**NASA DEVELOP National Program**

**Summer 2016 Project Proposal**

**NASA Langley Research Center**

**Middle East Water Resources**

Utilizing NASA Earth Observations to Create a Precipitation Climatology for Jordan to Enhance Rainfall Monitoring and Management

**Project Overview**

***Objective:*** To identify and analyze patterns in rainfall and ground water in Israel, Jordan, and the West Bank region for enhanced water management.

***Community Concern:*** Jordan has an arid climate with low and intermittent rainfall. The main sources of water in these areas are surface water and groundwater reservoirs; however, the majority of water sources that still exist are polluted and are deteriorating as the demand for water rises. As a result, schools in the region have closed down because of insufficient water supply and the lack of water accessibility.

***National Application Areas Addressed:*** Water Resources, Climate

***Study Location:*** Jordan, Israel, and the West Bank

***Study Period:*** January 2005 – January 2015

***Advisor:*** Dr. Kenton Ross (NASA DEVELOP National Program)

***Source of Project Idea:*** After attending a talk by Brendan McGinnis about water resources in the Middle East and WRAP, Merna Saad, a previous DEVELOPer, discussed with Brendan the potential of partnering on a project. Project ideas were later discussed with Dr. Kenton Ross as well.

**Partner Overview**

***Partner Organization:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Water Resources Action Project, Inc. (WRAP) | Brendan McGinnis, Executive Director  | End-User | No |

***End-User Overview***

***End-User’s Current Decision Making Process:***

Currently WRAP uses data from the Food and Agricultural Organization of the United Nations (FAO) and the World Bank to understand rainfall and population patterns. This information is used to assess future sites for rainwater collection programs based on rainwater availability and the number of people supported by the collection program.

***End-User’s NASA Earth Observations Capacity:***

WRAP – Previously, WRAP had limited familiarity with NASA Earth observations but did not utilize them before this project. Through knowledge of climatic precipitation patterns, WRAP will be able to identify school locations that would benefit from the installation of rainwater collection. The current data they utilize is out of date and is not as comprehensive as they would like for their use.

***Project Communication & Transition Overview***

***In-Term Communication Plan:***

The team will send a weekly email update to the partner to ensure that they are kept informed regarding the project’s progress. The team and the partner will have a telecon when necessary to answer any questions the team or the partner may have. The primary points of contact for this project will be Brendan McGinnis and the team lead.

***Transition Approach:***

The team will have a virtual hand-off at the end of the term where they will provide the results of their project and any needed materials to the project partner. The partner will then utilize the information provided by the team to make decisions regarding the best locations for their next projects in the coming years. The partner will also be invited to the Annual Earth Observations Applications Showcase at NASA Headquarters.

**Letters of Support:** WRAP, Brendan McGinnis, Executive Director.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **TRMM** | Rainfall accumulation | TRMM data will be used to create a precipitation climatology and to identify areas where rainwater harvesting projects can be implemented |
| **GPM** | Rainfall accumulation | GPM data will be used to create a precipitation climatology and to identify areas where rainwater harvesting projects can be implemented |
| **SRTM** | Digital elevation model | SRTM data will be used to understand elevation and to delineate watersheds |
| **GRACE** | Groundwater | GRACE will be used to understand the current groundwater and assist in identifying areas where groundwater can be extracted for schools |

***Ancillary Datasets:***

WRAP – Precipitation data – WRAP’s partner schools collect data regarding precipitation rates at their school. This information will be used to validate the findings from the satellite imagery.

**Decision Support Tool & End-Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Average Rainfall per Season  | Identify locations that could benefit from rainfall harvesting and implementation of WRAP projects | TRMM and GPM precipitation data  | N/A |
| Rainfall Climatology  | Identify locations that could benefit from rainfall harvesting WRAP projects for implementation | TRMM and GPM Precipitation data  | 1  |
| Change in Groundwater | Identify locations that could benefit from ground water resources | GRACE | 1 |
| Watershed Map | Identify drainage basins and outline watersheds  | SRTM DEM  | N/A |

***End-User Benefit:***

The end-user will receive an enhanced understanding of the current conditions and trends regarding precipitation patterns in Jordan, Israel, and the West Bank. From this information, WRAP will be able to determine the best school locations to implement their rainwater harvesting projects. Further, the use of QGIS in this project will allow WRAP to directly pull rainfall amounts from the end products provided without having to calculate rainfall amounts by hand. As our project partner POC, Brendan McGinnis, says, this project will be “extremely useful to WRAP in its efforts to identify the best areas to undertake new system installations or to expand existing systems. It would also be a useful supplement to our ongoing efforts to collect rainfall data from our partner schools to better quantify our impact.”

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1 Term: Summer 2016

***Related DEVELOP Work:***

Summer 2015 (LaRC) – Colorado Water Resources: Utilizing NASA Earth Observations to Identify Locations for Sedimentation Mitigation in the Ralston Creek Watershed Following the September 2013 Colorado Floods

Fall 2015 (LaRC) – Peru Climate: Monitoring and Forecasting Shifting Climate and Land Use Change Impacts in Peru’s Parque de la Papa for Enhanced Agricultural Management

Summer 2015 (UGA) Costa Rica Water Resources: Utilizing NASA Earth Observations to Develop a Comprehensive Water Budget for the Arenal-Tempisque Irrigation District of Costa Rica

**Project Needs/Requests**

***Participants Requested:*** 4

***Software & Scripting:***

ArcGIS – Raster manipulation/ analysis, image enhancement and map creation of rainfall patters using TRMM data, and groundwater change using GRACE data

ArcHydro/ ArcSWAT – tools for watershed delineation and drainage basin creation

Python 2.7 – downloading and processing both TRMM and GRACE data