. Outside the school they have a small garden that the children take care of. This is an initiative by the school itself and gets managed by the children and teacher only. Letting the children take care of the plants is a way of teaching them to care for something from an early age (Interview Nezaha, pre elementary school teacher; May 11, 2022). Even though the problems of climate change and learning how to adapt to it, is not high on their agenda, as Action Education states it: *"The climate emergency requires, as of today, changes in mentality. However, these cannot happen without quality education which, from an early age, will learn the right gestures and spread those in society..... Thereby mobilized, the children become great agents of change, capable of influencing the practice of daily lives of their families."* - Action Education, June 2022; p. 12 & 13. So even when the focus is not fully on the environment at an early age, attending quality education will help shape the children into environmental agents due to their changed mentality and ability to influence their surroundings (Image 24).

The start and end of a school day depend on the weather. Due to extreme heat, classes start in the early morning or the late afternoon. However, Nezaha states that “This does not take away valuable teaching as the kids still receive the same amount of teaching as other places in Morocco, despite this schedule. Every half hour we do different activities to keep the kids focused.” – Interview; Nezaha pre elementary school teacher; May 11, 2022.



**Image 24. Drawing of the earth in a hand with the country of Morocco and a tree on top, in pre-elementary school M'hamid el Ghizlane saying: “احافظ على بيئتي”, meaning: “Protect my environment”.**

When asking Nezaha about what the children want to become when they are older, they often mention the same profession as their parents or near entourage. Nezaha wants to show the kids how important education is and where it can bring you in life. What is interesting to note is that none of the children picture him/herself as a farmer, as this profession is seen as something that is easy to become and not very desirable. Instead, the children want to become cops, nurses, teachers and doctors (Interview & observation pre-elementary school teacher Nezaha, May 11, 2022).

Primary school teacher Elmouiaouaki Abderrahman provides education to the children coming from the surrounding villages of M'hamid el Ghizlane. Just like in the rest of Morocco, his school follows the French educational system. However, the teacher can choose to focus on whatever he/she finds the most important. Mr. Abderrahman tries to focus his activities on showing how important and fun education is and tries to make the children enthusiastic to keep attending the classes. “... I want to encourage them to look further so that they can become more successful than just following the easy path of their parents. I want to teach them the importance of education in achieving their goals.” – Interview; Elmouiaouaki Abderrahman, May 14, 2022. Even though there is a certain school system that is the same everywhere in the country, it is important to take the environment of where the education takes place into account. Teaching about the environment and nature by growing a school garden is an extracurricular activity that the teacher needs to do with the children in his own time and at his own responsibility. However as Mr. Abderrahman mentions: “I think it is very important, especially in this region because the environment is so important here.” – Interview; Elmouiaouaki Abderrahman, May 14, 2022. This is why he teaches the children about nature and maintaining a garden in a playful way, as according to him, the local environment is pressing on the daily life in and around M'hamid el Ghizlane.

Apart from teaching the children about the nature and environment of M'hamid el Ghizlane, Mr. Abderrahman understands that many children want to leave M'hamid el Ghizlane for better opportunities. However, in order to protect the heritage and livelihood of this oasis town, his goal is to provide the children with the best possible education and to let them continue their educational journey somewhere else in Morocco. But instead of helping them leave the town and not return, he mentions: “I would like them to come back to bring their knowledge back into the community where they grew up. So that they can take care of the oasis. I want to achieve that by showing them the beauty of this region, learning about Morocco and creating curiosity amongst them.” – Interview; Elmouiaouaki Abderrahman, May 14, 2022. By inviting other schools in the region, Mr. Abderrahman hopes to stimulate

them into starting a garden themselves as well and teaching the children more about the environment.

According to Climate Refugees CEO Amali Tower, it is important to not only state desertification as a natural hazard but as a social outcome of climate change and that we should educate both the public and the policy makers about the social and political choices made that eventually led to the situation of desertification. In combating desertification, it is important to educate both *“the population that it is happening to, and the populations that it is not happening to, like the policy makers, the public at large and the international community. I mean everybody needs to understand it.”* – Interview; Amali Tower, June 8, 2022. When asking Amali Tower about the importance of education and why it is so important in combating natural disasters like desertification, her answer was very clear: *“.. education to me is that it can help you start things sooner, right? Imagine building resiliency and solutions before you are in a crisis. Imagine building an oasis before an agrarian business has taken all the water away.”* – Interview; Amali Tower, June 8, 2022.

Using education to act before the disaster happens and to educate each other about habits and how to handle nature so that people can cooperate and that *“education goes from individual to community, to city, to town, to country to global. You know, imagine if that would be the thing. It is going to take imagination and creativity and you need to dream big.”* – Interview; Amali Tower, June 8, 2022. According to Amali Tower, education is necessary to move from the ‘I am just one person, I cannot make a difference’ to following the example of Habib, who is one man working alone and taking care of the trees, just to make a difference.

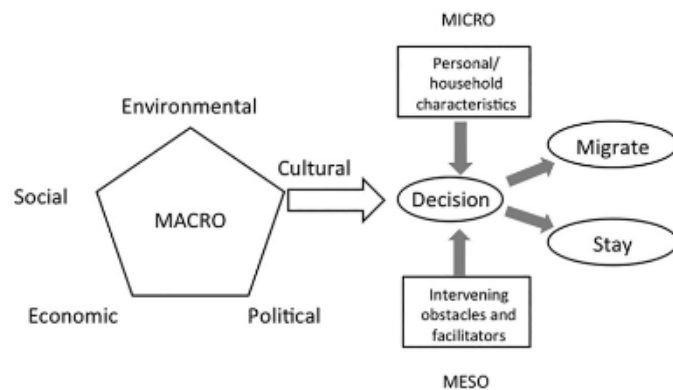
## Migration & Displacement

What is interesting to note is that while the people from M’hamid el Ghizlane and surroundings are aware of the extreme weather conditions, this is often not the main reason to migrate. “Lack of jobs”, “lack of opportunities” and “lack of facilities” are the reasons for displacement or migration mentioned by the people I talked to during my time in M’hamid el Ghizlane. *“Why would people stay here if there are no jobs?”* – Interview; Siham May 15, 2022 Bounou. And to the question if she would leave if she gets the opportunity she answered without hesitation: “of course”. However, the migration of people from M’hamid el Ghizlane to other parts of the country is not as simple and straightforward as just a desire to leave. As mentioned before according to a local guide in Zagora, people used to mainly work in Palmeries and grow and maintain (date) palms. However, due to a lack of water, partially caused by the earlier mentioned watermelon industry, palms are struggling to survive and people had to leave their plantations to find work and an income elsewhere as groundwater got depleted and even the watermelon would not be a beneficial crop here anymore. According to Mcleman & Gemenne (2018), migration and displacement are only rarely caused solely by environmental factors. It is therefore difficult to isolate environmental factors from non-environmental factors. Amali Tower, CEO of Climate Refugees confirms this statement: *“..because you cannot unpack climate as the primary driver of somebody’s displacement, it is very difficult.”* – Interview; Amali Tower, June 8, 2022. The lack of water and struggling to get an income are examples of ‘push’ factors that can cause people to choose to migrate or even force people to migrate (Mallick, 2019). When the resilience of people’s livelihoods get exceeded there is often no other choice than to leave to a place with the ‘pull’ factor of an income and a livelihood where one can survive. To migrate or not is a livelihood decision.

Case studies funded by the EU and the British government, showed that cultural, economic, demographic, social and political processes that are operating at the local to the global scale, interact with environmental factors and influence migration decisions at community and household levels. Due to this interaction of factors, environmental migration looks a lot

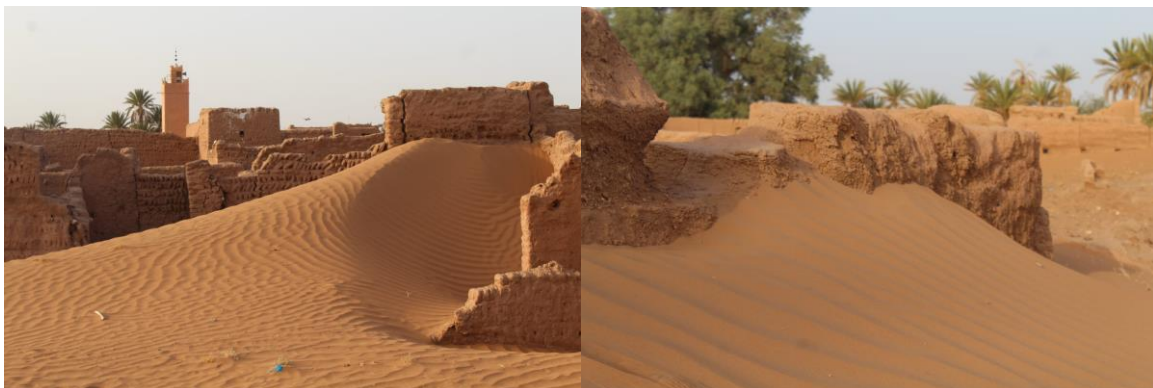
less like a phenomenon of simple push and pull factors that only affect poor communities in poor countries. Now, it begins to look a lot more like a complex interaction of processes that create heterogeneous, context-specific outcomes in both rich and poor countries (McLeman & Gemenne, 2018). Amali Tower explains this complex interaction in our interview as well, saying that climate refugees are often a result of a change in climate due to social pressures and outcomes of political decisions (Interview; Amali Tower, June 8, 2022).

In the figure 8, a simplified conceptualization of the environmental migration process is illustrated. It shows that even though many migrants might identify as economic migrants, their motivation to migrate might be fuelled by economic reasons as well as political, environmental, cultural or social ones. This figure counts for every migrants going from a migrants who leaves purely voluntary to the refugee-like migrant fleeing environmental hazards (McLeman & Gemenne, 2018). It is therefore hard to place a migrant in the box of 'economic migrant' or 'climate refugee' even though the person might only mention economic reasons for migration, the choice to migrate is often not only influenced by these economic reasons.



**Figure 8: Conceptualization of the environmental migration process, simplified from the final report of Foresight Report on Global Environmental Migration (Foresight 2011); McLeman & Gemenne, 2018)**

Apart from the 'voluntary' decision to migrate, whether this decision is based on environmental factors or not, some of the people of M'hamid el Ghizlane and its surrounding towns have experienced and still experience displacement due to desertification. Ouled Mhia is an example of a nearby village that has been abandoned by people as living conditions were too hard as the sand destroyed the houses resulting in the displacement of the inhabitants. Now the village works as a barrier for the sand, keeping it away from the people who moved a few hundred meters further to rebuild their lives (observation May 10, 2022) (Image 25 & 26).



**Image 25 & 26: Deserted village of Ouled Mhia, May 10, 2022.**

In Bounou, a combination of an increase in sand storms and heavy rainfall is creating heavy pressure on the houses in the oasis towns, causing the roofs of the houses to collapse. Nowadays, Siham and her family are one of the five remaining families in Bounou after already experiencing displacement themselves because of desertification. In their new

home, they still have to work hard to keep the sand away from their doorstep (Interview Siham May 15, 2022) (Image 27 & 28).



*Image 27: Collapsed houses in Bounou, May 15, 2022; Image 28: Sand in front of local homes Bounou, May 15, 2022.*

## Discussion

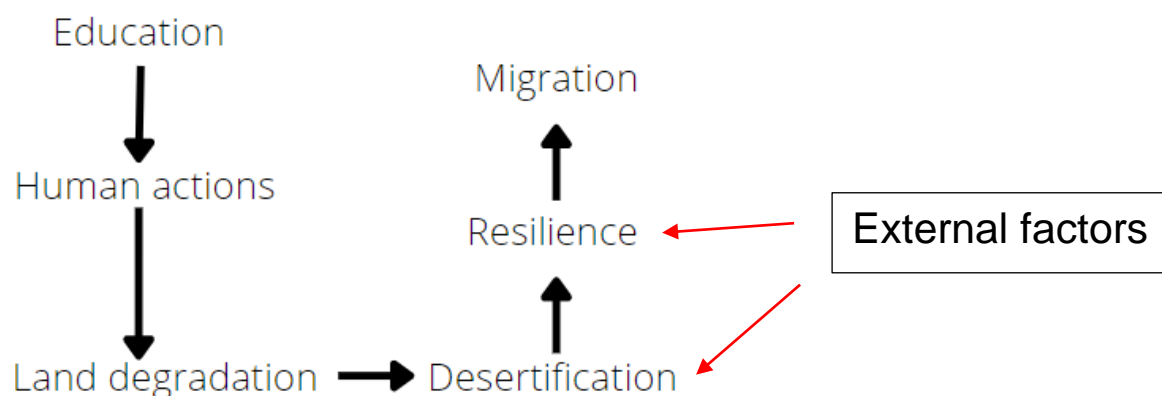
The purpose of this research is to add to the understanding of the relationship between education and desertification. From the findings of this research, it is important to take that the resilience of a community like the one from M'hamid el Ghizlane is to some extent dependent on the social and political choices made elsewhere. Despite educational and anti-desertification initiatives present in M'hamid el Ghizlane and the rest of Morocco, the environment keeps deteriorating. However, the positive influence of the Sahara Roots Foundation and the future Joudour Sahara cultural centre and the actions by the Moroccan government show willingness and ability to tackle the problem of desertification both on a local level as a countrywide level. Also, the music school of Joudour Sahara is a great example of an initiative that is moving towards the achievement of SDG4. The school is unique in the area for tackling inequality between boys and girls and gives girls the opportunity to thrive. Also, being free of charge and in the weekends, the school is accessible for children in and around M'hamid el Ghizlane, however, this accessibility is subject to the extreme weather conditions that keep children from attending classes.

Ouarzazate is an example of a rather successful anti-desertification project, where local organizations worked together with the Moroccan government and managed to create a green belt around the city. This project brought employment, protection against desertification and a green space for leisure. Thanks to the government funding and involvement, people were excited and willing to participate in the project, take better care of their environment and thus stay instead of leaving to other places in Morocco. Despite the Green Belt being a success, the Moroccan government has not yet started to replicate this project plan in other areas of the country. This is partly due to the recent COVID-19 crisis. But based on a local level, more is needed in order for people to stay in a town and fight for a better livelihood.

Apart from these anti-desertification initiatives, it is important to not blame the victims of desertification for their unsustainable practices, but instead look at the external factors making life in M'hamid el Ghizlane even more difficult. The harsh living conditions caused by strong winds, extreme heat and a dry climate are getting accelerated by external factors like the watermelon industry and the building of the dam upstream. The lack of government involvement, facilities and opportunities are all adding to the decision making for people to choose to migrate. Education plays an ambivalent role in the decision making process of people to migrate. On the one hand, education is key for raising awareness and getting the

local community involved in the fight against desertification and revitalise the oasis using a mix of traditional knowledge and new technological knowledge and changing the behaviour of the people. But on the other hand, education is one of the main reasons why people want to leave M'hamid el Ghizlane. Education is seen as a way to create opportunities and as a way to get out of the oasis town that has no future career prospects. However, there is a desire from the local people to send children off to study elsewhere in the country to gain knowledge and to return that knowledge to the community and improve life in M'hamid el Ghizlane.

In this way, it can be stated that the conceptual framework and the hypothesis mentioned in the beginning of this paper can be partially verified for the town of M'hamid el Ghizlane. Quality education offered to people or children from a community does impact their behaviour positively towards the environment. This leads to initiatives and community involvement in combating desertification and thus human actions have a decreased negative effect on the land. However, when looking at the state of desertification and the resilience of a community, this is impacted by external factors that are ignoring M'hamid el Ghizlane. Therefore, there is still a desire to migrate and find opportunities elsewhere.



**Figure 9: Conceptual framework following the hypothesis following up on the theory by Mirzabaev et al., 2019; & Mallick, 2019. Edited following the findings of this research.**

So coming back to the hypothesis: "If people from areas that are threatened by natural hazards like desertification receive quality education, then changes in behaviour and action will help combat desertification and make people opting less for migration as the resilience of the community increases.", it can be said that a part of it is definitely true. Education is key to change people's mindsets and behaviour and to teach them about the environmental impacts of their actions. However, as we have seen, there are many other factors that influence the decision to migrate and to make an anti-desertification project successful.

Therefore, this research contributes to the understanding on the role of education in the fight against desertification and the importance of taking into account external factors when looking at the level of success of anti-desertification projects and the limited resilience of the community.

## Limitations

Apart from the methodological limitations mentioned in the methods section, this case study brought some other limitations that may have influenced the outcome of the data, just like in other researches. However, these limitations also give opportunities for further research about which I will talk later.

Due to not receiving any answer from the ministries and government of Morocco, some parts of this research are solely based on available reports online. If I got the chance to talk to a government official, I perhaps would have gotten even more interesting and updated information than what I had to work with now. Another limitation to this research is the early development stage of the Joudour Sahara culture centre, that made it impossible for me as a researcher to fully see the impact and outcome of environmental education in M'hamid el Ghizlane. More time would have given this research more in-depth information about the value of this centre for a community like M'hamid el Ghizlane. Last but not least, another result from the language barrier mentioned in the methods section, was my accessibility to important documents and literature. As a lot is written solely in French, it is hard to find the right key words to use to find and access available documents. So not only was the language barrier causing difficulties in understanding interviews and documents, it made it also more difficult to find these online.

## Suggestions for Further Research

From these limitations and the findings of this research, I would like to make some suggestions for further research into this topic.

In order to better understand the role of education in combating desertification at a larger scale, it is important to conduct this research also at other places in the world dealing with the same or similar problems as M'hamid el Ghizlane. Also, further research into the question of who should receive education for combating desertification is needed. Education for those areas causing the problems of desertification rather than for those that are receiving and living with the problems of desertification, helps to understand where the role of education is greater in tackling the problem of desertification.

## Conclusion

In order to answer the main research question: "*What role do educational initiatives play in generating, implementing and distributing knowledge to combat desertification in Morocco?*", a case study has been done in a small oasis town in the Southeast of Morocco called: M'hamid el Ghizlane. Using document analysis, participant observations, in-depth semi-structured interviews and informal conversations, data has been collected. Using statements and quotes from interviews and substantiating them with existing literature, I have tried to find an answer to the sub questions and by combining them an answer to the main research question.

Despite a lacking focus on desertification in particular, educational initiatives in M'hamid el Ghizlane play a key role in shaping children into environmental agents. This is due to the power of education to spread awareness and to change peoples' mentality and ability to influence their surroundings. It can therefore be seen as a first and important step in the process of combating desertification.

In M'hamid el Ghizlane, local initiatives have shown to be successful in achieving a situation in which trees are surviving in the extreme weather conditions. However, people are still attracted to leaving M'hamid el Ghizlane. Instead of blaming the victims of desertification for the damage caused, it is important to take into account the external factors outside their control.

Fighting desertification is hard, especially when there is only effort and hope coming from local initiatives. However, people and their communities are creative and show great resilience and learn how to adapt to the current living conditions. Therefore, those who do

stay behind are not so much looking for how to fight the desert, but more how to ride and adapt to it.

## Policy Recommendations

Right now, SDG4 is all about equality and accessibility of and within education. However, within the Sustainable Development Goals, there is not enough focus on education as a tool to achieve sustainable development. I would therefore recommend to include education more prominently into the measures to achieve the SDGs.

Also, I would recommend the Moroccan government to include education in their national plan to fight desertification as it is important to make people aware of the value of the oasis and the threat of desertification on this valuable ecosystem. Through nationwide education, more people can be reached than only those that are included in the projects directly.

Last but not least, internationally I would suggest to re-evaluate the definitions that are used to put different types of migrants into boxes. As we have seen in this thesis, a decision to migrate, whether this is a voluntary or involuntary decision, is often influenced by multiple factors. Therefore the question to ask is: When a person decides to migrate or is forced to migrate due to the consequences of a changing climate and the loss of income due to this, is this person a climate refugee or 'just' an economic migrant? And does the person, therefore, deserve international or not?





Utrecht  
University



"YOU CAN'T FIGHT THE DESERT... YOU HAVE TO RIDE WITH IT."  
- LOUIS L'AMOUR



# References

- Action Education. (July 4, 2022). Association - International social & humanitarian organisation - Paris & France. Retrieved on 2 August 2022, from <https://action-education.org/en/who-we-are-2/>
- Action Education. (July 6, 2022). Education for all: our priority. Retrieved on 1 August 2022, from <https://action-education.org/en/why/our-vision-education-for-all/>
- Action Education. (July 7, 2022). SDGs: Education for All by 2030 - Education Action. Retrieved on 1 August 2022, from <https://action-education.org/en/why/sdgs-education-for-all-by-2030/>
- Action Education. (July 7, 2022b). Early childhood: the beginning of education. Retrieved on 1 August 2022, from <https://action-education.org/en/our-fighting/acces-a-education-and-early-childhood/>
- Action Education. (July 8, 2022). The impact of education in the world. Retrieved on 1 August 2022, from <https://action-education.org/en/why/the-impacts-of-a-quality-education/>
- Aide et Action. (June, 2022). Grand Angle FACE AU CHANGEMENT CLIMATIQUE: L'ÉDUCATION! (Nr. 163). <https://www.coordinationsud.org/wp-content/uploads/Magazine-163-VF.pdf>
- Ait Lamqadem, A., Pradhan, B., Saber, H., & Rahimi, A. (2018). Desertification sensitivity analysis using MEDALUS model and GIS: a case study of the Oases of Middle Draa Valley, Morocco. *Sensors*, 18(7), 2230.
- Amankwah, E. (2012). Desertification in the Upper West Region of Ghana: Causes, Processes and Impact. *International Journal of Technology and Management Research*, 1(1), 88-93.
- Anderson, A. (2010). *Combating climate change through quality education*. Washington, DC: Brookings Global Economy and Development.
- Association Interdisciplinaire pour le Developpement et l'Environnement. (December 21, 2017). Station de pompage solaire et d'irrigation. Retrieved on 1 August 2022, from <http://www.targa-aide.org/index.php/projets/projets-realises/1998-2004/root/projets/projets-en-cours/item/124-station-de-pompage-solaire-et-d-irrigation>
- Deshingkar, P. (2012). Environmental risk, resilience and migration: implications for natural resource management and agriculture. *Environmental Research Letters*, 7(1), 015603.
- Dominguez, P., Bourbouze, A., Demay, S., Genin, D., & Kosoy, N. (2012). Diverse ecological, economic and socio-cultural values of a traditional common natural resource management system in the Moroccan High Atlas: The Aït Ikiss Tagdalts. *Environmental Values*, 21(3), 277-296.
- European Commission Joint Research Centre. (June 21, 2018). New World Atlas of Desertification shows unprecedented pressure on planet's resources. *PHYS.Org*. Retrieved on 28 March 2022, from <https://phys.org/news/2018-06-world-atlas-desertification-unprecedented-pressure.html>
- European Commission Joint Research Centre. (April 25, 2019). Patterns of Aridity. WORLD ATLAS OF DESERTIFICATION. Retrieved on 29 March 2022, of [https://wad.jrc.ec.europa.eu/patternsaridity#:~:text=The%20Aridity%20Index%20\(AI\)%20is,climate%20at%20a%20given%20location.](https://wad.jrc.ec.europa.eu/patternsaridity#:~:text=The%20Aridity%20Index%20(AI)%20is,climate%20at%20a%20given%20location.)
- Fahad, S., Hossain, M. S., Huong, N. T. L., Nassani, A. A., Haffar, M., & Naeem, M. R. (2022). An assessment of rural household vulnerability and resilience in natural hazards: evidence from flood prone areas. *Environment, Development and Sustainability*, 1-17.
- Gkiougkis, I., Kallioras, A., Pliakas, F., Pechtelidis, A., Diamantis, V., Diamantis, I., ... & Dafnis, I. (2015). Assessment of soil salinization at the eastern Nestos River Delta, NE Greece. *Catena*, 128, 238-251.

Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification. (June, 2013). Rapport Principal. Le Programme d'Action National de Lutte Contre la Désertification : Actualisation et adaptation aux spécificités zonales. <http://www.eauxetforets.gov.ma/Desertification/L-C-D/Pages/PAN-LCD.aspx>

Ibarra, S. [@susie. ibarra]. (May 23, 2022). Day 2 Morning and Evening visit to the farm, the @joudoursahara Cultural and Environmental center and music school being built [Instagram post]. Instagram. <https://www.instagram.com/p/Cd5Cf11Oj41/?hl=nl>

Joudour Sahara. (April 17, 2022). Discover Joudour Sahara. Retrieved on 29 August 2022, from <https://joudoursahara.org/the-music-school/>

Jourjon, S. (April 22, 2013). Le Chergui, le vent du sahara marocain. Desert Maroc. Retrieved on 29 July 2022, from <https://desert-maroc.com/vent-du-sahara-le-chergui/>

Karataş, A., & Karataş, E. (2016). Environmental education as a solution tool for the prevention of water pollution. *Survey in Fisheries Sciences*, 3(1), 61-70.

Karmaoui, A. (2019). Drought and desertification in Moroccan Pre-Sahara, Draa valleys: exploring from the perspective of young people. *Geoenvironmental Disasters*, 6(1), 1-13.

Kassas, M. (1995). Desertification: a general review. *Journal of arid environments*, 30(2), 115-128.

Kioupi, V., & Voulvoulis, N. (2019). Education for sustainable development: A systemic framework for connecting the SDGs to educational outcomes. *Sustainability*, 11(21), 6104.

l'Agence Nationale des Eaux et Forêts. (June, 2013). PAN - LCD. Retrieved on 28 July 2022, from <http://www.eauxetforets.gov.ma/Desertification/L-C-D/Pages/PAN-LCD.aspx>

Langevang, T., (2007) Movements in Time and Space: Using Multiple Methods in Research with Young People in Accra, Ghana, *Children's Geographies*, 5:3, 267-282, DOI: 10.1080/14733280701445853

Laurier, E. (2010). Participant observation. *Key methods in geography*, 133.

le Roux, C., & Bouazid, T. (2009). Steps Towards Averting Desertification in the Sefiane Rural Community, Algeria: The Role of Environmental Education. *Southern African Journal of Environmental Education*, 26, 132-149.

Mallick, B. (2019). The nexus between socio-ecological system, livelihood resilience, and migration decisions: Empirical evidence from Bangladesh. *Sustainability*, 11(12), 3332.

McLeman, R. A., & Gemenne, F., (Eds.). (2018). *Routledge handbook of environmental displacement and migration* (Ser. Routledge international handbooks). Routledge. Retrieved August 10, 2022, from <https://www-taylorfrancis-com.proxy.library.uu.nl/books/edit/10.4324/9781315638843/routledge-handbook-environmental-displacement-migration-robert-mcleman-fran%C3%A7ois-gemenne>.

Mirzabaev, A., J. Wu, J. Evans, F. García-Oliva, I.A.G. Hussein, M.H. Iqbal, J. Kimutai, T. Knowles, F. Meza, D. Nedjraoui, F. Tena, M. Türkeş, R.J. Vázquez, M. Weltz, (2019): Desertification. *In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*

Moumane, A., Al Karkouri, J., Benmansour, A., El Ghazali, F. E., Fico, J., Karmaoui, A., & Batchi, M. (2022). Monitoring long-term land use, land cover change, and desertification in the Ternata oasis, Middle Draa Valley, Morocco. *Remote Sensing Applications: Society and Environment*, 26, 100745.

Nunez, C. (May 31, 2021). Desertification, explained. *National Geographic*. Retrieved on 28 March 2022, from <https://www.nationalgeographic.com/environment/article/desertification>

Popov, M. A., Stankevich, S. A., Kozlova, A. A., Luk'yanchuk, I., Mezzane, D., Bah, E., & Ould, M. (2012). Socio-economic benefits from the prevention of desertification in Morocco and Mauritania using satellite monitoring. In *Correlation Between Human Factors and the Prevention of Disasters* (pp. 3-14). IOS Press.

Pseau.org. (December, 2016). *Projet de ceinture verte autour de Ouarzazate et réutilisation des eaux usées*. (2016, December). Retrieved on 29 July 2022, from <https://www.pseau.org/outils/biblio/resume.php?d=6646>

Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P., ... & Walker, B. (2007). Global desertification: building a science for dryland development. *science*, 316(5826), 847-851.

RIOUCH, A., & BENAMAR, S. (2018). Evaluation and Proposals for Improving the Situation of Environmental Education in Morocco. *American Journal of Educational Research*, 6(6), 621-631.

Sahara and Sahel Observatory. (2022). About the OSS | Welcome at Sahara and Sahel Observatory. Retrieved on 31 August 2022, from <http://www.oss-online.org/index.php/en/about-the-oss>

Sahara Roots Foundation » About us. (2021). Sahara Roots. Retrieved on 28 April 2022, from [https://sahara-roots.org/?page\\_id=210](https://sahara-roots.org/?page_id=210)

Sahara Roots Foundation » Groasis Waterboxx. (2021). Groasis Waterboxx. Retrieved on 29 March 2022, from <https://sahara-roots.org/?project=tree-planting>

Sahara Roots Foundation » Joudour Sahara Culture Center. (2021). Sahara Roots. Retrieved on 28 April 2022, from <https://sahara-roots.org/?project=joudour-sahara>

Save the Children. (2022). Horn of Africa Climate Crisis. Retrieved on 31 August 2022, from <https://www.savethechildren.org/us/what-we-do/emergency-response/horn-of-africa-climate-crisis>

Schmitz, G. L., & Rocha, J. B. T. (2018). Environmental education program as a tool to improve children's environmental attitudes and knowledge. *Education*, 8(2), 15-20.

Sepehr, A., Hassanli, A. M., Ekhtesasi, M. R., & Jamali, J. B. (2007). Quantitative assessment of desertification in south of Iran using MEDALUS method. *Environmental monitoring and Assessment*, 134(1), 243-254.

Triad 3. (March 9, 2016). AN INTRODUCTION TO DOCUMENT ANALYSIS. *Research Methodology in Education*. Retrieved on 29 August 2022, from <https://lled500.trubox.ca/2016/244>

UNCCD. (2022). United Nations Convention to Combat Desertification (UNCCD) .. Sustainable Development Knowledge Platform. Sustainable Development Goals UN. Retrieved on 13 August 2022, from <https://sustainabledevelopment.un.org/index.php?page=view&type=30022&nr=556&menu=3170>

UNESCO. (2018, 21 November). SDG Resources for Educators - Quality Education. Retrieved on 21 August 2022, from <https://en.unesco.org/themes/education/sdgs/material/04>

UNESCO, United Nations Convention to Combat Desertification (Secretariat), UNESCO. Programme on Man and the Biosphere, & UNESCO. Division of Ecological Sciences. (2003). *Education Kit on Combating Desertification*. UNESCO and the UNCCD. <https://unesdoc.unesco.org/ark:/48223/pf0000125816>

United Nations Conference on Environment & Development Rio de Janeiro, Brazil, 3 to 14 June 1992 AGENDA 21. (June, 1992). <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>

United Nations Department of Economic and Social Affairs. (April 22, 2021). Climate change link to displacement of most vulnerable is clear. United Nations Department of Economic and Social Affairs -

Sustainable Development. Retrieved on 31 August 2022, from <https://sdgs.un.org/news/climate-change-link-displacement-most-vulnerable-clear-33087>

United Nations. (2015). Goal 4 | Department of Economic and Social Affairs. Retrieved on 2 August 2022, from <https://sdgs.un.org/goals/goal4>

United Nations. (2020). Migration. Retrieved on 10 August 2022, from <https://www.un.org/en/global-issues/migration>

United Nations. (2022). 4 Quality Education. UN Sustainable Development Goals. Retrieved on 20 August 2022, from <https://www.un.org/sustainabledevelopment/education/>

United Nations. (2022b). The Sustainable Development Goals Report. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>

United Nations Environment Programme. (October 23, 2015) Moroccan City Defies Desertification by Harnessing Solar Power and Treated Wastewater. Retrieved on 28 July 2022, from <https://www.unep.org/news-and-stories/press-release/moroccan-city-defies-desertification-harnessing-solar-power-and>

United Nations Environment Programme. (August 8, 2017). From wastewater to oasis: Greening the desert. UNEP. Retrieved on 27 July 2022, from <https://www.unep.org/ar/node/20757>

Unterhalter, E. (2019). The many meanings of quality education: Politics of targets and indicators in SDG 4. *Global Policy*, 10, 39-51.

Veron, S. R., Paruelo, J. M., & Oesterheld, M. (2006). Assessing desertification. *Journal of Arid Environments*, 66(4), 751-763.

VVOB. (2022). Our Vision on Quality Education | VVOB. VVOB Education for Development. Retrieved on 21 August 2022, from <https://www.vvob.org/en/education/our-vision-on-quality-education#>

Youssef Igrouane - Morocco World News. (November 18, 2016). French Start-up to Revitalize Arid Soils of Moroccan Desert. <https://www.moroccoworldnews.com/>. Retrieved on 30 March 2022, from <https://www.moroccoworldnews.com/2016/11/201689/french-start-revitalize-arid-soils-moroccan-desert>

# APPENDIX A

<b>Data collection interviews, observations &amp; informal conversations; M'hamid el Ghizlane, Morocco; May-June 2022</b>				
Date	Name	Description	Type of data collection	Duration
09-05-2022	Unknown	Local guide Zagora	Informal conversation	+30 minutes
09-05-2022	Halim Sbaï	President Joudour Sahara	Informal conversation	+1 hour
09-05-2022	Maryem	Employee Joudour Sahara & Carpet of Life	Informal conversation	+30 minutes
09-05-2022	Nour Houssein	(informal) English teacher	Informal conversation	+40 minutes
10-05-2022	Maryem	Joudour Sahara & Carpet of Life	Semi Structured interview + audio	45 minutes
10-05-2022	Nour Houssein	(informal) English teacher	Semi Structured interview + audio	30 minutes
10-05-2022		Map of M'hamid el Ghizlane and surrounding villages; basic resources (hospital) are missing	Observations + drawing	
10-05-2022	Naji	Music teacher at the Joudour Sahara music school	Semi structured interview, no audio	30 minutes
10-05-2022	Brahim	Music teacher at the Joudour Sahara music school	Semi structured interview, no audio	30 minutes
10-05-2022	Unknown	Employee Joudour Sahara Cafe	Informal conversation	+20 minutes
10-05-2022	Habib	Caretaker plants Sahara Roots Foundation	Semi structured interview, no audio	1 hour
10-05-2022		Desertification in Zouia, and Ouled Mhia; efforts to combat by planting on the SRF grounds; empty Draa river	Observations	

11-05-2022	Nezaha	Pre-elementary teacher (formal)	Semi structured interview, no audio	1 hour
12-05-2022		Kids hanging around	Observations	
13-05-2022		Life with desertification in M'hamid el Ghizlane	Observations	
14-05-2022	Sister of Maryem	Employee Joudour Sahara	Informal conversation	+30 minutes
14-05-2022		Joudour music school class	Observations	
14-05-2022	Local children	Children participating at the activities of the music school	Informal conversation	+20 minutes
14-05-2022	Elmouiaouaki Abderrahman	Primary school teacher surrounding areas (formal)	Semi structured interview, no audio	1 hour
15-05-2022		Visit Bounou with filmcrew	Observation	
15-05-2022	Mohammed	Guide film crew Desertification impacts, shooting a documentary about 'heat'	Informal conversation	+20 minutes
15-05-2022	Siham	Local girl who lives in Bounou. Displaced because of sand.	Semi structured interview, no audio	45 minutes
15-05-2022	Amali Tower	CEO Climate Refugees	Informal conversation	+40 minutes
15-05-2022		Visiting the SRF grounds with the music school	Observations	
15-05-2022	Local children	Children participating at the activities of the music school	Informal conversations	+1 hour
17-05-2022		English class	Participant observation	
18-05-2022	Anas	Local cafe employee	Informal conversation	Multiple times throughout the weeks
23-05-2022	Susie Ibarra	Music artist taking kids to the grounds to record the sounds of climate change	Observation social media	
08-06-2022	Amali Tower	CEO Climate Refugees	Online semi structured	1 hour

			interview with audio and transcript	
18-06-2022	Mohammed Ben Aissa	President of Maroc Jeune, a NGO that was active in the Green belt project	Online semi structured interview with audio and transcript	30 minutes

## APPENDIX B

### Examples of interview questions asked.

#### Interview questions Amali Tower June, 2022

1. Let's start with: what do you do?
2. How would you describe a climate refugee?
3. How does climate or environment affect people's livelihoods?
4. To what extent does climate have an impact on people deciding to move?
5. What about those who stay behind, how does the environment influence the livelihood of people?
6. Is desertification a recurring reason for people to migrate?
7. What are the main environmental reasons / circumstances for people to migrate?
8. Regarding the situation in M'hamid el Ghizlane, do you think that an improved situation with less desertification would keep the people in M'hamid el Ghizlane or would they still try to leave?
9. What other factors influence a person's decision to migrate?
10. In what way does a climate refugee / migrant differ from an economical migrant?
11. What is needed to reduce the amount of climate refugees?
12. Do you think education could be used as a tool to combat certain environmental problems like desertification? If yes, how?
13. Despite all the efforts that initiatives put into fighting desertification, why do you think is it still a big problem and maybe only getting bigger?
14. How do you see the future of M'hamid el Ghizlane and the people living there?

#### Interview questions Maroc Jeune President Mohamed Ben Aissa

1. What do you do?
2. When was the foundation founded? For what reason, what are the goals of the foundation? Main projects?
3. According to the article by the UNEP from 2015, Morocco started a project in Ouarzazate to plant a green belt of trees to prevent the city from getting subject to desertification, what exactly were the steps taken in the project?
4. How was Maroc Jeune involved in the project?
5. How was the Moroccan government involved? Did they start this project?
6. Why was the decision made to do the project in Ouarzazate, and not another city / town like Zagora or M'hamid el Ghizlane?
7. How was the project funded?
8. Would you call it a success? Why (not)? future steps for the project
9. Is the project finished?
10. What is done to protect the trees from dying?



11. Are there plans for the future to implement similar projects in other places?
12. In the article by UNEP they mentioned you used indigenous knowledge, in what fields was this used?
13. Do you think that with this project and the creation of jobs, people are more likely to stay in Ouarzazate and fight desertification?

**Questions asked to Siham local girl of Bounou May 15 2022**

*Visiting a local home in Bounou where 5 families are left. Everyone else is displaced due to the harsh living conditions due to desertification. Houses have collapsed due to a combination of sand and rainfall. Siham is a 20 year old girl who invited me for tea in her home. She goes to school in M'hamid el Ghizlane and for resources they need to go there too as there are no facilities in the village itself.*

1. Do you go to school?
2. Are the sandstorms getting worse?
3. Does this affect your possibilities for receiving education?
4. What do you think of climate change? Do you hear that term a lot?
5. Why do you think everyone left?
6. Would you stay or would you take the opportunity to move if it is there?
7. Why did your parents decide to stay?
8. What is the hardest part of living here?