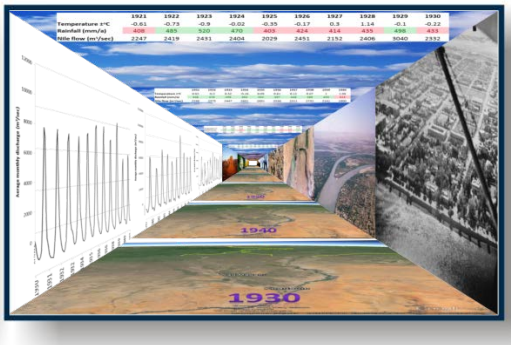
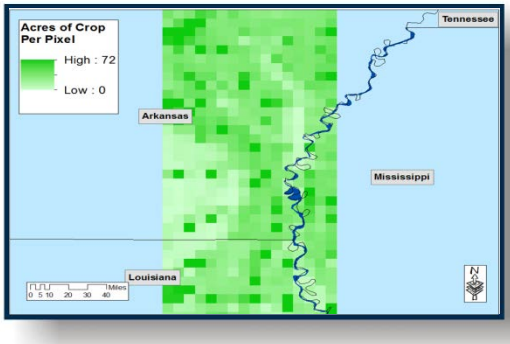
CSIR Contribution to Defining Adaptive Capacity in the Context of Environmental Change

3rd Interim Report





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CSIR Contribution to Defining Adaptive Capacity in the Context of Environmental Change

3rd Interim Report

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30 September 2014

CONTENTS

1. INTRODUCTION

The grant (W911NF-14-1-0113) is based on the premise that human security and environmental security is inextricably linked and that a better understanding the relationship between human and environmental security will assist in reducing vulnerabilities and improving stability. The grant supports CSIR and ERDC research in adaptation to water-related impacts of climate change. The grant supports a comparison of historic human responses to environmental change in the Mississippi River and the Nile River, as measured by human security indicator datasets and environmental variability data. The overall goal is to measure regional adaptive capacity and thus understand how to facilitate regional stability that can withstand threats imposed by environmental impacts. Based on the outcome of this analysis, a set of metrics will be developed that will assist in measuring the adaptive capacity of a region based on past behaviour and capabilities to cope with physical or environmental changes.

The research is focused on understanding and identifying vulnerabilities in developing regions that inherently have fewer institutional capabilities to handle large-scale changes. The qualitative and quantitative analysis of adaptive capacity compares areas in the Mississippi and Nile Basin. The Mississippi case area serves as a more controlled case study with the Nile Basin representing a context with more limited historical data. Environmental change and human behavior over the hundred year time scale (1910-2010) are being used for the analysis. The comparison of environmental change (eg. precipitation and temperature trends) and the corresponding human behavioural responses (eg food access and migration patterns) will provide an input to metric creation, contingent on evidence that changes in local stability are related to environmental change. These metrics will be used to measure areas of vulnerability within both study regions.

2. PROJECT TASKS AND PROGRESS

2.1 Tasks

No.	Task	Description	Target date
1	Datasets	1.1 Inputs to environmental and human security datasets	31 Jan 2014
2	Data fusion	2.1 Data overlay	31 March 2014
2	Data fusion	2.2 Data analysis 2.3 Additional data collection	30 Sept 2014
3	Correlation	3.1 Compare results	30 Sept 2014
4	Metrics	4.1 Develop adaptive capacity metrics	31 March 2015
4	Metrics	4.2 Identify areas of vulnerability	30 June 2015

This report pertains to Task 2.2: Data analysis; Task 2.3: Additional data collection; and, Task 3.1: Comparison of results. The Tasks has been described as follows in the Project Plan:

Task 2: Data Fusion:

Task 2.2: Determine if significant changes in environmental variability data correspond to changes in human behaviour using both visual (GIS) and statistical methods for each river. Use both the human security indicators and relevant historical case studies to find and affirm a correlation to tangible changes in environmental data. Due to the future transition of this research, past military involvement with populations residing within the watershed will also be researched and the impact will be considered. **This task will be facilitated through the joint workshop in which the CSIR will participate.**

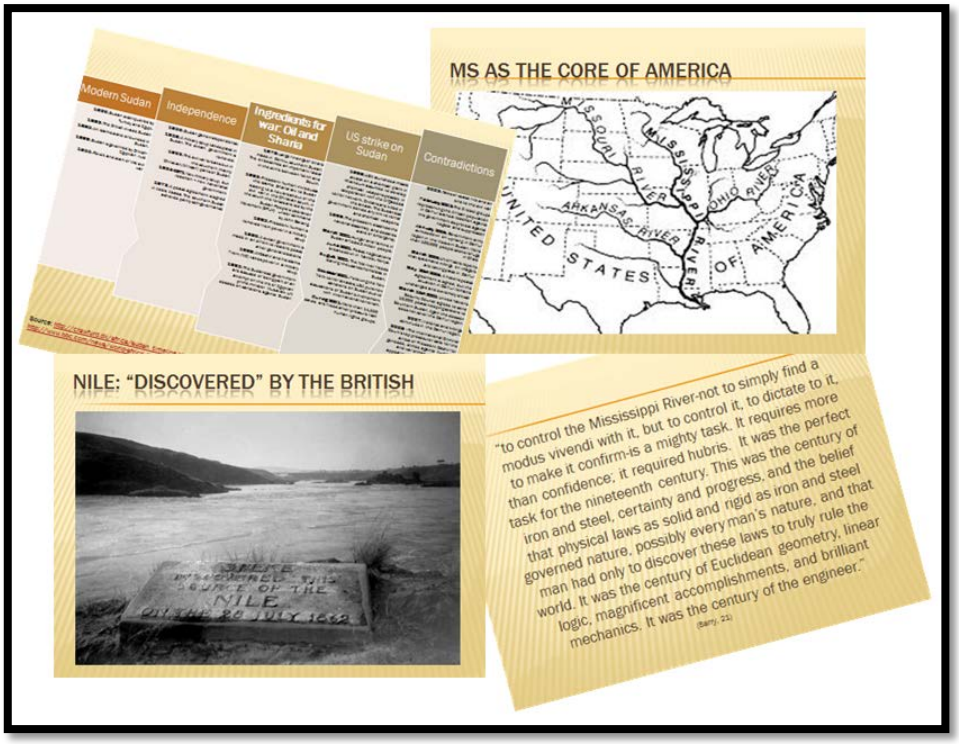
Task 2.3: To further define and confirm correlative relationships between the two datasets, additional background research will be conducted to consider the following potential historical factors: man-made infrastructure alterations to each river, topographic modifications within each watershed due to urbanization, industrialization, and technological advancements, and changes in environmental policy relating to use of and disposal in the rivers. **The CSIR will assist with this research particularly regarding the Nile Basin and selected study area.**

Task 3: Correlation analysis

Task 3.1: The results from both historical analyses will be compared and contrasted statistically. For example, we could do pattern analyses and if possible conduct a regression analysis. We expect there to be vast differences between the two regions because of the innate socio-economical differences between developed and developing countries. However, if the results from both the developed and developing regions demonstrate that there are specific human responses to changes in the environment, then it is plausible to create adaptive capacity measurable framework that could be utilized in other areas of the world. **The CSIR will provide inputs to the analysis.**

2.2 Progress

During the 2nd to the 6th of May 2014, Swathi Veeravalli visited the South African team in Stellenbosch. During this week Laura Harding and Nicole Wayant joined in via telecom for technical discussions with the team. During this week the qualitative data analysis team (Swathi Veeravalli and Karen Nortje) presented their findings thus far with regards to the he composite human security indicator dataset developed during Task 1 and Task 2.1.



One of the main findings for the qualitative data analysis is to interview the data as opposed to interviewing people. In order therefore to map the trends (as tested in Task 1 and 2.1), the qualitative team have developed a set of questions that captures the variables required, and yet is still flexible and embedded within the context:

Mapping the trends

Within a broad trend things change contextually – flexibility within the search for data

1. What has the evolution of identity been in the case study area? For example, how has boundaries of communities shifted
2. How has local governance been – and how has national governance influenced it?
3. What has the evolution of livelihood options been for the case study areas?
4. Along what lines is divisiveness within communities stratified?
5. Health care – what exist and who does it exist for? How has this changed?
6. Evolution of knowledge systems? How we know what we know (hierarchies within this) – epistemology.
7. Geo engineering. For example what have the dredging been – levies constructed, dams constructed? What is the water doing? How is humankind trying to manipulate the water?
8. Floods/droughts
9. Local colour – Greenville and Khartoum.

The qualitative team are currently busy delving into the available literature in order to find the data to populate the set of questions that has been developed. An example of this data is provided in the following table:

Major dams and barrages finished between 1910 and 2010 in the Nile Basin

Country	Dam name	River	Crest Height (m)	Reservoir Capacity (km^3)*m^3	Purpose (Power-MW)	Operational since
Egypt	Nag-Hamady Barrage	Main Nile	16	NA	I, N	1930
Egypt	Old Aswan Dam	Main Nile	53	5	I, H	1933
Egypt	High Aswan Dam	Main Nile	111	162	I, F, H (2100)	1970
Ethiopia	Tis-Abay	Lake Tana	NA	3.5	H()	1953
Ethiopia	Tekezze	Tekezze	185	3	H()	2009
Ethiopia	Charachara	Blue Nile	NA	9126*	H (84)	2000
Ethiopia	Finchaa	Finchaa	25	0.65	I	1973
Ethiopia	Koga	Blue Nile	NA	80*	I	2008
Ethiopia	Tana Beles	Blue Nile	NA	NA	H()	2010
Sudan	Sennar	Blue Nile	48	0.93	I,H ()	1925
Sudan	Jebel Aulia	White Nile	22	3.5	I, H ()	1937
Sudan	Khashm El Gibra	Atbara	35	1.3	I, H ()	1964
Sudan	Roseires	Blue Nile	60	3	I,H ()	1966
Sudan	Merowe	Main Nile	67	12.5	I, H ()	2009
Kenya	Sondu Miriu	Victoria Nile	NA	1.1*	H (60)	
Uganda	Owen Falls	White Nile	30	200	I, H ()	1954
Uganda	Kiira/extension		NA	NA	H (200)	1993-2000

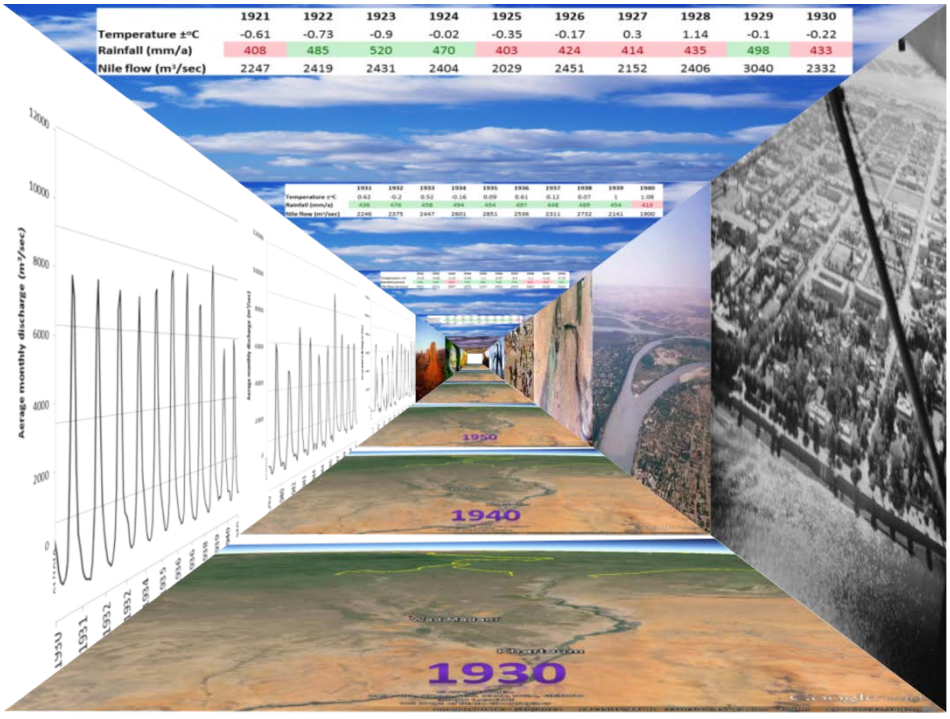
I-Irrigation, H-Hydropower, F-Flood control (Awulachew, et al.,(eds) 2012; FAO, 2014)

In August (12-15) the CSIR team consisting of Marius Claassen and Karen Nortje travelled to Washington DC. During the team meetings Karen Nortje gave a presentation on the progress thus far with regards to the Nile case example.

Some of the interesting finding reported on related to the following:

1. Relating to method: understanding the difference between data being “reported on” in literature and an event or issue being analysed and discussed in literature. It will be important to develop a way in which to differentiate in the representation of the data.
2. Relating to our own analysis: developing a method relating to how the team reports on ‘value’ as embedded in the text being analysed.

One of the challenges of data fusion is to represent different data themes covering a 100-year period. The team developed a visualisation tool that allows the user to travel through a “time tunnel”, where different sources of data are presented for each time slice. A still image of the visualisation is presented in the adjacent image.



The South African team, accompanied by Swathi Veeravalli also spent some time in the case study area of the Mississippi. Here the team used the time to visit the areas affected by hurricane Katrina in New Orleans which generated useful insights to the analysis of the literature thus far accessed. In addition, the team drove up to Greenville (the specific site for the Mississippi case study) where they had the opportunity to interview some local people with regards to their knowledge and experiences of droughts and floods in the area. Again, these insights have been crucial to ground the theoretical insights already garnered in the practicality of real-time examples. It is interesting to note that the engineering solutions (levees) along the Mississippi River have cut off people from the river, both in terms of the view of the river, and the perceived risks associated with the river.

2.3 Red Flags

The work is progressing according to schedule.

2.4 What's next?

Following on from Task 2.2; 2.3; and, 3.1, the team will now take work further by focussing more specifically on the metrics development:

> Task 4: Metric development
>
> Task 4.1: Develop a set of metrics to measure human adaptive capacity based on successes and failures of past communities in both the Mississippi River basin areas and Nile River basin region of adapting to variability in the environment. This task will be conducted with support from the CSIR team.

3. COST AND PAYMENT SCHEDULE

3.1 Cost and Price

	Tasks	Cost items	Units	Rate	Amount (US$)	Due date
	Datasets	Karen Nortje Marius Claassen Stationary & communication	40 hrs 29 hrs	69 146	2 760 4 220 20	31 Jan 2014
		Task total			7 000	
	Data fusion (Data overlay)	Karen Nortje Marius Claassen Travel cost (visit to ERDC)	48 hrs 44 hrs	69 146	3 312 6 402 3 286	31 March 2014
		Task total			13 000	
	Data fusion (Analysis and data collection)	Karen Nortje Marius Claassen Local travel & communication	48 hrs 40 hrs	74 156	3 544 6 227 229	30 Sept 2014
		Task total			10 000	
	Correlation (Compare results)	Karen Nortje Marius Claassen Travel cost (visit to case study area)	56 hrs 48 hrs	74 156	4 134 7 473 3 393	30 Sept 2014
		Task total			15 000	
Subtotal for year 1					45 000	
	Metrics (Adaptive capacity metrics)	Karen Nortje Marius Claassen Local travel & communication	48 hrs 40 hrs	74 156	3 544 6 227 229	31 March 2015
		Task total			10 000	
	Metrics (Areas of vulnerability)	Karen Nortje Marius Claassen Local travel & communication	24 hrs 20 hrs	74 156	1 772 3 114 114	30 June 2015
		Task total			5 000	
Subtotal for year 2					15 000	
	Total amount requested from ERDC				60 000	

3.2 Payment schedule

Invoices will be generated as per the deliverable dates based on approval of deliverables and transfers should be within 30 days of invoice receipt